

PRESERVING OUR MARINE WEALTH

AN ECONOMIC EVALUATION OF THE PROPOSED
COMMONWEALTH MARINE RESERVES NETWORK

By **Caroline Hoisington**

and **Laura Eadie**

June 2012

Centre for Policy Development

Occasional Paper 19

ISSN 1835-0135



ABOUT THE AUTHORS

Caroline Hoisington is the Centre for Policy Development's Marine Economy Fellow. She has 30 years experience as an economist in 25 countries for organisations ranging from Africare to The World Bank and the Asian Development Bank. Her professional experience includes Euroconsult, an engineering consultancy, and Deltares, a hydrological research institute. Her research background ranges from poverty alleviation to natural resources management, with specific expertise in forestry and water resources. Caroline has qualifications in agricultural and natural resources economics and a Master of Science, Michigan State University (USA). She is currently an Honorary Fellow at ANCORS, University of Wollongong and a Visiting Fellow at the Sydney Institute of Marine Sciences.

Laura Eadie is the Sustainable Economy Research Director at the Centre for Policy Development.

The Centre for Policy Development would like to thank the Thomas Foundation for funding our marine economy research, and the Centre for Conservation Geography for providing data and expert advice on the proposed Commonwealth Marine Reserves Network. All conclusions in this publication and any errors that remain are the authors' own, and do not necessarily reflect the views of our funders or advisors.

ABOUT THE CENTRE FOR POLICY DEVELOPMENT

The Centre for Policy Development (CPD) is a progressive think tank dedicated to seeking out creative, viable ideas and innovative research to inject into Australia's policy debates. Our work combines big picture thinking about the future of government with practical research on options for policy reform. We give a diverse, cross-disciplinary community of thinkers space to imagine solutions to Australia's most urgent challenges and we connect their ideas with policy makers, media and concerned citizens. The CPD is a non-profit organisation, and donations to our research fund are tax deductible. If you'd like to join the CPD supporters or hear about future CPD publications go to <http://cpd.org.au>

CREATIVE COMMONS LICENSE

The contents of this publication are released under a Creative Commons license. Extracts, summaries or the whole paper may be reproduced provided both the author and CPD are attributed, with a link to the CPD website at <http://cpd.org.au>. For more details on the Creative Commons Attribution 3.0 Australia license that applies to this document see <http://creativecommons.org.au/learn-more/licences>

Cover image thanks to Richard Ling <http://www.flickr.com/photos/rling/1697373746/>

Contents

Main Points	3
Australia's newly declared marine reserves – an important asset	4
Australia's comparative advantage in marine resources	5
The right policy mix for managing marine assets	6
Marine Protected Areas.....	6
A bi-partisan, multi-year process	6
Marine reserves offer a win-win for fishers and for the environment	8
Compensation of fishers displaced by creating the Commonwealth Marine Reserves	12
Why both good fisheries management and protected areas are needed for sustainable fisheries.....	13
Why momentum needs to be maintained with fisheries management	15
A smart decision and one of which Australia can be proud	16
Appendix: Valuing marine ecosystem services.....	17
Economic value of the marine estate and marine ecosystem services	17
Protection zones within Marine Reserves Network.....	18
Area of total marine estate and Marine Reserves Network	19
Marine ecosystem services values by category	20

Main Points

- CPD's analysis shows that the new National Marine Parks in the Proposed Commonwealth Marine Reserves Network cover an area that provides \$1.2 billion a year in ecosystem service value that is not recognised in our economic accounts, bringing the total value of Australia's fully-protected Marine Parks to \$2 billion a year in ecosystem services.
- CPD has estimated the value of ecosystem services covered by the fully-protected National Parks only. We have calculated the economic value provided by four categories of marine ecosystem: coral reefs, seagrasses, coastal shelf and open ocean. Each of these areas provides services of value such as nurseries for fish, carbon storage, etc.
- Australia can be very proud of having taken such a strong step to protect its marine resources. Preserving the marine environment will help to secure Australia's marine economy, underpinning the long-term productivity of our marine estate.
- The Proposed Marine Reserves Network covers 36% of Australia's marine territory. The fully-protected part, the National Marine Parks, cover 13% of the total. In the other 23% recreational fishing is allowed and some kinds of commercial fishing, varying by zoning. Most of the reserve restricts the most damaging forms of fishing including bottom trawling – this is likely to deliver long-term benefits for recreational fishers and commercial fishers using more sustainable practices.
- The National Marine Parks, areas closed to fishing, are an essential part of preserving marine ecosystems and marine life, including fishing for the longer term. Given the high economic value provided by coral reefs, seagrasses, and coastal shelf areas, more of these areas should have been included in marine parks under the Proposed Marine Reserves Network
- Marine parks have been shown to have numerous benefits, leading to larger fish and more biodiversity. The parks make marine ecosystems more resilient to environmental shocks and act as restocking areas for the surrounding waters. Studies show that in the long run they provide benefits to fishers. Recent studies on marine parks in the Great Barrier Reef find that they are working as they are supposed to – rebuilding the biomass of local fish populations in ways that are likely to deliver long-term benefits to fishers.
- The Great Barrier Reef compensation package, which blew out to \$250 million, would form a very poor precedent for compensating fishers who are displaced by the Marine Reserves Network. The Finance Minister at the time, Nick Minchin, thought that the Great Barrier Reef package was too large. Initial estimates of the value of fishing production displaced by the Great Barrier Reef rezoning were \$14 million a year, but dropped to \$3-\$7 million after accounting for the fact that many fishers were able to shift to other areas. Initial estimates are that \$11.1 million a year of commercial fishing production may be displaced by the newly announced Marine Reserves Network. \$100 million, a figure flagged by Minister Tony Burke as available for compensation, would be a generous compensation package.
- Compensation should be implemented along the lines of the 'Securing our Fishing Future' package to ease rather than displace long-term pressures on fish stocks and the profitability of the fishing industry.

Australia's newly declared marine reserves - an important asset

Australia can be extremely proud of having taken such a strong step to protect its marine resources now and for future generations. Australia's ocean territory is the 3rd largest in the world, and is the richest in biodiversity, with over 4,000 species of fish and tens of thousands of invertebrates, plants and micro-organisms. Including the new and existing reserves, the proposed National Marine Reserves System will cover 36% of Australia's ocean territory and help to protect the wealth of marine life that makes our oceans such a national treasure.

Australia's marine estate provides many types of value to Australians. As an island nation, we place a strong cultural and recreational value on the ocean – it shapes everything from childhood memories to our national identity. Our marine estate also has an economic value, part of which shows up in our national accounts through the measured economic activity of the commercial fishing, marine tourism and mining industries. In our 2011 report *Stocking Up: securing our marine economy*, CPD found that an additional \$25 billion in value every year is provided in ecosystem services which are currently uncounted in national statistics. This includes the value that healthy marine ecosystems provide in the form of nurseries for young fish, reduction of pests and disease, carbon storage and recreationally caught fish.

The proposed network of marine reserves, building on policies endorsed by successive Australian governments from both major parties, will provide different types of protection in different areas. Some areas will be mostly business-as-usual, with a few of the most damaging types of commercial fishing restricted. Some will allow recreational fishing but not commercial fishing. Around a third of the proposed marine reserves network is in 'marine parks', protected from all types of potentially damaging activity. Evidence on the benefits of existing marine parks indicates that they will help to secure the future of marine resources for all Australians, support long-term jobs in commercial fishing and marine tourism, and provide better catches for recreational fishers.

Using the same valuation method established in *Stocking Up* (see Appendix for a discussion of the methodology) it is possible to estimate the value of the ecosystem services provided by the areas covered by marine parks within the newly declared and previously established reserves. These values are broken down for different kinds of marine areas, including open ocean, coastal systems, coral reefs and seagrasses. The results presented in

Table 1 show that the areas to be covered by new marine parks under the Proposed National Marine Reserves System provide services worth at least \$1.2 billion per year to Australia.

Table 1 Estimated value of ecosystem services in the Marine National Parks, newly proposed and existing in Australia's Proposed National Marine Reserves System

<i>Ecosystem service</i>	<i>Newly Proposed Marine Parks</i>	<i>New and Existing Marine Parks</i>
	<i>Estimated value (\$ millions/year)</i>	
Raw materials	19	49
Climate regulation	849	1,355
Biological control	356	484
Nursery services	4	133
Food ¹	Not calculated	Not calculated
Opportunities for recreation ¹	Not calculated	Not calculated
Total	1,229	2,021

¹ The economic value of food and opportunities for recreation provided by marine national parks are assumed to be nil in this estimate, as they are too difficult to calculate at present. For example, marine national parks may support the value of recreational fishing catch (food) and leisure in surrounding areas, by stabilising fish stocks and increasing the number of large fish. However, this benefit can only be observed after marine national parks are established. Marine national parks may also provide enhanced opportunities for recreation such as diving and swimming: though they are likely to be significant, these benefits are also difficult to predict precisely. A system for monitoring the spillover benefits of marine national parks for recreational fishers and the direct benefits to the marine tourism industry should be established as the marine reserves network is implemented.

Evidence of the economic benefits of highly-protected zones or 'marine parks' is strong, and continues to grow, with several studies finding that they help to rebuild fish stocks and improve their resistance to environmental shocks. These benefits will be increasingly important in the face of growing global threats to the health of marine ecosystems and fish stocks from warming, acidifying oceans and from overfishing. It makes good economic sense for Australia to maintain its lead on the rest of the world in the management of its marine wealth – especially given that the value of production from sustainably managed Australian fisheries could increase by up to 42 per cent in 20 years if global over-fishing continues unabated and international fish stocks collapse.²

Australia's comparative advantage in marine resources

Australia has an interesting mix of marine resources:

- A huge marine area with very high biodiversity but not naturally high productivity.
- The Great Barrier Reef, an iconic, World Heritage-listed asset that brings in \$2.8 billion a year in direct benefits to the national economy.³
- A commercial fishing industry produces very high quality seafood for domestic and international markets, yet is financially pressed by lower-priced, competing imported products, high and rising fuel costs, arguably by some remaining over-capacity in some fisheries, with some overfished stocks and many of uncertain status.
- About 20%⁴ of Australians go recreational fishing at least once a year, and a marine tourism industry valued at \$11 billion a year⁵
- A national identity that includes a strong affinity for coasts and beaches with 85% of the population living within 50 km. of the coast.⁶

So where does that put Australia's economic comparative advantage when it comes to its marine estate, and what is a good vision for the future?

We believe that Australia's comparative advantage is:

- Exceptionally high biodiversity and reefs and beaches in good condition that will continue to attract international and domestic visitors. While international tourism is negatively affected by the strong Australian dollar at present, the prospect for well-cared for coastal areas and high-quality marine environments to continue to attract visitors and financial support for the longer run seems assured.
- A strong recreational fishing culture, for both domestic and international fishers that will need to be managed for the long run. If some areas show signs of over-fishing, restrictions may be needed, but the marine reserves should, for the most part, help to sustain good recreational fishing well into the future. In fact, the much expanded system of marine reserves, 63% of which allow recreational fishing and nearly all of which have banned the destructive fishing practice of bottom trawling, should deliver large benefits for the future of recreational fishing. Despite some complaints about closed areas, most recreational fishers are in favour of measures to protect the future of their sport.⁷
- A high-value, specialised, commercial fishing industry which is supported by much better fisheries management than most countries, supporting regional communities and supplying very high quality seafood to domestic and export markets. There is room for progress in Australia's fisheries management by further rebuilding fish stocks to protect fish populations from sudden crashes,

² Eadie, L. and Hoisington, C. (2011) *Stocking Up: Securing Australia's marine economy*, Centre for Policy Development, <http://cpd.org.au/2011/09/stocking-up/> p. 49

³ Access Economics, 2007, *Measuring the economic and financial value of the Great Barrier Reef Marine Park: 2005-06: A report for the Great Barrier Reef Marine Park Authority*, The Great Barrier Reef Marine Park Authority, Townsville, QLD

⁴ Henry, G.W. and Lyle, J.M. (eds), 2003, *National Recreational and Indigenous Fishing Survey*, Tasmania Aquaculture and Fisheries Institute, Hobart, TAS

⁵ Australian Institute of Marine Sciences, 2010, *The AIMS Index of Marine Industry*, Australian Government and Australian Institute of Marine Science, Canberra, ACT

⁶ Australian Bureau of Statistics, latest figures for percent of population living near the coast are from 2006, confirmed by telephone with ABS, 25 June 2012 (author).

⁷ Patterson Market Research 2011, *Western Australian Community Attitudes Towards Marine Sanctuaries*, Paterson Market Research, Applecross, WA

possible group fishing rights to be managed by local fishers with limits to total effort/off-take as needed, and marketing innovations linking local fishers and their communities and nearby cities more directly as is developing elsewhere.

- Recent moves by foreign trawlers to access Australian waters are a sign of how depleted overseas fish stocks are. The super-trawler *Magridis* is planning to fish large amounts of small pelagic fish from Tasmanian waters and further. (See section 'Marine reserves offer a win-win for fishers and for the environment' below for more detail.) Healthy and robust Australian stocks of fish are likely to be an asset that rises in value over time. This raises the question of whether Australian policy should support short-term jobs that are likely to disappear if stocks are over-fished or the long-term development of a secure domestic fishing industry
- A competitive and lucrative aquaculture industry that has developed alternate feed sources other than wild-caught feed fish and managed to significantly reduce the negative environmental effects of open-ocean aquaculture or the depletion of wild fish stocks. While aquaculture is the obvious sequel to wild harvest and arguably the way of the future, significant problems remain, and some Australian producers are working on finding ways to resolve these including plant-based protein, salt-water aquaculture tanks and breeding programs. If they are successful, sustainable aquaculture could become an important part of Australia's future (quasi)marine-based production. It is not, however within the scope of this paper.

The right policy mix for managing marine assets

The mix of protected zones in the proposed Network of Marine Reserves represents the kind of 'portfolio of valuable marine ecological assets' described by CPD in *Stocking Up* as shown in Table 2.

Table 2 - Managing our portfolio of marine ecological assets

Asset	Strategic benefits:
Well managed commercial fishing estate	<ul style="list-style-type: none"> • Mostly low financial returns at present but important employment & some highly-valued products • Products likely to rise in value • Some risk of stock collapse that needs ongoing management
Marine Reserves (areas with some degree of fishing & other uses)	<ul style="list-style-type: none"> • Immediate high returns to tourism (international & domestic) • Medium-term high returns to recreational fishing • Longer-term returns to commercial fishing • Must be managed to preserve environmental assets value over long-term
Sanctuary and Marine National Park Zones (highly protected areas)	<ul style="list-style-type: none"> • Marine asset 'capital' kept in reserve, just as banks hedge against unexpected losses and protection against GFC-type shocks, which have parallel in environmental threats • Similar to low-risk, low-yield bonds in financial portfolios • Help to ensure we are relying on yield from our natural capital, not drawing down the principal.

Marine Protected Areas

A bi-partisan, multi-year process

"Establishing a comprehensive, adequate and representative network of marine reserves – one that ensures that examples of all the major marine ecosystems under Australian jurisdiction are managed primarily for biodiversity conservation – complements, rather than replaces, many existing measures. This includes improving sectoral management, such as considering ecosystem and food-chain impacts in fisheries

*management, improving oversight and environmental management in the offshore oil and gas industry, and supporting research and monitoring on ocean processes and biodiversity.*⁸

The announcement of the proposed Marine Reserves Network is the latest step in a process that has been building for many years. In the 1992 Intergovernmental Agreement on Environment established under the Keating government, responsibilities of the commonwealth, states and local governments with regards to the environment were laid out. In this document, commitment was made to principles including the precautionary principle, the principle of intergenerational equity, the conservation of biological diversity and ecological integrity.

Under Schedule 9 Nature Conservation, section 13 the principles for a system of marine protected areas are laid out and the parties agree that a representative system will be created and managed:

The parties agree that a representative system of protected areas encompassing terrestrial, freshwater, estuarine and marine environments is a significant component in maintaining ecological processes and systems. It also provides a valuable basis for environmental education and environmental monitoring. Such a system will be enhanced by the development and application where appropriate of nationally consistent principles for management of reserves.

The Environment Protection and Bioconservation Act of 1999, enacted under the Howard Government, defined the process of declaring Commonwealth reserves, including in marine areas, as part of a broader marine bioregional planning process:⁹

The just released Regulatory Impact Assessment includes the following table to show the history of the process of how Australia has committed to establishing a network of Marine reserves:¹⁰

Table 3 Australia's commitments to establishing a network of National Marine Reserves

Year	Key frameworks	Relevant commitment
1991	Ocean Rescue Program	The Australian Government committed to the establishment of a National Representative System of Marine Protected Areas (NRSMPA).
1992	Conference on Environment and Development (RIO Earth Summit)	Objective 10.1 states that states will "establish a comprehensive system of protected areas... "
1993	Convention on Biological Diversity	Article 8a establishes a legal obligation for all member nations to establish a system of terrestrial and marine protected areas by 2012.
1995	CBD COP-2 (Jakarta, Indonesia)	Identified marine and coastal biodiversity, including "Establishing and maintaining marine and coastal protected areas" as a high priority issue
1996	Strategy for the Conservation of Biological Diversity	"... the establishment of a comprehensive, representative and adequate system of ecologically viable protected areas"
1998	National Representative System of Marine Protected Areas	All Australian Governments and the New Zealand government agreed to establish a system of representative marine protected areas.
1998	Australia's Oceans Policy	Commitments and actions for the ongoing establishment of the NRSMPA.
2002	World Summit on Sustainable Development (WSSD) (Johannesburg, South Africa)	"...the establishment of marine protected areas consistent with international law and based on scientific information, including representative

⁸ Marine Division, Department of Sustainability, Environment, Water, Population and Communities, 2012, 'Completing the Commonwealth Marine Reserves Network, Regulatory Impact Assessment', Marine Division, Department of Sustainability, Environment, Water, Population and Communities, p.11

⁹ http://www.comlaw.gov.au/Details/C2012C00248/Html/Volume_2 accessed 20 July 2012

¹⁰ Regulatory Impact Assessment, 2012, *Op. Cit.* p.8

networks by 2012..."		
2004	CBD COP-7 (Kuala Lumpur)	Commitment to establish a system of protected areas by 2010 for terrestrial reserves and by 2012 for marine reserves.
2006	South-East Commonwealth Marine Reserves Network	First representative network of marine reserves within Commonwealth waters.
2010	CBD Strategic Plan for Biodiversity 2011-2020	"by 2020, at least... 10% of coastal and marine areas... are conserved through... well connected systems of protected areas... ."

The Howard government established the first reserves in the planned national system in the South East in 2007. The process of declaring the rest of Australia's Commonwealth Marine Reserves has taken many years and has been supported by governments of both major parties. It has not been a sudden or a partisan process, but rather one that has been chosen by a succession of elected officials. A great deal of work has gone into the process.

Marine reserves offer a win-win for fishers and for the environment

A growing body of international research on marine parks that have been closed to fishing shows that the result is larger fish, a better mix of species (increased biodiversity) and that closed areas act as buffer zones helping marine species to survive environmental shocks and also serve as a source for restocking surrounding waters. Australian research focused on the Great Barrier Reef has found the same benefits¹¹:

*"Surveys of areas that had been open and closed to fishing for over a decade showed that the two main target species of the RLF [note: RLF is reef line fishing], the common coral trout and the red throat emperor, were significantly more abundant, larger and older in areas zoned Marine National Park 'B' (and so closed to fishing) than in adjacent General Use areas that have always been open to fishing."*¹²

*"Experimental manipulations of reef zoning status and fishing effort verified that fishing on reefs that had been closed historically reduced the abundances of target species on those reefs to levels similar to surrounding open reefs. In the absence of prior data with which to compare open and closed reefs before zoning was implemented, these manipulations provide the most convincing evidence that the Marine Park zoning strategies have been effective in protecting sub-populations of the fishery resource from the impacts of harvest. The protection of such refuges, with sufficient compliance, thus has the potential to sustain high biomass of reproductively mature populations of harvested species in spite of an active fishery on the GBR".*¹³

A study by six researchers from various institutions (CSIRO, Crawford School of Economics & School of Fishery Sciences, University of Washington) published in 2010 found the following:

*"Results of the scenarios we modelled suggested that a decrease in total allowable catch at high levels of harvest either increased net returns or lowered them only slightly, but increased biomass by up to 10% for a wide range of reserve sizes and an increase in the reserve area from none to 16% did not greatly change net returns at any catch level."*¹⁴

¹¹ Because a large amount of the catch is by recreational fishers and data on recreational fishing is not collected as much as for commercial fishing, it is difficult to know the exact effect of the spatial closures. Ongoing, consistent, monitoring of both recreational and commercial fish catches in the Marine Reserve Network will be essential.

¹² Mapsonte, B.D. *et al*, 'The Effects of Line Fishing on the Great Barrier Reef and Evaluations of Alternative Potential Management Strategies,' n.d. CRC Reef Research Centre, CSIRO, ELF, FRDC, GBRMPA, pp ii and iii

¹³ *ibid*

¹⁴ Little, L.R., Grafton, R.Q., Kompas, T., Smith, A.D.M., Punt, A.E. and Mapstone, B.D. "complementarity of no-Take Marine Reserves and Individual Transferable Catch Quotas for Managing the Line Fishery of the Great Barrier Reef," *Conservation Biology*, 2010

In other words, studies on the impact of highly protected marine parks in the Great Barrier Reef find that they are working as they are supposed to – rebuilding the biomass of local fish populations in ways that are likely to deliver long-term benefits to commercial and recreational fishers.

The benefits from highly protected zones such as the Marine National Parks in the proposed Marine Reserves Network are clear and include:

- Increased biomass of marine species in and also (to varying degrees) outside the highly protected zones.
- Measured increases in size and age of species, including commercially harvested fish species. This is particularly important because for many species fertility increases far more than proportionally with the age and size of fish – so for example if a female fish is allowed to grow twice as big, it could produce 10 to 100 times as many eggs.
- Increased biological resilience to various environmental threats, from pollution to over-fishing and even to climate change; these effects have been measured repeatedly.
- Many papers also report spill-over effects, meaning increased fish biomass outside the boundaries of the highly protected zones and MPAs. This varies greatly by species as some are more mobile than others. Fisheries management regimes outside the highly protected zone, history of exploitation and other factors will also influence the extent of the spill-over effect.
- Reappearance and/or increased numbers of top predators, better-functioning food webs and more stable ecosystems.
- Opportunities for research to establish baselines of fish populations in undisturbed ecosystems. This provides vital information on how to manage entire ecosystems for long-term sustainability.¹⁵

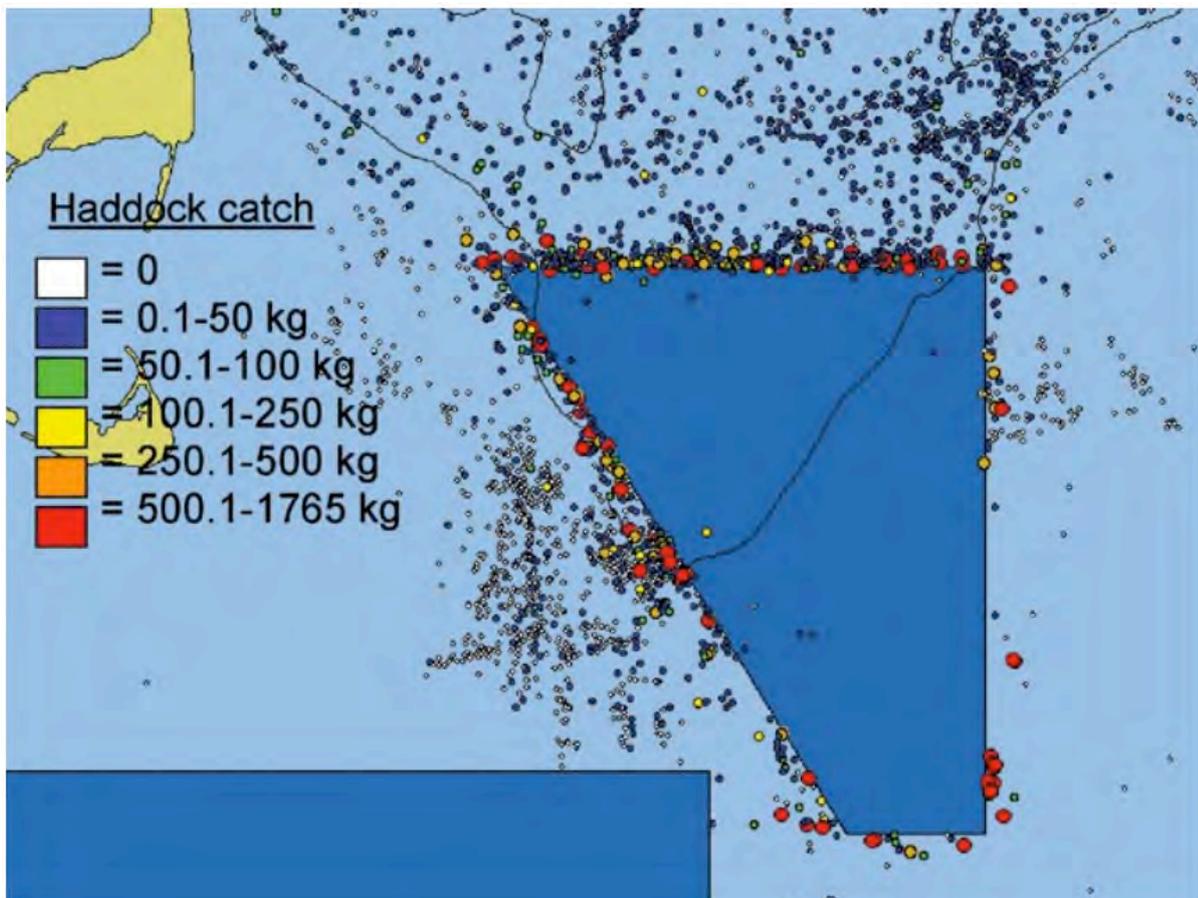
Clear evidence of spill over effects comes from established marine parks. Analysis of four fishery closed areas located in coastal systems off New England (U.S.), found the density of fish stocks increased close to a protected area boundary for 22 per cent of 279 species/area combinations.¹⁶

Results were particularly dramatic for haddock, for which 42 per cent of the U.S. catch was taken within 1 kilometre of a closed area boundary, and 73 per cent taken with 5 kilometres. Figure 1 - Distribution of haddock catch rates around fishery closed area off the New England Coast (Coastal system of the United States of America) Figure 1 shows haddock catch around one of the fishery closed areas.

Figure 1 - Distribution of haddock catch rates around fishery closed area off the New England Coast (Coastal system of the United States of America)

¹⁵ *Stocking Up*, p.35

¹⁶ Fogarty, M. J., and Botsford, L. W., 2003, 'Population connectivity and spatial management of marine fisheries', *Oceanography*, vol. 20, no. 3, pp. 112 – 123.



Source: Fogarty et al, 2003

Recreational fishing is huge in Australia. Estimates are that someone in one of every five Australians over five years of age fishes at least once each year. In some areas, recreational fishing take is large enough that it needs to be taken into consideration by fishing managers when setting total allowable catch (TAC) limits. Recreational fishers, however, do not use the destructive methods of fishing such as bottom trawling, nor do they run the long lines that cause the death of large amounts of 'by-catch' (the unwanted species that are thrown back, generally in lifeless condition).

Building a system of marine reserves is environmentally sound, and it will improve recreational fishing in the short term and commercial fishing in the long run. There are also direct and indirect economic benefits to protecting marine areas, and they are numerous and substantial.

First of all, Australia has high-value fisheries the value of which is very likely to increase over time as large areas in the rest of the world are not being well managed, and current levels of marine capture fishing globally will become impossible to maintain. Overfishing globally is so extreme that recent estimates by the World Bank are that the global fisheries wealth would increase from the current US\$120 billion to US\$900 billion if fish stocks were rebuilt.¹⁷

Australia currently engages in quality arbitrage in fishing trade. We import relatively low-value fish, often in a processed state and we export some of our high-value fish to other countries. Estimates of large pelagic fish that have disappeared from the oceans worldwide range from 65% to 90%. Globally, in a 2009 research report, 63% of assessed fish stocks worldwide needed to be rebuilt, and many are not assessed.^{18, 19} The FAO

¹⁷ The World Bank, 2012, "Focus: Oceans" in *Little Green Data Book 2012*
<http://issuu.com/world.bank.publications/docs/9780821389935> accessed 19 June 2012

¹⁸ Worm, B. et al, 2009, 'Rebuilding Global Fisheries,' *Science*, vol. 325 (578) pp 578-585

¹⁹ "A conservative estimate is that probably only 10 percent of the exploited fish stocks are assessed, but not always regularly. Although these assessed stocks include the largest single-species stocks and account for almost 80 percent of the total declared landings, it is clear that for the large majority of the exploited fish stocks there is no or little information on their status. In addition to the difficulty of developing a reliable

estimates that 85% of fish stocks are fully exploited, over-exploited, depleted or recovering from depletion. As is the case with some other natural resources that have been heavily exploited, future prices of seafood species, particularly the high-value ones are predicted to rise considerably. Huge factory ships are currently scouring the remaining areas with relatively large numbers of fish, places such as the coasts of Africa and some smaller Pacific Islands, much to the detriment of local subsistence and small-scale commercial fishers. This practice is not going to continue simply because it will be impossible: these areas are becoming fished-out. This will affect the long term value and prices of fish. Global fish prices are set to increase by an estimated 30% by 2020 compared to 2008-10 by recent OECD-FAO estimates.²⁰

From the environmental point of view, the gains are clear. In its descriptions of the Marine Reserves Network Proposal, key conservation values protected in each of the six areas are listed. Habitats, key species and the migration paths of migratory pelagic species are listed along with historical values and ranges of seafloor features.²¹

Some of the species whose habitat is listed as protected include:

- *Several whale species including humpback whale (annual migration path) and southern right whale*
- *Transient highly migratory pelagics including billfish, tuna and sharks*
- *Black marlin (seasonal migrants)*
- *Australian snubfin dolphin (endemic)*
- *Whalesharks (aggregation sites)*
- *Grey nurse sharks (east coast population critically endangered),*
- *White sharks, Bleekers devil fish (endangered or vulnerable)*
- *Black cod (threatened)*
- *Olive, ridley, green, flatback, loggerhead and hawksbill marine turtles,*
- *Several species of sea snake, sawfish*
- *Several species of migratory shorebirds*
- *Australian lesser noddy*
- *Dugongs*
- *Australian sea lion (endangered)*

Recent research has demonstrated that large pelagic species targeted by fisheries benefit from marine reserves. This is most likely because:

- Even protecting a part of species' ranges or life cycles, especially critical habitat areas which function as important feeding or breeding grounds, can cause a decrease in overall population mortality;
- Pelagic species are not uniformly distributed, but tend to aggregate around bathymetric and hydrographic features that are predictable in space and time, making the most beneficial design of pelagic reserves possible; and
- Even species identified as 'highly migratory' display movement patterns where the majority (70 to 90 percent) of the population moves no farther than 600 km.²²

The just-released Regulatory Impact Assessment 'Completing the Commonwealth Marine Reserves Network' adds to this assessment of the value of Marine Reserves:

- *“Representative networks of marine reserves are a key tool for ecosystem-based spatial management that enhances the effectiveness of conservation over wider geographic scales when used in concert with other sectoral management tools.”*

global overview of the state of fish stocks, this situation also undermines the ability of states to manage their fisheries sustainably.” FAO, 'The State of World Fisheries and Aquaculture 2010', p.40

²⁰ FAO, OECD (2011) 'OECD-FAO Agricultural Outlook 2011-20'

²¹ Commonwealth of Australia (2012), 'Final Commonwealth Marine Reserves Proposal' www.env.gov.au/coasts/mbp/reserves/index.html accessed 16 June 2012

²² Ceccarelli, D. 2011, 'The value of marine reserves for protecting highly mobile pelagic species: Coral Sea Case Study',

Ceccarelli, D, 2011, 'The value of oceanic marine reserves for protecting highly mobile pelagic species: Coral Sea case study'

- *“Representative marine reserve networks provide an insurance policy for our biodiversity assets by building and supporting the health and resilience of ecosystems. This is particularly important given that the combination of pressures on the marine environment is growing and the impacts are becoming increasingly unpredictable, particularly in the context of the potentially significant disturbances from ocean warming and acidification due to climate change.”²³*

Compensation of fishers displaced by creating the Commonwealth Marine Reserves

The best Government estimates available to date for valuing the amount of fishing production that will be displaced by creating the Commonwealth Marine Reserves is about \$11.1 million per year. Given that the annual value of commercial fishing is about \$2.2 billion per year (see Figure 2 in Appendix), this should represent less than 1% (the Regulatory Impact Assessment estimates 1.1%)²⁴ of the total gross value produced by Australian fisheries.²⁵ Displaced does not necessarily mean ‘eliminated’ – in some cases, fishers will be able to adjust their activities by fishing in other areas. Initial estimates of the impact of the Great Barrier Reef rezoning on the gross value of production dropped from \$14 million to \$3-\$7 million a year after accounting for adaptation.²⁶

One good practice for calculating payments for forgone revenue is to calculate income streams into the future, meaning net value of production, not gross value, and then to discount them over an appropriate time period. The net value of production is what the fishers actually see as income. However, the figures that are given here are for gross value of production, not net, because information about actual fisheries costs – and therefore their net revenue – is not generally available. This makes compensation more difficult to calculate definitively.

Fishing interests are calling for the Great Barrier Reef package to be treated as a benchmark for calculating the compensation to be paid to any fishers displaced by the Proposed Marine Reserve Network, but the payouts made for the GBR were considered excessive by many observers, including the then finance minister Nick Minchin. The payouts expanded over time, and eventually were driven by a largely political process until the final package had reached about \$250 million, to compensate for the displacement of \$14 million in gross production.²⁷

“From the very outset, the then finance minister Nick Minchin complained that the package was too large, that it was being misallocated and that it would set a horrid precedent for future conservation programs. Prime Minister Howard brushed his concerns aside and shovelled money at virtually anyone, near the Great Barrier Reef, who asked for it. In addition to the funds provided to commercial fishers, multiple onshore businesses got handouts, including several fish-and-chip shops. It got so farcical that even the Queensland Seafood Industry Association, the peak commercial fisheries lobby group, was given \$200,000, apparently to help it restructure and ‘achieve longer term financial self-sufficiency’.”²⁸

A better process to use would be that followed under the fisheries structural adjustment package ‘Securing our Fishing Future’ which was designed to decrease excess fishing capacity and was more closely related to actual incomes from various fisheries. The Minister, Tony Burke has announced that about \$100 million will be available for the fisheries adjustment package under the Marine Reserves program, and this would be a generous amount. The mechanism and decisions on which fisheries will be compensated will be developed under the management plans but it should be based on the precedent of this package, not the GBR.

Fishery adjustment payments contain both buyouts that reduce total fishing effort and compensations. The buyouts can have a positive effect on the fishers remaining in the industry, but compensations that do not reduce fishing effort can do the opposite when they subsidize fishing activities that may be marginal. A former consultant on the Great Barrier Reef adjustment package has suggested that some of the longline fishers in the Coral Sea may welcome a buyout package, given the context of rising fuel prices and the high Australian

²³ Regulatory Impact Assessment, 2012, *op cit*

²⁴ Packham, B & Kelly, A. (2012) ‘New Australian marine reserves to cost at least \$100 million in fishing industry compensation’, *The Australian*

²⁵ Regulatory Impact Assessment, 2012, *Op Cit*. p.39

²⁶ Macintosh, A (2012) *Crikey*

²⁷ Macintosh, A, Bonyhady, T. and Wilkinson, D.(2010) *Ocean & Coastal Management*, “Dealing with interests displaced by marine protected areas: A case study on the Great Barrier Reef Marine Park Structural Adjustment Package,” vol 53 581-588

²⁸ Macintosh, A (2012) *Crikey*

dollar.²⁹ The ratio of compensation to buyouts in the Great Barrier Reef package was far too high. The 'Securing our Fishing Future' package was better and would make a better model.

Why both good fisheries management and protected areas are needed for sustainable fisheries

There is strong evidence now, from around Australia and elsewhere in the world, that to rebuild fish populations that have been over-harvested or reduced by destructive fishing practices, marine reserves along with good fisheries management are an important key to success. In fisheries management terms, marine parks with no-fishing zones are 'spatial closures' and fishery managers sometimes claim – with some justification – that while their spatial closures are based on science, the Marine Parks and Marine Protected Areas (MPAs) are often decided more on political grounds. There is no denying that this is an issue and that protected areas are much more effective when their location is decided on scientific bases. Fisheries managers' 'spatial closures' however, tend to be done for short periods of time. What is now clear is that for depleted fish stocks to be rebuilt, some areas need to be protected – closed from fishing – for the longer term. It is also now demonstrated that MPAs can stabilize fish stocks even in better-managed fisheries.

Fishing is the last large-scale example of humans using wild animals as an important source of food. There is no particular reason to believe that our ever-growing human population with our ever-expanding purchasing power can be fed indefinitely on wild foods. Worldwide the situation in fishing is dire. Many fishing grounds have been effectively fished out and the long-distance 'factory ships' are now fully exploiting newer fishing grounds in some areas, as for example off African coasts, to the detriment of artisanal fishers.

Australian waters have not suffered depletion to the extent other areas have, for several reasons:

- Australian waters, while high in biodiversity are not particularly productive so never attracted the kind of exploitation that North Atlantic cod for instance did. The massive volume of catch available elsewhere is mostly not found in Australian waters, although there are some high-value pelagic exceptions such as tuna and whale species.
- Until modern technologies became available, Australian waters were uneconomically distant from most markets (with small exceptions like the traditional trade in sea cucumbers between the northern Australian coast and SE Asia)
- Australia's human population is relatively small compared to its massive marine area.
- Australia's development of large scale fishing capabilities is relatively recent (compared to much of the old world) and has been accompanied by increasingly sophisticated, largely scientifically-based fishery management.
- Australia has also in recent years done a good job of patrolling its waters and discouraging illegal fishing from whatever source.

Nevertheless, in 2010 40% of Australian Commonwealth fish stocks were assessed as either over-fished or of unknown status.³⁰ Australian fishers are under a lot of economic pressure, both from international competition and from rising fuel prices as well as what is still regarded by many experts as excess capacity. The tendency is for fishing capacity to expand beyond what can be supported in the long run, and competition for limited resources ensures that fishing becomes a subsistence activity for many fishers and leaves fishing-based communities in a poverty trap.

The Securing our Fishing Future package recognised the importance of reducing excess fleet and established a good precedent for doing so. However, it may not have done enough to improve overall profitability by reducing excess fleet – given that the additional pressures of rising fuel prices and the high Australian dollar have left around half the Commonwealth fisheries under financial pressure.³¹ The current Marine Reserve process (and any future policy changes) should learn from this and provide fair market value for reducing fleet, rather than over-compensating for possible reductions in catch. If the benefits of marine parks for rebuilding and stabilising fish stocks are combined with a) a well-designed buyout scheme; and b) a concerted push by fishers and fisheries managers to build higher stock levels to ensure more stable and reliable yields

²⁹ Hunt, C. (2012) 'A solid marine parks compensation package will be good for fish and fishers', *The Conversation* <http://theconversation.edu.au/a-solid-marine-parks-compensation-package-will-be-good-for-fish-and-fishers-7696>

³⁰ Stobutzki, I., Woodhams, J., Vieira, S. and Curtotti, R. 2011, *Fishery Status Reports 2010*, ABARES

³¹ Ibid, *Stocking Up*, p. 30 Less information is available about State fisheries, but some are likely to be facing the same pressures.

and to insure against future population crashes; it should be possible to make Australia a much more profitable place to fish.

While Australia is subject to the same problems as the rest of the world to some degree, including a growing demand for seafood, threats to the oceans from climate change, pollution largely from land, both urban and agricultural, and some degree of over-fishing, Australian Commonwealth fishery management is much better than that of many countries. State governments control the area from the short to 3 nautical miles out (about 5 km) and States' management varies. The Commonwealth – which controls waters from 3 nautical miles out from shore to 200 nautical miles out, the extent of the Australian Exclusive Economic Zone (EEZ)– has changed its management since 2007 to emphasize rebuilding fish stocks. This includes the concept of fishing levels to be changed from the Maximum Sustainable Yield (MSY) which has, in fact, been shown to be not sustainable because it allows too high levels of catch, to Maximum Economic Yield (MEY) which incorporates the idea that the most effort is expended in catching the last fish (as fish stocks are thinned), and the net income of fishers will be improved by catching slightly less. This concept has not yet been widely adopted in practice.

While MEY is an improvement over MSY, some scientists are making a strong case that the management levels chosen would be better if allowable take were adjusted to increase fish stocks to levels considerably higher than current management allows. The idea would be to gradually rebuild fish stocks by catching slightly less (a few percent per year) to the point where the total biomass of fish would be considerably greater. With fish stocks rebuilt, it should be possible for Australian fisheries to get approximately the same catch as at present. This would allow fishers to catch fish more easily and to leave a larger percentage of the fish population, called 'unfished biomass' remaining each year, allowing the remaining population to be stronger and more able to cope with the combined threats facing fisheries and marine ecosystems worldwide. Part of ensuring that the fishery biomass numbers can remain high is providing safe areas where no fishing is allowed, to function as buffers and areas where stocks can build up.

While logical, this could be difficult to achieve for a number of reasons. It may require a change in attitudes of fishers and fisheries managers, some of whom tend to resist the idea of leaving any more fish in the ocean than seems absolutely necessary to allow them to rebuild to present numbers. There is strong evidence, however that this view suffers from the 'shifting baseline' problem, where every generation sees its own experience as the starting point, without realizing what has gone before. Furthermore, marine management is tricky, with many variables interacting. Internationally, 63% of fish stocks internationally are over-fished.³² Most current levels of commercial fish populations worldwide are at or below 25% of what they were originally and fish sizes have also decreased dramatically.³³ The economic results of this are illustrated by one example quoted recently in the Economist magazine:

"For all the marvellous improvements in technology, British fishermen, mostly using sail-power, caught more than twice as much cod, haddock and plaice in the 1880s as they do today. By one estimate, for every hour of fishing, with electronic sonar fish finders and industrial winches, dredges and nets, they catch 6% of what their forebears caught 120 years ago."³⁴

Effects of chronic overfishing:

An extreme, but hardly unique example of overfishing is found in several tuna species.

Prices for sushi-grade tuna in Japan are already so high as to stagger belief. Whole Yellow Fin Tuna in the Sydney Fish Market often go for over \$100,000 to Japanese buyers and double or triple that in Japan. Southern Bluefin Tuna (SBT) are so rare that a manager joked if any showed up, it would get a first class ticket to Tokyo.

Because the SBT is migratory, Australia is only partially responsible for the management of the catch. It's stocking level is dramatically poor, however:

"The species has undergone very severe reduction in numbers as a result of heavy fishing pressure throughout its range. The Scientific Committee of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) completed a revised stock assessment of Southern Bluefin Tuna in 2009 (CCSBT 2009). This assessment estimated that the spawning stock biomass of the species was at around 5% or less of unfished levels. The stock assessment also indicated a general decline in recruitment since about 1970, coincident with declining spawning stock sizes. There were four particularly poor recruitment years from 1999–2002, and indications of some further poor recruitment after 2004, which will lead to a further decline in spawning stock biomass (CCSBT 2009a).

"Thunnus maccoyii — Southern Bluefin Tuna," Australian Department of Sustainability, Environment, Water, Population and Communities, Biodiversity species profile and threats database.

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=69402 accessed 20 June 2012

³² *Stocking Up*, p.22

³³ The *Economist*, review of book *The Ocean of Life: The Fate of Man and the Sea*, by Callum Roberts, May 12th 2012, p. 75

³⁴ *The Economist*, Ibid.

Australia has not suffered from as much overfishing as much of the world, but the fact that most of its fisheries are not naturally highly productive does make them vulnerable. Setting fishing quotas to allow a higher proportion of unfished baseline biomass will, in the long run, ensure better harvests as well as more robust marine ecosystems. An Australian example of how critical this can be is the recent decline of its gold-standard-management, highest-export-value, marine-seafood-certified fishery: Western Rock Lobster. Monitoring of lobster larvae (*puerulus*) five years in advance of them becoming harvest-sized lobsters has been carefully undertaken to predict and – in theory, and in practice until a few years ago – to manage the harvest appropriately. About seven years ago, the *puerulus* population dropped off dramatically, and two years ago the lobster harvest dropped too. While the fishery managers could not explain the decline, they took the appropriate measure of reducing the harvest in an effort to rebuild stocks.

Since the reduction in allowable harvest, some of the monitored areas have started to rebuild the lobster populations satisfactorily and some have not. It is hoped, but not certain, that the population levels will rise again in a few years. In the meantime, lobster fishermen have suffered dramatic decreases in livelihood as they try to adjust by switching to alternative, less lucrative, catch. While it is not known whether the decrease was caused by overfishing or by environmental changes, one thing is certain: the lobster population was suddenly unable to rebuild to former levels that allowed for the planned levels of off-take. There was not a sufficient population buffer to protect those harvest levels. This management approach is like standing too close to a cliff and saying everything is fine, the risk is appropriately managed and has not caused us to fall yet – and then having an unusually large wind come up which blows us over the edge. Overfishing, pollution from urban, agricultural and other factors are combining now with the new variable of climate change to create just such an unusually large wind effect. Australia can protect its high-value fishing industry for the longer run by allowing fish populations to rebuild to higher levels and by protecting some areas.

Why momentum needs to be maintained with fisheries management

Australia is somewhat ahead of the rest of the world in managing Commonwealth fish stocks. Internationally, some estimates indicate 63 per cent of assessed fish stocks required rebuilding in 2009.³⁵ In 2010, 42 per cent of Commonwealth fisheries were either of 'over-fished' or of unknown status.^{36,37}

Key policy changes over the last decade have established important principles for sustainably managing fish stocks:

- Since 2005, Individual Transferable Quotas (ITQ's) have allocated a percentage of total allowable catch, or a set number of tonnes, to each fisher. This reduces competition, or the 'race to fish'.
- The 2005, the 'Securing our Fishing Future' package recognised the need to reduce commercial fleet, rather than provide subsidies to marginal fishing operations. This improved industry profitability and sustainability. It also reduced the risk of excess fleet moving to new areas and increasing the pressure to over-fish.
- The 2007 Harvest strategy recognised that maximising fishers' profitability (Maximum Economic Yield) rather than maximising revenue (Maximum Sustained Yield) allows stocks to rebuild over time. It also means fishermen can catch their quota with less effort and make higher profits. This is an important consideration given rising fuel costs.

However, more progress needs to be made to insure Commonwealth fish stocks against future shocks.

- In 2004-05, half of Commonwealth fisheries were under economic pressure.³⁸ Most of these fisheries are likely to be struggling to cope with the economic pressure of increased fuel prices and the Australian dollar exchange rate over the last several years. Others, which were profitable then, are also likely to be under economic pressure now.

³⁵ Worm, B., et al., 2009, 'Rebuilding global fisheries', *Science*, vol. 325 (578), pp. 578 – 585

³⁶ 'Over-fished status' indicates whether the total stock of fish is large enough to support continued fishing. In a fishery considered 'over-fished' the total weight of fish is below a threshold limit and fishing should be stopped to allow stocks to rebuild.

³⁷ Woodhams, J, Stobutzki, I, Vieira, S, Curtotti, R & Begg, G. A. (eds) 2011, *Fishery status reports 2010: status of fish stocks and fisheries managed by the Australian Government*, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.

³⁸ Newton, P., et al., 2007, *Fishery economic status report: ABARE report 07.19*, Australian Bureau of Agricultural Resource Economics, Canberra ACT

- Climate change threatens the productivity of fisheries in Australia, as in the rest of the world. It also introduces extra complications for their management. Globally, ocean productivity has dropped by 6 per cent since the 1980s.³⁹ In Tasmania, the South Eastern Australian sea urchin has moved south from Victoria, destroying previously productive seabeds.⁴⁰ Ecosystems already disrupted by human impacts, including over-fishing, are likely to be more vulnerable to climate change

A smart decision and one of which Australia can be proud

Australia is ahead of the game on this one, and should be very proud. Other countries are also starting to work hard on rebuilding their ocean resources. The President of the Maldives recently announced a plan to create the world's largest marine reserve⁴¹, linking it to the preservation of sustainable fishing and tourism industries in the country. The United States has just recently done a lot and some fish stocks have recovered markedly. Europe – hampered by the EU processes, the need to build a consensus, and the political difficulties it has in reducing the large subsidies the EU gives out to its commercial fishers – has not. Its super trawlers are still travelling the world's oceans, including one planning to arrive in Australia before the proposed Commonwealth Marine Reserve Network takes effect. Asian countries are turning to aquaculture heavily, but still tend to overfish both at home and around the world.

The size of the Commonwealth Marine Reserves Network should not be the focus of debates on its value or impact. Placement of the reserves, and what is protected is key. Given the high economic value provided by coral reefs, seagrasses, and coastal shelf areas, more of these areas should have been included in marine parks under the Proposed Marine Reserves Network. Some important threats remain in particular areas and no doubt will be addressed in future debates. Nevertheless, the fact remains that Australia has taken an important step in the direction of preserving its marine resources for the future.

The benefits of the proposed Marine Reserves Network are significant, and are likely to grow over the long term:

- Commercial fish resources are only going to gain in value as the price of high-quality fish rises worldwide as the FAO and OECD⁴² predict.
- Recreational fishing is of enormous value to Australians today, and ensuring that it remains so has high value in terms of inter-generational equity, another way of saying that Australians want their children and grandchildren to have the option of enjoying recreational fishing.
- Marine tourism, for both domestic and international markets rests largely on the quality of the marine environment, whether to fish, scuba and snorkel to observe and enjoy the beauty on reefs and more, or simply to be out on the water. Ecotourism is a rapidly growing area, and Australia enjoys a reputation of a healthy outdoors generally.

Preserving the health of Australia's marine estate is both environmentally and economically the sound thing to do. Australia is already doing better than most in this area, and Australians have more to lose than most if climate change and other threats combine to damage this rich marine heritage. Australia is being economically wise, environmentally smart, and we can be proud of our government for acting in the public interest on this issue.

³⁹ Hoegh-Guldberg, O., et al, 2010, 'The impact of the climate change on the world's marine ecosystems', *Science*, vol .328 (5985), pp. 1523 – 8

⁴⁰ Australian Bureau of Agricultural and Resource Economics–Bureau of Rural Statistics, 2010, *Australian Fisheries Statistics*, Canberra ACT

⁴¹ <http://www.presidencymaldives.gov.mv/Index.aspx?lid=12&dcid=7556>

⁴² FAO/OECD Ibid.

Appendix: Valuing marine ecosystem services

Economic value of the marine estate and marine ecosystem services

"Environmental factors should be included in the valuation of assets and services." ⁴³

In addition to the fish that are pulled out of the ocean, there are plenty of other values to marine ecosystems, including tourism, industry, boat-building and offshore oil and gas, all of which enter into national accounts, but many marine ecosystem services that we depend upon are not bought and sold and so not priced, and not in national accounts. Traditionally we have not thought of them in economic terms, but that leads to their being ignored, and effectively valued at zero in decision-making processes. Eco-system services are from natural processes such as seagrasses and kelp beds providing fish nurseries, natural pest and disease control and climate regulation in the form of carbon and heat storage in the ocean. The movement to value these things economically began with the realisation that we have become capable of removing or damaging enough of the ocean ecosystems to impinge on ecosystem services that we value and depend upon.

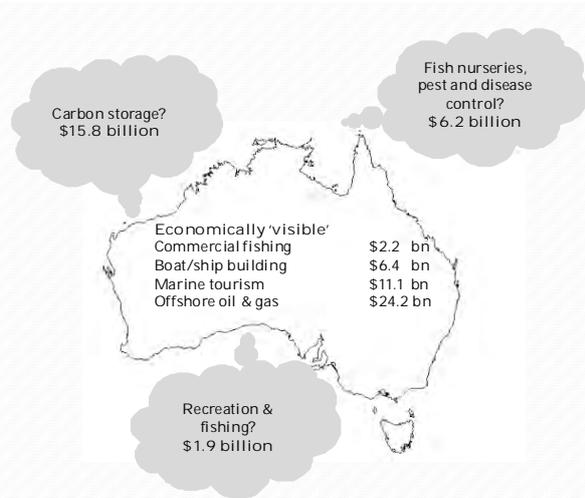


Figure 2 – Australia's marine economy, all valuable but only partly 'visible'

Australia's marine estate is enormous and provides Australians with a variety of goods that are priced and many that are not, as shown in Figure 2. As part of the work to value Australia's Marine Estate, the ecosystem service values were calculated and published by the Centre for Policy Development (CPD) in 2011 in *Stocking Up: Securing our marine economy* and are summarized here.

Commercial fishing produces about \$2.2 billion every year, and while it is considerably less than boat and ship building and marine-based tourism by official accounts, the fishing industry provides jobs for over 9000 people and income for many coastal communities as well as high-value product for both domestic and overseas markets.

Of the economically visible activities shown in Figure 2, the first three total to \$19.7 billion per year for, commercial fishing, boat/ship building and marine tourism, which accounts for more than half at \$11.1 billion a year. Offshore gas and oil account for a larger amount, totalling \$24.2 billion per year.

Those values which are not economically visible amount to \$25.2 billion per year (Table 4). This is comparable to and slightly larger than that of gas and oil industries on the continental shelf shown in Figure 2. The total value of ecosystem services would be higher than this study suggested if all of the eco-system services that can be used, including those not costed as shown in Table 7, were counted here.

⁴³ In section 3.5.4 of the Intergovernmental Agreement on the Environment, 1992, signed, Prime Minister of Australia, First Ministers of all the States and Territories and the President of the Australian Local Government Association

Table 4- Estimated Ecosystem Services Values of Australia's Marine Estate

<i>Ecosystem service</i>	<i>Estimated value (\$ billions/year)</i>
Food (market value of recreational catch) ⁴⁴	0.4
Raw materials	0.9
Climate regulation	15.8
Biological control	4.6
Nursery services	1.6
Opportunities for recreation (spend by recreational fishers) ³	1.9
Total ⁴⁵	25.2

Protection zones within Marine Reserves Network

The marine reserves contain different protection zones. There are about eight categories of zoning in the Marine Reserves Network Proposal. (The zone names and activities allowed in each vary slightly in different regions with particular allowances or prohibited activities, so the definitions and boundaries are not quite as simple as this summary chart shows.)

The categories are shown in Table here. All six of the regions include Marine National Park Zones, Multiple Use Zones and Unzoned areas that are not affected by the Proposed Marine Reserves. The other zones are in some but not all of the planning regions. The last column shows the percent of the total planning area: Marine National Park Zones are in 13% of the area, other zones in the Marine Reserves but not the fully-protected Marine National Parks make up 23% of the area. Together these two cover 36% of the total area. The remaining 64% of the area is unaffected by the Proposed Marine Reserves.

Table 5 - Zones and allowable activities in Australia Commonwealth Proposed Marine Reserves, and planning regions containing each

Zones	CS	TE	SE	SW	NW	N	%
(1) Marine National Park Zones (IUCN Ia and II)	✓	✓	✓	✓	✓	✓	13%
(2) Recreational Use Zones (IUCM II and IV)		✓	✓				
(3) Habitat Protection Zone (Coral Sea) (IUCN IV)	✓						
(4) Habitat Protection and Conservation Park Zones (IUCN IV)	✓	✓		✓	✓		23%
(5) Special Purpose Zones (IUCN VI)		✓	✓	✓		✓	
(6) Special Purpose Zone (Oil and Gas Exclusion) (IUCN VI)				✓			

⁴⁴ The total value of food caught by recreational fishers, as well as opportunities for recreation, is assumed not to change as a result of the expansion of the marine reserve network. Recreational fishing will continue in all zones except for marine national parks (IUCN Ia & II). Due to fish mobility, recreational fishing catch and time currently spent in designated marine national parks is likely to shift to nearby areas. The combination of spillover of larger healthy fish from marine national parks and the elimination of destructive fishing practices in most of the marine reserve network is likely to increase recreational fishing values across Australia's marine estate. However, this possible increase in value has not been estimated.

⁴⁵ Note that in *Stocking Up*, a more detailed method was used to estimate the areas for the South-West case study

Zones	CS	TE	SE	SW	NW	N	%
(7) Multiple Use Zones (IUCN VI)	✓	✓	✓	✓	✓	✓	
(8) General Use Zones (IUCN VI)	✓						
Unzoned area (activities not affected)	✓	✓	✓	✓	✓	✓	64%

CS: Coral Sea, TE: Temperate East, SE: South-east, SW: South-west, NW: North-west, N: North

Marine National Parks are total protection, 'sanctuary' zones. These exclude commercial fishing, tourism-related fishing (charters, fishing/spear fishing tours), recreational fishing and mining. All the other zones allow recreational fishing. Almost all allow tourism-related fishing. All of the other zones allow some forms of commercial fishing, but almost none allow the highly destructive demersal (bottom) trawling that destroys the structures and so much of the life on the sea bottom. Commercial fishing varies with different types of fishing allowed, but all types except for bottom trawl (except the ET where it is allowed) and, in some, demersal longline are allowed in Special Purpose Zones, and almost all (varies by location) in Multiple Use Zones. Habitat Protection Zones also allow commercial fishing except for demersal types and some traps.

Area of total marine estate and Marine Reserves Network

A summary over-view of the extent of Australia's marine areas is given in Table . The total Australian Marine Estate is very large at over 12 million km². A good part of that is in territorial waters bordering Antarctica. That portion and some of the more remote islands are not part of the Proposed Marine Reserve System. The area called contiguous is over 9 million km² and percentages of total area are taken on the basis of the contiguous area. The Marine Reserves, which provide different degrees of protection, total over 3.2 million km²; before the current proposal, the total was 910,000 km². The National Marine Parks, which are the totally protected areas, total 1.2 million km² or 13% of the contiguous area. Before the current proposal, the area was 360,000 km². This leaves the largest part of the contiguous area, over 5.8 million km² or 64% of the total not zoned or protected, although various fishing regulations continue to apply.

Table 6- Summary of Marine Areas, totals and Marine Reserves

<i>Australian Marine Areas, different categories</i>	<i>km² (rounded numbers)</i>	<i>km² (rounded numbers)</i>	<i>% of contiguous area</i>
Total Australian Marine Estate:	12,420,000		
Marine area contiguous to Australian continent (excluding Antarctic territorial waters)	9,054,000		100%
Of which, marine reserves with different degrees of protection	3,240,000		36%
- existing before 14/6/12		910,000	10%
- proposed on 14/6/12		2,330,000	26%
Of which, National Marine Parks, totally protected	1,200,000		13%
- existing before 14/6/12		360,000	4%
- proposed on 14/6/12		840,000	9%
Of which, not designated/protected	5,810,000		64%

Marine ecosystem services values by category

Ecosystem service values were estimated by CPD on the basis of work done by a number of researchers in Australia and internationally, including work on The Economics of Ecosystem-services and Biodiversity by the United Nations.⁴⁶ The values used are as shown in Table . This estimation focused on those which contributed directly or indirectly to identified uses, not non-use or existence values. Where no numbers are shown, no estimations were made for these categories.

CPD's estimates are conservative compared to similar studies from around the world. In this scoping study, we have selected a few examples of ecosystem services to illustrate the value of healthy oceans. We have also been conservative in estimating average values per hectare to account for Australia's relatively low-productivity waters and to avoid over-estimating ocean carbon storage.

Table 7 - Ecosystem service values used by CPD to estimate value of Australian Marine Estate and value of Proposed Marine Reserves Network (\$/ha)

<i>Category</i>	<i>Open ocean*</i>	<i>Coastal systems</i>	<i>Coral reefs</i>	<i>Seagrass</i>
PROVISIONING SERVICES				
Food	0.1	2	5	5
(Fresh) water supply				
Raw materials		4	1	4
Genetic resources				
Medicinal resources				
Ornamental resources				
Subtotal	0.1	6	6	10
REGULATING SERVICES				
Influence on air quality				
Climate regulation	9	27	79	79
Moderation of extreme events				
Regulation of water flows				
Waste treatment/water purification				
Erosion prevention				
Nutrient cycling and maintenance of soil fertility				
Pollination				
Biological control	4			
Subtotal	14	27	79	79
HABITAT SERVICES				
Lifecycle maintenance (esp. nursery services)			134	183

⁴⁶ CPD analyses using de Groot et al (2010) and other sources. See *Stocking Up*, p. 13 and Appendix 1.

<i>Category</i>	<i>Open ocean*</i>	<i>Coastal systems</i>	<i>Coral reefs</i>	<i>Seagrass</i>
Gene pool protection (conservation)				
Subtotal	-	-	134	183
CULTURAL SERVICES				
Aesthetic information				
Opportunities for recreation and tourism	-	9	9	9
Inspiration for culture, art and design				
Spiritual experience				
Information for cognitive development				
Subtotal	-	9	9	9
Total	14	42	227	280