Dear Director of National Parks (CC Minister Frydenberg, Tony Burke MP),

Background

My name is Geoff Castle and I am a biologist/climate scientist. My particular area of interest as a biologist is developing sustainable systems that will reverse humankind's tendency to overexploit both the biotic and abiotic environment.

Warning: If current levels of marine exploitation continue unabated, there will not be one commercial viable fishery left by 2050!

Naturally, as a scientist, I would have liked to have seen even greater levels of protection afforded to our marine ecosystems rather than rather than myopic attempts to pander to 'big oil'. This paper will frame the main reasons put forward by various stakeholders within the fishing industry to scale back the proposal, and then counter their arguments with peer-reviewed science. References to 'the industry' in this paper refer to the commercial fishing industry responses to the marine reserves proposal.

I have chosen this approach for a specific reason. It has become almost a standard practice for industries to obfuscate the debate, on any proposal that may impede on their bottom line, by essentially 'marketing doubt' in order to delay responsible action. Economic interests are continually telling politicians and scientists that we cannot restructure our economic system to embrace the kinds of values that people like myself subscribe. Industry promotes the view that it is the economy that is the bottom line to which everything else, including nature, must capitulate. This paper will endeavour to show that such a belief is an act of incredible hubris.

Introduction

Marine national parks, just like their terrestrial counterparts, will play an essential role in allowing species to survive and adapt in a world where the increasing demands of the burgeoning human population are placing unprecedented stresses upon natures capital. This paper defines Marine Protected Areas (MPA'S) in accordance with the Australian Marine Science Association (AMSA),"areas of the ocean or coastal seas, securely reserved and effectively protected from at least some threats". The current spatial location, size, extent and distribution of global MPA's is vastly inadequate (Koldewey et al. 2010), with less than 1% of the world's oceans being off-limits to fishing.

The industry maintains that it has the worlds best practice management objectives, that commercial fisheries are being harvested in a sustainable manner, that the risks posed to ecosystems are insignificant and present significantly lower risks than activities such as gas extraction.

There is a perception that commercial fishing, an activity that essentially kills and removes marine organisms from their habitat for humankind to eat, has little if any effect on the populations being fished. This perception remains widespread in Australia and is ill conceived. However we define sustainable fishing, it has rarely occurred as a result of voluntary management systems, but more so as our inability to access exploitable stocks of marine biota (Pauly et al. 2005).

The problem today is one of scale. Modern industrial fishing techniques such as demersal trawl, pelagic longline, gillnets (demersal and pelagic), factory-freezer trawlers, GPS equipment, sonar fish-finding equipment and spotter planes have resulted in a global fleet of about 4 million fishing boats that pursue fish throughout the world's oceans (Miller and Spoolman 2011). According to the Food and Agriculture Organization of the United Nations 2010, 85% of world fish stocks were fully exploited, overexploited, depleted or recovering. Currently, the collective overfishing of the world's nations is taking 57% more than the sustainable yield. This means we are harvesting more than half again as many marine fish

stocks as these species are capable of renewing. A study by marine biologists Myers and Worm (2003), examined the composition and biomass of predatory fish in nine oceanic systems using a meta-analytic approach. They reported that 90% of all large predatory fish, including tuna, swordfish, marlin, sharks and cod had been removed from the ocean since 1950, industrialized fishing being the culprit (Myers and Worm 2005).

The scientific evidence clearly supports the view that fisheries extraction is one of the major threats to marine biodiversity, and one that has resulted in the depletion and extinction of many species (Jackson et al. 2001; Baum et al. 2003; Myers and Worm 2003; Hutchings and Baum 2005; Essington et al. 2006; Heithaus et al. 2010). It is therefore clear, that the establishment of refugia, now called marine reserves or 'no-take zones' is a legitimate and obvious management tool to ensure the long term sustainability of Australian marine food stocks.

This paper rejects claims by the fishing industry that overexploitation does not occur in Australian fisheries. Species such as the Orange Roughy (Hoplostethus atlanticus), remained relatively unaffected by commercial fishing right up to the early 1990's. In just over a decade, Australia's south east trawl fishery hunted them to the brink of commercial extinction. According to a CSIRO stock assessment report by Wayte (2003), all but one of Australia's five roughy stocks (the Cascade Plateau), remain severely overfished with populations currently estimated to be less than 10%-20% of their original biomass. East coast Grey Nurse shark (Carcharius taurus) populations have been decimated by both commercial and recreational fishing pressures. The commercial bycatch of this species could see it driven to regional extinction (Otway et al. 2004). Furthermore, bycatch species comprise almost one third of the biomass of the global annual fish catch and are mostly thrown overboard dead or dying (Miller and Spoolman 2011), considerably adding to biodiversity loss.

Both the commercial fishing industry and many recreational fishers have argued that there is little evidence to the theory that MPA's can be designed as a connected network to sustain fish populations. They caution against using 'theoretical' benefits and dispute their ability to reduce biodiversity loss.

There are over 250 peer-reviewed research papers that support the concept of marine reserves. Commercially valuable fish populations within fully protected marine reserves have doubled, fish sizes have increased by almost one third, fecundity has tripled and up to a 25% increase in biodiversity has been observed (Russ et al. 2008). There is no doubt that marine reserves work and they work quickly. These effects have been observed within 2-4 years following complete protection such as the IUCN category 11 zones.

A recent study undertaken by Harrison et al. (2012) used DNA fingerprinting technology to track the dispersal pathways of baby coral trout (Plectropomus maculates) and stripey snappers (Lutjanus carponotatus) in a 1000 square kilometer reef area near the Keppel Island group on the GBR. Researchers initially DNA tested 466 adult coral trout and 1154 adult stripey snappers caught and released within the marine reserves that accounted for 28% of the study area. Over the next 15 months, they tested juveniles of these species caught from 19 protected and fished locations. The data indicated that the populations residing in the three reserves exported 83% of the coral trout and 55% of the stripey snapper offspring to fished reefs. It was estimated that reserves representing 28% of the study area, accounted for approximately half of all juvenile recruitment to both reserves and fished reefs up to 30km away. This study provided compelling evidence that marine reserve networks can significantly increase fish populations in both reserves and adjacent fished areas on a spatial scale relevant to a variety of stakeholders.

Figure 1. Sampling locations of adult and juvenile fish. The Keppel islands include six no-take marine reserves (Marine National park Zones shaded green) protecting 28% of the coral reefs.

Adult P. maculates and L. carponotatus were sampled within three no-take reserves (dashed line borders), and juveniles were sampled from 19 locations (red stars) within reserves and areas open to fishing. Conservation park zones (yellow) permit limited recreational hook-and-line as well as spear fishing. Habitat Protection zone (dark blue) exclude demersal trawling but permit hook-and-line and spear fishing. General use zones (light blue) allow all types of fishing. (Source: Harrison et al. 2012).

This paper supports and commends the Federal Government's commitment to increase Australia's Marine Reserve Network as this will represent a win- win for the sustainability of commercial fisheries and biodiversity conservation.

The commercial fishing industry also maintain the argument declaring an absence of protocols for testing whether MPA's can achieve conservation objectives such as reducing biodiversity loss. Hundreds of studies have demonstrated that exploited species in fully protected marine reserves exhibit higher abundance, fecundity and biomass (Halpern 2003; Russ et al. 2008; Lester et al. 2009; Babcock et al. 2010). Indeed, the DNA parentage analysis procedures detailed by (Harrison et al. 2012), is indeed a powerful empirical tool that directly measures the MPA's contribution to maintaining local biodiversity.

The world's oceans are littered with the corpses of collapsed fisheries. Earth's open-access renewable resources, including its biota, atmosphere, groundwater and the oceans, have been subjected to collective degradation referred to by biologist Garret Hardin, as 'the tragedy of the commons' (Hardin 1968). The tragedy is almost universally the overexploitation of a resource viewed as common property that nobody actually owns. The collapse of Atlantic cod (Gadus morhua) stocks off the coast of Newfoundland in 1992 is a poignant example and should serve as caveat to governments that a supposed scientifically-based, well-managed fishery, could indeed end in tragedy.

The industry has stated that the Australian government has yet to demonstrate that benefits exceed the cost of marine reserve investment and that the fishing sector is part of Australia's heritage that deserves greater support. They also argue that networks of reserves that reflect industry's advice is likely to be more efficient in terms of operational management. Consider the following.

The Newfoundland cod fishery began around 1497 and lasted for almost 500 years. In 1600, English fishing captains reported, 'the cod are so thick by the shores, we can hardly row our boats through them'. This fishery was also an integral part of the heritage of many coastal Atlantic Canadian communities.

A variety of reasons led to the commercial extinction of the Atlantic cod.

1. Increasingly efficient fishing technology, such as navigational aids, fish finding equipment, gillnets, cod traps, longlines, net design and trawling.
2. The conservation regulations needed to protect the cod stocks failed to evolve commensurately with the industry's ability to harvest the cod.
3. The biomass of the cod were overestimated. Fishery scientists based their assessments on data gained almost exclusively from commercial trawlers. The scientists, and indeed the commercial fishers overlooked the fact that Atlantic cod, like many species of pelagic fish, are divided into sub-populations. Sub-populations function differently in complex marine ecosystems, in this case a continental shelf environment. Fisheries management must consider the population structure when assessing the spatial complexity of marine fish species (Riveiro et al. 2011) as a failure to do so could lead to a depletion of sub-population units with deleterious consequences to stock viability (Stephenson 1999). Science is often complicated and the fisheries scientists managing the Atlantic cod fishery based their assessments of sustainable yield on an oversimplified model of population dynamics.
4. It is the belief of this paper that there was a complete absence of 'no-take' IUCN category 11 zones to serve as refuges for a population under siege.

This paper rejects the claim that reserves based on the advice of industry are likely to be more efficient and cautions against developing reserves based solely on 'industry's advice and recommendations'. Marine science is still an inchoate discipline as only 1% of life forms in the sea have been formally identified and studied (Miller and Spoolman 2011). It is unlikely that the commercial fishing industry is aware of the arcane interactions occurring in the marine ecosystems in which they operate and there will always be a pecuniary conflict of interests inherent in their advice.

Figure 2. This graph illustrates the collapse of the Atlantic cod (Gadus morhua) population off the east coast of Newfoundland in 1992. Fisherman began using bottom trawlers in 1959 which considerably increased their catch and is reflected in the sharp rise in the graph at that time. By 1970, the cod population began to fall rapidly in response to this extreme overexploitation until it totally collapsed in 1992. To this day, there is no sign of recovery. (Source: Millenium Ecosystem Assessment).

Between 1850 and 1950 the annual average catch off the east coast of Newfoundland was about 250 000 tonnes. In 1959, factory freezer trawlers commenced operating in the fishery. These ships can remain at sea for months, like floating fish plants processing and freezing hundreds of tonnes of fish around the clock in all but the worst of weather conditions. Naturally, the catch rate increased (as can be seen from the unprecedented spike in the graph), and more than doubled from 360 000 to around 810 000 tonnes. The harvestable biomass of the cod plummeted by 82% between 1962 and 1977, and the only reason the catch rates remained at an even 220 000 tonnes per annum in the 1980's was due to the increased efficiency of commercial fishing technology. It almost defies belief that in 1982, the Federal Department of Fisheries and Oceans purported that the cod population was recovering and boldly forecast an annual sustainable yield of 550 000 tonnes.

In the mid 1980's, the inshore cod fisherman and marine biologists warned the government and advised an immediate reduction in catch volume of 50%. The government ignored the warnings, a typical response to avoid having to make unpalatable hard decisions, and maintained the quotas instead of scaling them down in order to prevent economic losses and massive unemployment. By 1992, scientific data revealed that the original cod biomass had been reduced by 95% due to overfishing (Shelton et al. 2006) and the Canadian government declared a moratorium on the entire cod fishing industry. An estimated 40 000 people lost their livelihood and by 1998, the 2 billion dollar assistance program to help these communities was out of funding. The species remains at less than 5% of pre-collapse levels despite an imposed moratorium forbidding their capture since 1992 (Shelton et al. 2006; Suzuki and Taylor 2009).

This example clearly demonstrates that humankind has the technology to harvest and annihilate any commercial fish stock anywhere on the planet, and transmogrifying the ecosystem in the process. Current research regarding the failure of the cod population to recover from overfishing has revealed a 900% increase in forage fishes and a 200% increase in macroinvertebrates following the 1992 collapse (Bundy et al. 2009). Biologist refer to this as a trophic cascade. Fauchald (2010) has suggested that a predator-prey reversal is occurring whereby these organisms now prey upon the early life stages of the cod that once preyed upon them, which seems to be the main cause of the delayed recovery of this benthic fish complex (Casini et al. 2007; Fauchald 2010; Frank et al. 2011). Therefore, overfishing clearly does more ecological damage than simply depleting one particular species. It often changes the way an ecosystem functions which inevitably effects many other species. This happens because in nature, everything is connected like a network of synergistic functions.

Indeed the Australian fishing industry should take note of this poignant example of a government that failed dismally to protect its marine biota and the industry that depended

upon it. It has been argued that such a collapse could never happen in Australian waters and that secure access rights are the foundation for sustainable commercial fisheries. The irony of this claim is highlighted to me as the super-trawler Margiris, a trawler capable of taking and processing 240 tonnes of fish per day, is heading to Tasmanian waters, at the time of writing this paper, to catch 18 000 tonnes of Jack mackerel (Trachurus symetricus) and redbait (Emmelichthys nitidus nitidus). This trawler has the capacity to cause the local depletion of fish that are the primary food source for endangered species further up the food chain such as Bluefin tuna (Thunnus maccoyii), cetaceans, seabirds and furseals. Furthermore, the stock assessments for the fisheries the Margris will be operating in are up to eight years old, and with such poor data, it is hard to be confident that overfishing will not occur, depite the assurances from the government and the Australian Fisheries Management Authority that it will not. (Is this sounding a little familiar?).

The industry also claims that continued access on a large spatial scale to all possible fishing areas will be necessary to protect Australia' food security. Indeed in the light of the evidence presented, the opposite is essentially true. It may seem counter intuitive to layman to believe that if you actually reduce the areas able to be fished there will be more fish to catch.

Biodiversity has been recognised as a crucial factor contributing to the stability and resilience of ecosystems, both terrestrial and marine. Ecosystems containing fewer species are less able to adapt to change and environmental stressors (Suzuki and Taylor 2009).

Five major human activities, invasive species, overfishing, pollution, habitat fragmentation and habitat destruction are exerting significant pressure on global biodiversity through species extinction (Eldredge 2002; Clavero and Garcia-Berthou 2005; Brooke and Sohdi 2006; Barnosky 2008; Sax and Gaines 2008). These stressors are essentially working synergistically to force species to extinction (Schneider 2009), and as a result, create major ramifications for the way we manage our fisheries.

Historically, the focus has been on individual fish stocks rather than the ecosystems upon which those fish populations depend. It has been argued that the implementation of marine reserve networks is an essential component of marine management (Agardy 2000), as the focus is on the protection of entire ecosystems, a need which has never been more poignant than in today's world. Therefore, the federal government's proposal to formalise a network of marine reserves around the entire coastline of Australia, will, in the view of this paper, become the sine qua non in preserving the future food security of Australia's marine resources.

The commercial and the recreational fishing industry has argued that reduced access to fisheries as a result of marine reserves will impact on ecosystem monitoring, surveillance of illegal immigrants and will result in increased levels of illegal fishing.

The argument is both a tenuous and polemical attempt to promote 'assumed' socio-economic disadvantages of MPA's in order to filibuster the implementation of a milestone achievement of marine protection. This argument neglects the reality of management once MPA's have been declared. The Great Barrier Reef Marine Park had an annual budget of $47 million for the 2010-2011 financial year. Such budgets fund activities such as surveillance and prosecution of illegal fishing, both domestic and foreign. This paper argues that the creation of future budgets and management plans for the proposed marine reserves would potentially reduce illegal activities rather than enhance them.

Summary of action required by government

1. Implement the proposed marine reserves network and recognise that protecting vulnerable and rare ecosystems will be the key to maintaining biodiversity.
2. Recognise the need to consider multispecies management approach, such as taking into account interactions among different species, particular predator-prey interactions, when determining the sustainable yield of fisheries.

3. Develop a program to manage the threats to marine habitats, namely, overfishing, marine debris, climate change, agricultural runoff, habitat destruction and invasive species through the implementation of management tools such as the precautionary principle, MPA's', the ecosystem approach to conservation and a committed policy to rapidly reduce anthropogenic greenhouse gas emissions.
4. Increase the funding for public awareness campaigns for the above issues, bioregional planning and the enforcement and monitoring of MPA's.
5. Increase the level of IUCN fully protected zones to a minimum of 20% of Australia's territorial waters, particularly inshore coastal habitats.

Conclusion

The addition of more than 2.3 million square kilometres of Commonwealth marine reserves will cement Australia's position as a world leader in the field of marine science and conservation. This paper recognises the need to protect critical regions of the marine environment from human pressures in the same way we do so with land-based National Parks. The evidence is mounting that humankind is exerting growing pressures on aquatic biodiversity and ecosystem services. To avoid ecological tipping points, this trend must be reversed within the next couple of decades through the implementation of the precautionary principle and an ecosystem approach to biodiversity conservation. Immediate action is required and so this paper endorses the expansion of the Marine Reserves Network, and calls upon the Federal Government to increase protection for Australia's marine biodiversity.
I would like to close with a quotation from the respected zoologist – David Suzuki, and I thank you for taking the time to read this paper.

"When we measure everything according to its economic value, those things that matter most to us are worthless. The biosphere is our home. All other species in Creation are not resources, opportunities, or commodities; they are our relatives, and in an act of generosity, they provide our most fundamental needs while also giving us companionship and enriching our lives with beauty, mystery and awe. We have to see the world through new eyes, because how we view the world affects the way we treat it." (Suzuki 2010).

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At the 2030 World Conservation Congress scientists set an evidence-based target that 30% of the ocean should be protected by 2030. The government's proposed changes to Australia's marine parks network represent a giant step backward from our commitment to ocean protection.

The biological and societal benefits of marine reserves are clear. It is well established that genuine marine reserves protect wildlife and also support productive fisheries and other uses of the marine environment. Crucially, they enhance the ocean's resilience against the impacts of climate change, and mitigate its effects, promoting increased well-being for coastal communities.

Resilience is greatest in reserves that are large long-established, well-managed and have full protections from all extractive activities including mining and its associated exploration.

In the face of devastating coral bleaching, depleting global fisheries, mangrove dieback and vanishing kelp forests, Australia's Commonwealth Marine Reserves are even more important than ever.

As someone who enjoys recreational fishing I am certain that stronger marine protection is in my interest. As an Australian who wants to buy sustainable local seafood for my family, and support local fishing jobs, I value the role marine parks can play in ensuring that's possible for the long term.

Therefore, I am opposed to any rollback of marine parks especially in critical areas like the Coral Sea, and I strongly support real protection from oil and gas mining in the uniquely biodiverse and productive Great Australian Bight which is currently at risk from oil exploration.
In particular:

1. I am strongly opposed to any reduction in fully-protected National Park zones in Australia's marine parks network - science tells us these no-take areas are critical if marine reserves are to give us full benefit;

2. The network should be science based, and therefore deliver adequately sized and located National Park zones (IUCN II/ 'sanctuaries') on both the continental shelf and in deeper waters;

3. I support the draft changes where new and/or increased National Park zones are proposed.

4. I reject the draft management plans where:
National Park zone areas are made smaller (eg: the Coral Sea Marine Park, Cape York West Marine Park, Gascoyne Marine Park, Argo Rowley Terrace Marine Park, the SW Corner Marine Park (Diamantina Fracture Zone section), Lord Howe Marine Park, Dampier Marine Park and Twilight Marine Park); or removed altogether (ie: the Wessels Marine Park, Geographe Bay Marine Park, the Peaceful Bay section of the SW Corner Marine Park); or where National Park zone areas have been moved to areas of far less ecological importance (eg: the Perth Canyon Marine Park, the Gulf of Carpentaria Marine Park); or where the Government has ignored the Review's recommendations for additional National Park zone areas (eg: in the Norfolk Island Marine Park).

5. I believe it is an unjustifiable example of poor governance that the Government has ignored the findings of its own Independent Review, and is proposing significantly less National Park zone protection than the Review recommended.

6. I am gravely disappointed and it diminishes my confidence in government and in particular in Parks Australia the 54,000 submissions to last year's first round of consultation the vast majority of which called for a significant increase in marine National Park zones, have not been taken into account.

7. I reject the claims by government that Habitat Protection zones are equal to National Park zone zones.

8. I urge the Government to make the following additional changes to the draft management plans:
a) That new marine National Park zones are declared:
In the northern section of the Kimberley Marine Park; at west Holmes and South Flinders Reefs in the Coral Sea; in the Norfolk Island Marine Park as recommended in the Review; adjacent to the Great Barrier Reef Marine Park as recommended in the Review;

b) That every marine park under Review be afforded an adequately sized and located National Park zone (currently 16 of the 44 of have none) and;
c) That all marine parks should be fully protected from oil and gas mining as has been achieved in the Great Barrier Reef MP and the Coral Sea MP.

9. And finally, I impress upon Parks Australia to recognise that my submission should be treated with the same regard as others made in any other format. That just because it is made online facilitated by community organisation does not diminish its importance. I ask that you act on this and all other submissions equally.

Yours sincerely,
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cc: Hon Josh Frydenberg

cc: Tony Burke