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Park **is published to strengthen international collaboration among protected area professionals and to enhance their role, status and activities by:**

- maintaining and improving an effective network of protected area managers throughout the world, building on the established network of WCPA;
- serving as a leading global forum for the exchange of information on issues relating to protected area establishment and management;
- ensuring that protected areas are placed at the forefront of contemporary environmental issues such as biodiversity conservation and ecologically sustainable development.

Editorial

GRAEME KELLEHER AND KRISTINA GJERDE

THIS EDITION of PARKS recognises the critical roles played by the world's oceans in maintaining the biosphere and the rapidly increasing stresses being applied to them by human activities. The oceans, and consequently the biosphere, are under threat. These threats are embodied in the great reductions in populations of fishery-targeted marine species, the destruction of deepsea benthic habitats which are biological 'islands' with many endemic, slow-breeding species and the now almost universally recognised increases in global temperatures, among other issues. In particular, the latter may lead to unpredictable changes in ocean circulation patterns, with potential dramatic effects including shifts in species composition, migratory patterns and even entire ecosystems. Healthy ecosystems are better able to respond to changing oceanic conditions. The time to act is now.

Many of the threats to fished species have long been recognised and attempts to ameliorate them by conventional fishery management approaches have often demonstrably failed, particularly, but not only, in the sea areas beyond national jurisdiction referred to here as the High Seas.

The High Seas are special. They cover about 50% of the world's surface but are regulated in almost inverse proportion to the size of the area they occupy, as well as to their substantial importance to life on earth. The United Nations Convention on the Law of the Sea (UNCLOS) provides a fundamental framework, but it has many deficiencies as it is presently applied. The Convention on Biological Diversity (CBD) is a complement to UNCLOS as are regional fishery management organisations (RFMOs) and other regional arrangements, but they are not working adequately either. Marine protected areas (MPAs) have been shown to be successful in Exclusive Economic Zones (EEZs) of nations in protecting biological diversity and productivity when traditional fishery management approaches have failed. Because we are now seeing the same problems in the High Seas as we have seen in EEZs, it is time to use MPAs to achieve the fundamental objectives of the World Conservation Strategy – repeated in IUCN's Guidelines for Marine Protected Areas:

- to maintain essential ecological processes and life support systems;
- to preserve genetic diversity; and
- to ensure the sustainable utilisation of species and ecosystems.

This edition of PARKS addresses the opportunities and challenges of achieving the High Seas component of the target of the World Summit on Sustainable Development (WSSD) and other fora: representative networks of MPAs by 2012. The articles cover a wide range of topics by some of the leading experts in the field:

- *Protecting earth's last frontier: why we need a global system of High Seas marine protected areas networks*, Dan Laffoley, Vice-Chair Marine, World Commission on Protected Areas.
- *High Seas marine protected areas on the horizon: legal framework and recent progress.* Graeme Kelleher, Chair of the WCPA High Seas MPA Task Force and Kristina M. Gjerde, IUCN Global Marine Programme.
- *Improved oceans governance to conserve high seas biodiversity*. Elizabeth Foster and Tia Flood of the Australian Department of Agriculture, Fisheries and Forestry, Alistair Graham, WWF International and Martin Exel of Austral Fisheries.
- *The economic rationale for marine protected areas in the High Seas.* Paul Morling, RSPB.

- *Pelagic protected areas: the greatest parks challenge of the 21st century*. Elliott Norse, President of Marine Conservation Biology Institute.
- *Challenges of marine protected area development in Antarctica*

Foreword: high time for High Seas marine protected areas

SYLVIA EARLE

AMONG THE MOST AMAZING DISCOVERIES of the 20th century is the awareness of how little is known about the ocean, especially the great blue expanse beyond the jurisdiction of any nation known as the 'High Seas' – an area comprising about 64% of the ocean as a whole. Spacecraft fly over it, documenting temperature, salinity, wave height and even the broad configuration of the sea floor far below. Thousands of ships cross over it, some dedicated to probing the three-dimensional realm below with ingeniously-crafted instruments and sampling devices. A few manned submersibles, remotely operated vehicles, and divers breathing compressed air and sometimes exotic mixes of gases, have descended into previously unexplored parts of the open sea. In the past 50 years we have learned of the existence of great mountain chains in the deep ocean, the forces of plate tectonics that drive the movement of continents, and the power of deepsea hydrothermal vents and ecosystems based on chemosynthesis by microbes – not sunlight and photosynthesis. Yet, as the 21st century begins, less than 5% of this amazing three-dimensional realm has been seen, let alone fully explored or even mapped with the accuracy accorded to the moon, Mars, and other distant parts of the solar system.

Slowly, exploration is proceeding, yielding priceless insights about the value of the open sea and the deep sea – including the High Seas beyond national jurisdiction, as the blue heart of the planet, the vital core of what makes life on earth possible – generating oxygen, absorbing carbon dioxide, stabilising temperature, governing climate, weather and planetary chemistry. The world ocean is the largest ecosystem in the universe, populated with representatives of nearly all of the major divisions of life, half of them entirely marine. A single bucketful of water dipped from the open sea may contain planktonic young or adults of a dozen major categories of life and more than a thousand kinds of microbes. It is a realm unimaginable to those who have not dived into the sea at night and experienced a glimpse of what it is like to be immersed in a vast, deep, liquid

scientifically explored, but enough is known to recognise that each one potentially hosts a high percentage of species unique to each place. Previously protected by their inaccessibility, these areas are now being fished with trawls that scrape the bottom with the efficiency of bulldozers, taking entire ecosystems along with long-lived, slow-reproducing fish with astonishing eyes, unique sensory systems and mysterious modes of communicating. Before they have been explored or even named, seamounts are being systematically destroyed by unlikely terrestrial hunters. Nothing in the repertoire of survival techniques developed for living in the icy, dark, high pressure environment of the deep sea has prepared these creatures for predation by crafty humans accessing their realm for the first time in history. With modern deepsea trawling gear, it takes only minutes to eliminate whole species, some with a highly restricted range and complex ecosystems fine-tuned over hundreds of millions of years.

Increasingly, deepsea trawling is moving from the Exclusive Economic Zones of various countries to the open ocean beyond, where fishing practises are largely unregulated. While bottom fishing in some regions on the high seas is controlled by regional fisheries management organisations, few restrict bottom trawling or its impacts. Vast areas of the High Seas (a frighteningly high 75%) lack any management body currently capable of restricting bottom

Protecting earth's last frontier: why we need a global system of High

What is meant by a comprehensive, adequate and representative system?

As defined by IUCN, an MPA is 'any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment' (Kelleher 1999). Such protection can range from areas managed strictly for science or wilderness values where extractive activities such as mining and fishing are excluded, to areas managed more broadly for the sustainable use of natural resources and ecosystems. Kelleher and Recchia, 1998, provide a detailed overview of the six IUCN Protected Area Management Categories as applied to the marine environment.

As noted by Norse (this issue), the ocean may look vast and indistinguishable, but in fact it consists of many distinct ecosystems, habitats and communities, with vast differences in species and genetic composition from region to region. At the same time, many species, like the loggerhead sea turtle, transcend these boundaries. Representative MPA systems could encompass known ecologically and biologically significant areas such as seamounts, cold-water coral reefs, hydrothermal vents, and upwellings, convergence zones and other areas important to fisheries and migratory species. At the same time, they could also protect areas that are representative of specific ecosystems, habitats and communities, but whose significance has not yet been assessed. Networks of MPAs, usually within a single ecosystem, are necessary to ensure that biological connections are maintained between interdependent MPAs. A common example of this interdependence is where populations of one or more species within one MPA are supported by larvae from another MPA.

A comprehensive, adequate and representative system of MPA networks would provide protection for examples of all major ecosystem components in conjunction with their characteristic habitats and species at an appropriate scale within and across each bioregion. It would also have the required level of restrictions to ensure their ecological viability and integrity, be effectively managed, address the full range of human activities, and be sufficiently duplicative so that a single event, such as an oil spill, would not eradicate that diversity.

The untrawled seafloor off North-west Australia showing dense populations of corals and sponges. Photo r K ith Sa i s ury, CSIRO

The development of representative MPA systems is generally achieved through demarcation of ecological regions of open ocean (pelagic) and/or seafloor (benthic) components on large geographic scales using biogeographic classification systems. These regions are then examined more closely to identify the range of habitat/biotope types, species assemblages, ecological processes or other natural features that are characteristic of the larger marine region.

Representative networks and systems of MPAs add value to the case-by-case approach traditionally taken with MPAs by focusing on protecting species and ecosystems before they become endangered or irreversibly damaged (Laffoley, *et al.* 2004). Past practice focused only on the protection of rare, threatened, declining or endangered species and small-scale protected areas often succeeded only in generating longer and longer lists of habitats and species needing urgent action. Too often, action to restrict human activities is only taken when the future viability of species or biological communities is in doubt, or where proof of damage to the ecosystem or its features is clear and is produced. In the poorly understood remote and deep oceans, this strategy can turn out to be costly and largely unsuccessful, as information and management processes will inevitably fail to keep up with expanding human activities.

Rolling out a system of High Seas marine protected areas

A representative system of High Seas MPAs is now achievable. It should be foremost and fundamentally based on the available geophysical information wmationeucaiudytatTj thatr

The seafloor off North-west Australia after trawling. Photo r K ith S i s ury, CSIRO

as we are finding in national waters, perfect knowledge need not be the linchpin for rolling out a representative system of networks of MPAs.

I believe, therefore, that over the next two years the following four steps towards achieving a representative system of MPA networks should be given priority:

First, immediate protection from destructive high seas bottom fishing activities should be sought for the known most vulnerable areas, such as seamounts, cold water corals and sponge beds, until effective measures are in place to ensure sustainable fisheries in these areas and to protect biodiversity.

Second, identification and interim protection should be provided to other vulnerable areas, including candidate MPA sites, where more information is necessary in order to reach a final decision on appropriate measures for these sites.

Third, efforts should be dedicated to developing agreed site-selection criteria and advancing biogeographic classification systems in order to establish representative MPA networks.

Fourth, and last, a framework should be developed to:

1. set priorities for biodiversity conservation and sustainable use in areas beyond national jurisdiction;
2. promote co-ordinated decision-making amongst international and regional bodies with competence to take action; and
3. ensure consultations with the full range of interested stakeholders.

The question that is repeatedly raised at this point is how to do all this in areas beyond national jurisdictions. Implementation of existing legal responsibilities to conserve and sustainably use biodiversity throughout the High Seas is clearly a priority (see Gjerde and Kelleher, this issue). Whilst this is debated through the relevant United Nations processes, the example in the early stages of consideration for Antarctica gives some hope that a workable template will soon emerge (See Grant, this issue). The progress in Antarctica shows the potential for a Regional Fisheries Management Organisation (RFMO) to work in concert with conservation. If this happens and results in High Seas MPAs and improved protection overall for Antarctica's marine ecosystems, it will set new standards to be met by other bodies with jurisdiction on the High Seas, such as in relation to other RFMOs, elsewhere in the world.

Policy makers also repeatedly remind us that 'good science' is needed to underpin good decisions. An ongoing priority is for further collaborative scientific research to improve understanding of ocean life and processes and to enhance our capacity to conserve and sustainably use marine biodiversity in areas beyond national jurisdiction. Whilst we know little or nothing about some aspects of the High Seas, good data do exist in a number of areas. Therefore, I hope we can move forward on high seas conservation in a more effective manner than that currently Fourth, and laewhere i32is isstectiohan Twss02ubilitut Tcrdsoas beyond 0 TD 0 Tc 0 Tw8.74Tj /F3 1 Tf 0.25

communities, focus co-operation on a regional, and where necessary, global scale. Third, they can create the impetus and political will to address problems that originate outside the area, such as pollution from ships or from land. Finally, they can build on the success of regional seas and large marine ecosystem programmes, while promoting improved co-ordination and co-operation with existing sectoral regimes (see Gjerde and Kelleher, this issue).

It is a fact of life on earth that every successive human generation possesses more information than the preceding one. I hope that the next generation will look back on ours and say two things: we were smart and realised what needed to be done for conservation on the High Seas; and, that we actually made the right moves before it was too late. The facts are clear: this responsibility to act falls resoundingly to our generation. The survival of countless species and some ecosystems that we are only just discovering, let alone beginning to understand, is at stake. I believe that the next few years will be critical in deciding whether we are seen to deliver or fail. I hope that you will join with me and my colleagues across the world in helping introduce protection for our very last vast wilderness on earth – the High Seas.

References

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Under UNCLOS, all States must respect the high seas freedoms and the rights of access of other States to the High Seas and its resources, but States also have the duty to conserve high seas living marine resources, to protect and preserve the marine environment, and to co-operate for these purposes. In key language catalysing the development of MPAs within national waters and regional seas, UNCLOS calls for measures to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life. Unlike the open access regime for the high seas water column, in UNCLOS, the seabed 'area' and its mineral resources are declared the 'common heritage of mankind'. Mineral activities are to be carried out for the benefit of humankind, with due regard for the need to protect the marine environment and animal life, and under the supervision of the International Seabed Authority (ISA).

The 1992 Convention on Biological Diversity (the CBD) is the other leading international agreement that obligates nations to conserve High Seas biodiversity (Kimball 2005). Parties to the CBD are required to implement the Convention consistently with the rights and obligations of States under UNCLOS. In areas beyond national jurisdiction, CBD parties must ensure that processes and activities carried out under their jurisdiction or control do not have adverse impacts on biodiversity. As part of this process they are to identify, assess and monitor activities and seek to minimise the risk of significant adverse effects. The CBD also calls for co-operation among parties for the conservation and sustainable use of the High Seas.

The 1995 UN Fish Stocks Agreement is also key. Although this only applies to highly migratory fish stocks and fish stocks that straddle national and international waters, it sets an agreed performance standard that should guide all high seas fisheries. In addition to detailed requirements for precautionary and ecosystem-based management, this agreement calls for States to minimise the impact of fishing and to protect biodiversity in the marine environment.

Apart from UNCLOS and the CBD, there is no single global framework agreement for addressing threats posed by multiple activities to geographically-defined areas or for identifying such areas on a scientific basis. Individual High Seas MPAs can already be established by the collective action of several willing States in conformity with UNCLOS. As was done via the Titanic Memorial Agreement between the United States, the United Kingdom, France and Canada, protection for specific areas can be achieved by each party agreeing to strictly regulate the conduct of its nationals and nationally flagged vessels. However the absence of globally agreed criteria, management guidelines and enforcement

protected areas in the Southern Ocean (see Grant, this issue). With no universally recognised territorial seas or EEZs adjacent to Antarctica, any MPAs established adjacent to that continent can be considered as within the High Seas.

Regional seas agreements and action plans under the auspices of the United Nations Environment Programme (UNEP) in the Mediterranean and the Pacific also include marine areas beyond national jurisdiction. In the Mediterranean, this is a substantial area, as coastal States have so far limited their offshore claims and most have not established EEZs. They have adopted an agreement to designate 'Specially Protected Areas of Mediterranean Significance' that can include High Seas areas, and have established one in the Ligurian Sea spanning both national and international waters. The 'Pelagos Sanctuary' in the Ligurian Sea is an example of an MPA that was initially established through the collective action of a few nations (France, Italy and Monaco) and later adopted at the regional level.

Regional Fisheries Management Conventions apply to specified regions or fisheries and generally only empower their operative bodies – Regional Fisheries Management Organisations (RFMOs) – to focus on management and conservation of fishery resources. Despite the abundance of Regional Fisheries Bodies (RFBs) and RFMOs, management of high seas fisheries is far from complete. Only tuna and tuna-like species are covered on a global scale. See: http://www.fao.org/fi/body/rfb/Big_RFB_map.htm

However, some conventions provide explicitly for their RFMOs to designate or recommend designation of special areas for protection and scientific study, or to declare closed areas to conserve fish stocks, thus setting a precedent for agreements (binding parties only) to prohibit certain activities within a discrete area. Several significant RFMOs are now in the process of updating their legal mandate and scope to include ecosystem-based management and biodiversity protection, as called for by the Fish Stocks Agreement.

International progress towards a global representative network of High Seas marine protected areas

Progress before he V h IUCN World Parks Congress (WPC) 2003

One of the first international commitments to a global system of MPAs, including on the High Seas, was the resolution adopted at the IUCN General Assembly in 1988. However, the majority of such commitments have occurred this century. These include commitments to establish representative networks of MPAs by 2012 at the World Summit on Sustainable Development (WSSD) in 2002; and subsequent United Nations General Assembly (UNGA) resolutions and CBD decisions.

At the Vth IUCN World Parks Congress in 2003, the IUCN's World Commission on Protected Areas (WCPA) adopted the IUCN 10-year High Seas MPA Strategy (Gjerde ed. 2003). The establishment by WCPA of a High Seas MPA Task Force in 2003, which brings together IUCN, WWF, WCPA and governmental, scientific and non-governmental (NGO) experts in the cause of High Seas MPAs, has aided oich b toh High

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The CBD Protected Areas Working Group met in June 2005 and recommended that parties improve co-operation and co-ordination among various forums for establishment of MPAs consistent with international law, and recognised the need for further collaborative scientific research to develop criteria and biogeographical classification systems for potential MPAs beyond national jurisdiction. In response, the Canadian government hosted a workshop on criteria for 'ecologically and biologically significant areas' in December 2005.

Important global discussions also occurred under UN auspices in February 2006. The *Ad hoc* Open-ended Informal Working Group – established pursuant to a 2004 UNGA resolution – considered issues related to the conservation and sustainable use of marine biological diversity in the High Seas. While acknowledging that urgent action is necessary to address the two greatest threats to high seas biodiversity, namely illegal, unreported and unregulated (IUU) fishing activities and destructive fishing practices, many nations agreed that MPAs were a key tool to manage biodiversity in the High Seas. It was noted that additional co-operation was necessary on criteria for the identification of ecologically and biologically significant areas and on biogeographic classification systems for representative MPA networks. There was some debate among delegations over a European Union proposal for a new implementing agreement to UNCLOS to provide for, among other things, establishment and regulation of High Seas MPAs. The results of the meeting will be fed into the deliberations of the UNGA, which will decide what further actions should be taken. Many hope that, at a minimum, an additional meeting will be convened to further explore the options raised in February 2006.

Interest in MPAs within sector-based international organisations has been growing. Serious discussions on the role of MPAs at the UN Food and Agriculture Organisation's (FAO) Committee on Fisheries (COFI) in March 2005 resulted in acknowledgement that MPAs may enhance fisheries management as well as protect biodiversity conservation.

COFI recommended FAO develop technical guidelines on the design, implementation and testing of MPAs and assist members to achieve the goal of representative MPA networks by 2012. Many States noted the need for RFMOs to update their mandates and improve their performance to enable this broader focus on both sustainable fisheries and biodiversity conservation. Hopefully the Review Conference of the UN Fish Stocks Agreement in May 2006 will provide renewed encouragement for RFMOs to adopt pro-active conservation measures.

Action is also being taken to address the problem of IUU fishing. The Ministerially-led High Seas Task Force (HSTF) on IUU Fishing launched a multi-national effort in 2003. This aimed to deter IUU fishing, expose IUU fishing vessels and States, and improve enforcement. The HSTF consisted of Ministers from Australia, Canada, Chile, Namibia, New Zealand and the United Kingdom (Chair) and the Directors-General of WWF, IUCN, the Earth Institute and the Marine Stewardship Council. In March 2006 it released its comprehensive recommendations for action. Building global support is a key component of their strategy.

With respect to international shipping activities, the International Maritime Organisation (IMO) adopted revised Guidelines for the Designation of Particularly Sensitive Sea Areas (PSSAs) in December 2005. PSSAs may be designated in national waters and the High Seas to gain international recognition of the sensitivity of a specific area to impacts from international shipping. As designation *per se* does not introduce legally binding requirements, protective measures such as special reporting, routeing or discharge measures, would need to be introduced and approved separately.

Regional level

Some regional organisations have made significant headway in the development of criteria, biogeographic classification systems and commitments to developing representative MPA networks.

In November 2005, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) launched work on an integrated system of MPAs throughout the Southern Ocean. A joint workshop is proposed for 2007 in conjunction with the Antarctic Treaty Committee for Environmental Protection to develop a biogeographic classification system for the region. CCAMLR agreed that attention may need to be given to, *inter alia*, the protection of:

1. representative areas;
2. scientific areas, to assist with distinguishing between the effects of harvesting and natural ecosystem changes in areas not subject to human interference; and
3. areas potentially vulnerable to impacts by human activities.

Interim protection for candidate sites was seen as an essential step to enable information collection necessary to reach a final decision (Grant, this issue).

Additionally, two RFMOs have taken steps to protect vulnerable deepsea habitats from specific fishing activities. In January 2006, the General Fisheries Commission for the Mediterranean (GFCM) agreed to protect three ecologically-important deepsea areas in international waters off Italy, Cyprus and Egypt. The decision requires Mediterranean States to prevent bottom-trawl fishing fleets from operating in the designated areas. This follows two important GFCM decisions in 2005: to ban both bottom trawling at depths beyond 1,000 m, and the use of driftnets, throughout the Mediterranean Sea.

In November 2004, the North-East Atlantic Fisheries Commission (NEAFC) closed four seamounts and part of the Reykjanes ridge to bottom-trawl and static-gear fishing for a three-year test period, based on a proposal from Norway. Two other proposed areas, including one requested by OSPAR, were referred to the International Council for the

procedures. Tools such as codes of conduct, and environmental impact assessments can be more broadly utilised to aid integrated and precautionary management for the areas. Non-initiating States can be invited to join in.

Sixth, work should commence on the development of a framework or mechanism, on an informal basis at first, to: set priorities for biodiversity conservation and sustainable use; promote co-ordinated decision-making amongst international bodies with competence to take action; and ensure consultations with the full range of interested stakeholders.

Seventh, work should be initiated to promote scientific and technical progress, particularly with respect to biogeographic classification systems, as described by Dan Laffoley in this issue.

And eighth, urgent action should be taken to improve high seas fisheries management and governance and to curtail destructive fishing practices and IUU fishing activities.

Two key reviews of actions by States and RFMOs are scheduled to occur in 2006. States should use these opportunities to promote reforms in high seas fisheries governance and improvements in the performance of RFMOs to effectively incorporate ecosystem-based and precautionary management, including mechanisms for biodiversity protection such as High Seas MPAs.

IUCN, WWF and other members of the WCPA High Seas MPA Task Force are working at the

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governance arrangements are an essential first step if High Seas MPAs are to be of any utility.

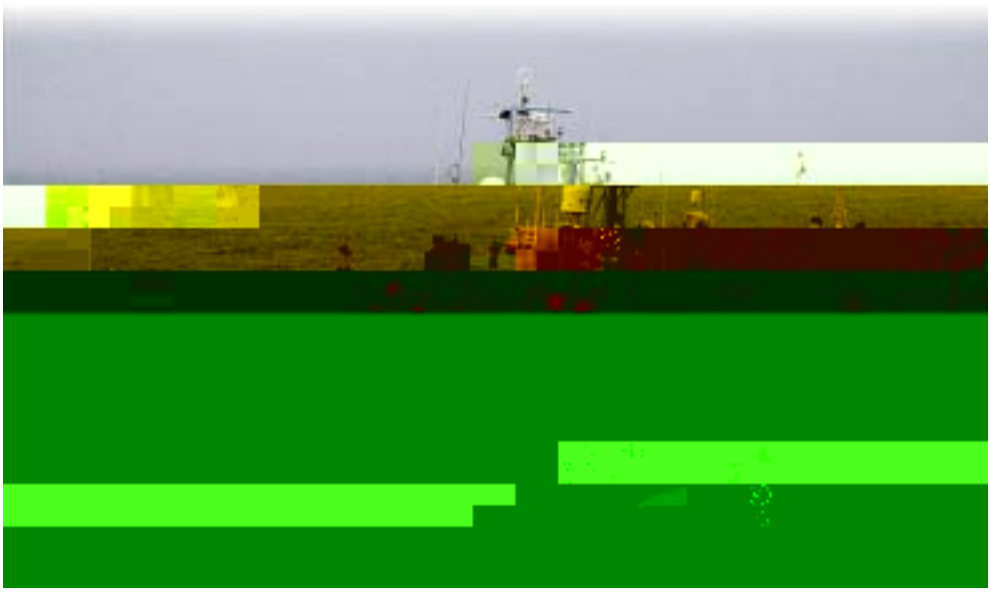
There is a plethora of hard and soft law instruments used to govern maritime activities and, in the first instance, these should be examined for their potential to incorporate provisions for High Seas resource management and biodiversity conservation, including MPA management. Making the most of what we have is the critical first step in oceans governance reform – we need to identify and fill governance gaps, not duplicate efforts.

As a first step, there needs to be a commitment by all countries to fully participate in, and adhere to, all relevant international and regional agreements, which relate to the conservation and management of the world's oceans. The UN Convention on the Law of the Sea (UNCLOS) is acknowledged as the most important agreement, along with the UN Agreement for the implementation of the provisions of the UNCLOS relating to the conservation and management of straddling fish stocks and highly migratory fish stocks (UNFSA), the CBD, and the Food and Agriculture Organisation's (FAO) Agreement to promote compliance with international conservation and management measures by fishing vessels on the high seas (the Compliance Agreement), along with various agreements developed by the International Maritime Organisation (IMO).

UNCLOS focuses the world's attention on nations' rights and obligations in a competitive global environment dealing with over-exploitation of collapsing fish stocks, growing concern for the environment, and interest in seabed mining. It gives coastal States the right to exploit, develop, manage and conserve all resources within 200 nautical miles of their coasts. Beyond 200 nautical miles, however, for UNCLOS parties the High Seas are open to all States for fishing, though the exercise of the so-called 'freedom on the High Seas' is conditioned upon fulfilment of certain legal requirements as set out in UNCLOS. In particular, the freedom to fish on the high seas is constrained by obligations of UNCLOS parties to ensure sustainability and to protect and preserve the marine environment. (Articles 116-119 and 192).

UNCLOS also establishes responsibilities of States who authorise vessels to fly their flag and operate under their laws (the flag State), requiring flag States to exercise effective control over ships flying their flag by maintaining a 'genuine link' with such ships (Article 91). The UNFSA

A boarding party returns after apprehending an illegal fishing vessel near Heard Island. Photo LSPH [illegible] P[illegible]wl [illegible]ko



and the Compliance Agreement elaborate on these obligations with respect to fishing activities, especially in requiring identification of the 'beneficial owner' of such ships (FAO 1993). The Compliance Agreement was intended to improve the effectiveness of regional fisheries

The results of the RFMO review should provide a useful gap analysis upon which concrete proposals for oceans governance reform can be soundly based. That such a review will take place in parallel with a formal review in May 2006 of the implementation of UNFSA is most timely. Together they can provide impetus for the improvement and reform of RFMOs, and perhaps the basis for evolving RFMOs into broader regional oceans management arrangements. Many view this as an essential next step in the unfolding governance reform agenda.

Improved ocean governance, especially of the high seas and distant water fishing activities, is widely recognised as fundamental to the conservation and management of marine living resources, especially in areas beyond national jurisdiction. There is a clear need to move away from traditional exploitative approaches of single stock management, towards integrated oceans management that delivers an ecosystem-based management approach to biodiversity conservation and sustainable use.

This approach needs to allocate access to resources fairly and equitably, combat IUU fishing, minimise or avoid bycatch and incidental mortality, eliminate marine debris, and focus marine scientific research. It also needs to ensure that all relevant States fully exercise their relevant responsibilities as flag States, coastal States, port States, market States, as well as exerting effective control over their nationals, both companies and people.

There are two major governance obstacles to the sustainable management of high seas resources through RFMOs. One is that there are no legal mechanisms to prohibit or prosecute fishing in RFMO-controlled waters by vessels flying the flag of non-member States, even if nationals of Member States are involved. The second is that in the absence of an agreed framework within which fair and equitable rules can be adopted for allocating mechanisms and management arrangements, the allocation of resources between States that are party to RFMOs is a constantly changing and never-ending battle between competing companies and countries.

RFMOs, based on regional inter-governmental agreements, are fora for States to operate in. However, fishing is done by companies, often multi-national companies, not States. Ensuring that companies are fairly, fully and enforcedly obliged to meet the responsibilities that governments take on in their dealings with each other is critical to the success of regional arrangements like RFMOs and any next generation of regional oceans management arrangements. Governments, as a matter of urgency, need to find ways to achieve an effective level of control over their nationals, as well as over their waters, ships, ports and markets, before regional conservation and management of the world's oceans can be effective – only then can High Seas MPAs become a genuine reality.

Australians have long been at the forefront of regional and multilateral international efforts to promote an increased understanding of integrated oceans management, especially on the high seas. For some years now, Australian fishers, conservationists and government officials have been at the centre of a broadening informal discourse on the future of high seas conservation and management and effective control of fishing activity. Australians recognise that governance is not an issue to be addressed solely by governments. Last year, WWF and the fishing industry held their own informal round table, bringing together fishers and fishing industry advocates from New Zealand and South Africa, senior WWF representatives from Europe and the United States, other NGOs and government officials. The resultant 'Manuka vision – a collaborative perspective on the future of high seas management' (named after a suburb within Australia's capital city, Canberra, where relevant discussions took place) is a start in providing a framework for industry and NGOs to focus governments' attention and efforts on practical and feasible reform. Copies of the Manuka Vision can be downloaded at www.daff.gov.au/manukavision.

The Manuka Vision supports the direction progressive governments have been taking in pursuing oceans governance reform to allow effective High Seas management. The Manuka Vision states 'Government, industry and NGO's collaborate so that by 2015 the high seas are managed to ensure that the integrity of healthy ecosystems is maintained; fisheries resources are

used sustainably and equitably with all States, fishing enterprises and other stakeholders acting responsibly; livelihoods and rights are preserved; populations of threatened species are protected and restored; and that this arrangement is secured for the benefit of present and future generations'. The Manuka Vision, in conjunction with its associated objectives and action plan, provide a practical and collaborative way forward and clearly articulate that on-going government, industry and NGO collaboration is required, in order to achieve the common vision of sustainably-used resources and protected biodiversity on the High Seas. It is our hope that our shared vision can be expanded to encompass other companies, other NGOs and other governments in the future.

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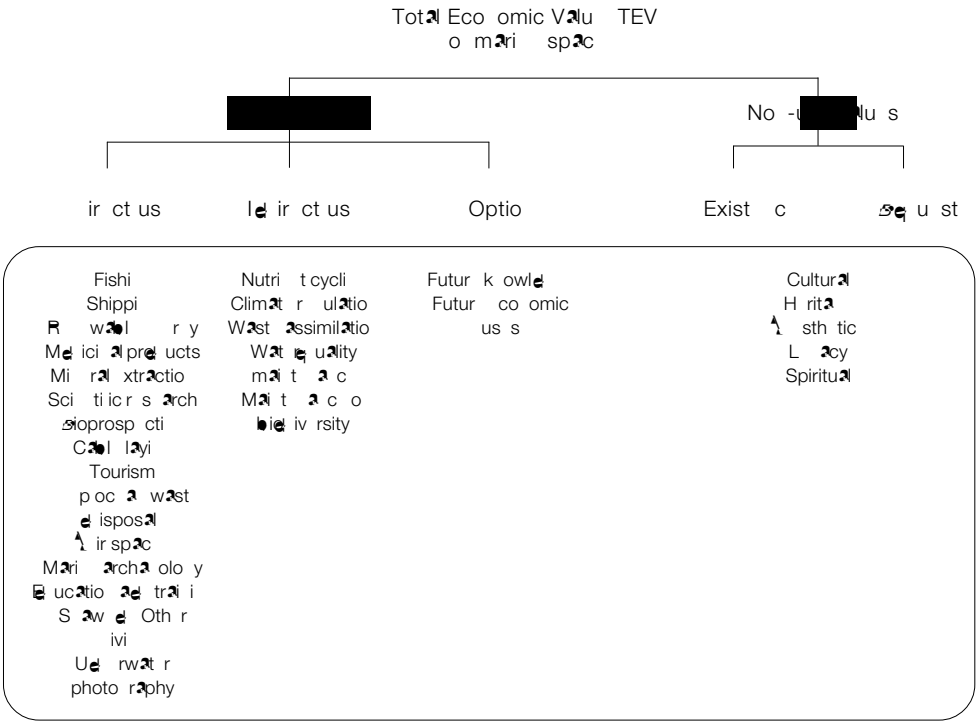
Fig re 1. *Total Economic Value (TEV) of the high seas.*



Direct use values. The benefits derived from the direct use of the sea are generally well-understood. Examples of these uses range from fishing and oil drilling to energy, transport, and eco-tourism.

Indirect use values. The benefits derived indirectly from the sea are only just becoming apparent. Marine environments are, in economic jargon, 'multi-functional resources supplying tradable outputs and performing a large number of ecological functions.' These ecological functions not only support economic activity but also the planet's life-sustaining biological systems such as climate regulation, nutrient cycling and waste treatment, and the maintenance of biological diversity. Until our dependency on these services rendered by the sea are better understood, the value of maintaining biodiversity and biological resilience will continue to be routinely unrecognised or discounted.

Even if we recognise the importance of these ecosystem services, they may still be over-exploited because of their 'public goods' characteristics. A public good has two defining characteristics. Firstly, one person's use of it does not preclude anyone else's; secondly, it is impractical to exclude other people from using it. These two characteristics make such services not amenable to allocation through markets. Without effective regulation, such services will likely be undervalued and overexploited.

Option values. There is an option value in conserving marine habitats for economic reasons, given the high prospect of developing new resources or new opportunities to create wealth, that are yet unseen. Economic activity often impinges on biodiversity. When considering changes to habitats of which little is currently known, adopting a precautionary approach means recognising

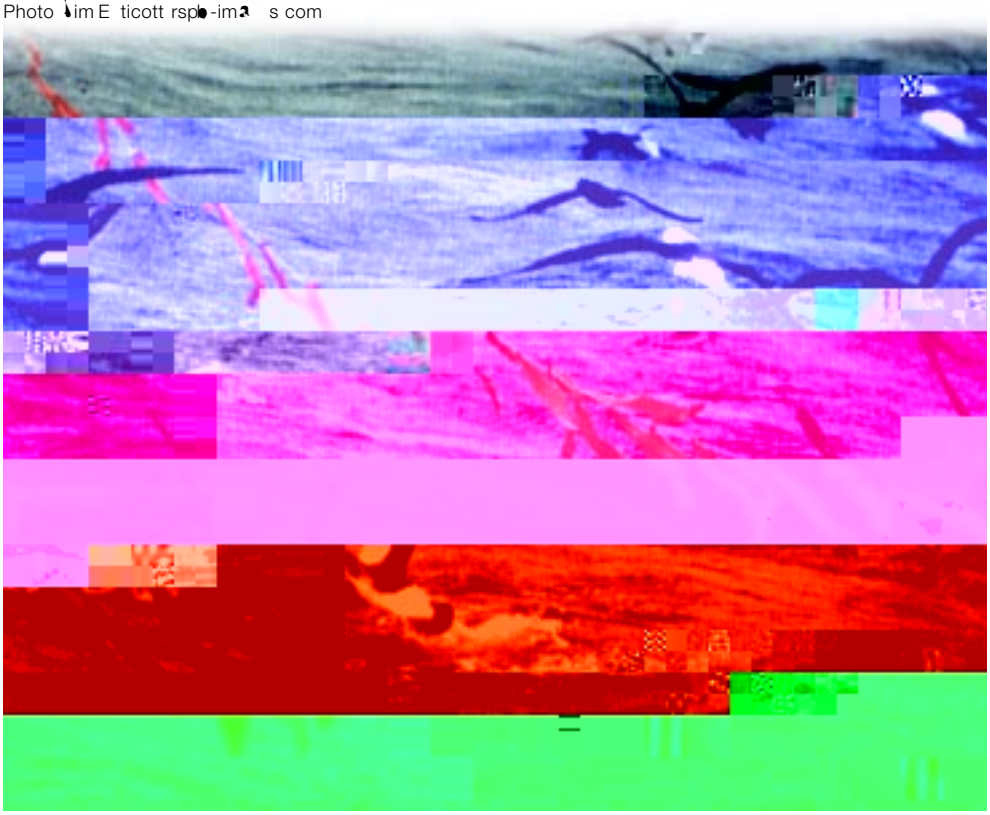
these option values and the potential scale of permanent loss that may be associated with short-term economic gain.

Advances in food production and pharmaceuticals rely heavily on the natural genetic diversity of marine life because marine organisms have evolved complex chemical compounds and processes for defence and predation, or for survival in extreme environments such as deepsea hydrothermal vents. These compounds and their underlying genetic diversity have huge potential economic value that would be foreclosed by the loss of marine biodiversity. The scale of the loss can be gauged from a recent UN estimate that the combined market for products derived from genetic resources in the cosmetics and drug industries is worth approximately US$100 billion per year (Zakri and Johnston 2004).

Bequest values. These refer to the conservation of natural resources for future generations to enjoy. These values arise out of a concern for future generations and the uncertainty surrounding the supply of resources or the long-term consequences of altering the natural environment.

Existence values. Many people desire to see environmental resources conserved, even though they never intend to use them. Markets cannot capture the spiritual, cultural, or aesthetic regard in which people hold the natural world. It is hard to measure existence values and many people dispute whether it is right or meaningful to put monetary values on the existence of other species or aspects of the natural world. Nonetheless, the vast amounts of money contributed by millions of people worldwide to conservation indicate the high value we collectively place on nature.

Solutions to bird by-catch, such as the use of streamers, can be both effective and inexpensive.
Photo Jim E ticott rspb-images com



Critical marine issues

Overfishing. World fish consumption increased from 45 million tons in 1973 to more than 94

Inappropriate gear. The negative impacts of overfishing are exacerbated by the use of fishing gear that fails to minimise environmental externalities for which the fishers are not held financially accountable. In some instances, it is apparent that inexpensive modifications to gear and techniques could reduce environmental damage by reducing the capture of undersized fish and the bycatch of birds and mammals.

Ever-increasing capacity for damage. Technological advances and economic growth have increased the scope and range of human impacts on the marine environment. The UN estimates that 90% of the ever-increasing volume of world trade is transported by ships while the doubling of large-scale fishing vessels, since 1970, has generated rapid growth in the number of fleets plying non-local waters. Technological advances in oil drilling, seabed mining and fishing also increase the pressure on deepsea habitats and species. Furthermore, rapid economic growth in countries has contributed to pollution and climate change that also affect the quality and resilience of the marine environment (UNEP 2002).

The particular problem of the High Seas: a global commons

While many of the foregoing issues are common to both waters within national jurisdictions and the High Seas, the global commons nature of the High Seas poses special problems for safeguarding their biodiversity. The problems posed by common access are straightforward. The absence of property / use rights or enforceable agreements means that it is in the financial interest of fishers to maximise their catch regardless of the overall status of the stock. The first step in solving the problem is to establish an enforceable regulatory framework.

Ac ion o da e: he Uni ed Na ions Con en ion on he La of he Sea (UNCLOS) as a fo nda ion for reg la ion

In recent years, the issue of High Seas MPAs has received considerable attention. This has included recognition in the plan of implementation adopted by the 2002 World Summit on Sustainable Development; a call for urgent action to protect seamounts, cold-water corals, and other vulnerable high-seas features and ecosystems by the 2003 IUCN World Parks Congress; consideration by the CBD; but, most importantly, consideration in the framework of United Nations Convention on the Law of the Sea (UNCLOS).

These positive developments have been given impetus by IUCN and its World Commission on Protected Areas (WCPA) and WWF International, all of whom have identified the High Seas as a gap in a global representative system of marine protected areas. Threatened marine ecosystems, including those in the High Seas, will be a major issue in forthcoming years, as will MPAs – one of the key remedial options for addressing the threat.

The costs of financing High Seas marine protected areas

The 2003 IUCN World Parks Congress estimated that US$ 25 billion in additional annual support is required just to effectively maintain the current global system of protected areas. This stands in stark contrast to the actual worldwide expenditure of around US$ 6.5 billion a year (James *et al.* 1999). The recent adoption of a new programme of work on protected areas by the CBD necessitates a change in the scale and range of financing arrangements if it is to be successfully implemented.

It is critical that the full financial costs of individual MPAs be understood. These costs include establishment, administration, employment, monitoring and enforcement. On the basis of survey data on the financial requirements of 83 MPAs worldwide, Balmford and colleagues (2003) suggest that a global MPA network covering 30% of all the world's seas (both territorial waters and High Seas) might cost between US$ 5 billion and US$ 19 billion annually to run. This may seem expensive yet the higher figure is a mere 2% of annual global military expenditure and

equivalent to the annual amount the world spends on cosmetics or pet food. On the basis of the vast ecological functions the oceans afford us, let alone the direct economic benefits, the investment is worth it.

Financing mechanisms and so rces

To find the money, the principles of UNCLOS reinforce the need for a shared approach, as does the principle of common but differentiated responsibilities. However, the failure of developed countries to fulfil intergovernmental commitments related to financing, such as those made in the CBD, is a major concern, and the need to explore a range of potential financing options is becoming widely recognised.

Multilateral agencies. The Global Environment Facility (GEF) focuses on global benefits and has a limited number of marine projects under its focal area on international waters. It is well placed to take on financing High Seas MPAs but the funding available through the GEF is woefully inadequate to address the needs for protected areas in developing countries let alone expand its activities. Still, given the supranational nature of the problem, it still has a role to play along with the World Bank and the regional development banks.

National governments. Many individual countries have contributed to the degradation of the marine environment, though no individual country can solve the problem by acting alone. However, an enforceable multilateral framework will ultimately depend on the support of individual countries. Many developed nations express, as part of their principles governing overseas assistance, a commitment to environmental sustainability, and they should ensure that their policies and activities, such as sectoral subsidies, support rather than undermine conservation efforts.

Charges for the use of global commons. Over the years, proposals have been made for global fundraising mechanisms and a number of novel, market-based financing mechanisms, in support of conservation, have been developed and implemented. There is a strong economic case for the introduction of charges to ensure that economic actors meet the full social costs of their activities. The conventional economic solution to public goods and externalities is to make the polluter or user pay through regulation, taxation, or market interventions. Conceivably, a variety of revenue sources can be generated from ocean activity. They could relate to extractive and bioprospecting activity on the ocean bed, fishing, overflights and shipping. Methods could include user charges and permits for commercial activities. The introduction of charges for the use of global commons has two beneficial outcomes: the revenue raised, and the incentive provided to reduce environmentally harmful activities. For all market-based approaches, appropriate legislation, regulation and governing authorities would need to be established for implementation.

Supranational tax. Taxation, a conventional national means of paying for public goods, has been proposed as a means of increasing financing for a number of global concerns. To this end, a number of national and supranational taxes have been mooted, including taxes on international currency transactions, on international trade and on international aviation to account for negative externalities that affect areas beyond national jurisdictions.

Mobilising private and voluntary support. The existence value placed on marine environments is apparent by the significant worldwide efforts made to conserve it. If MPAs provide the conservation results currently pursued by voluntary groups and individuals, then it is conceivable that a portion of resources needed to maintain a system of MPA beyond national jurisdiction

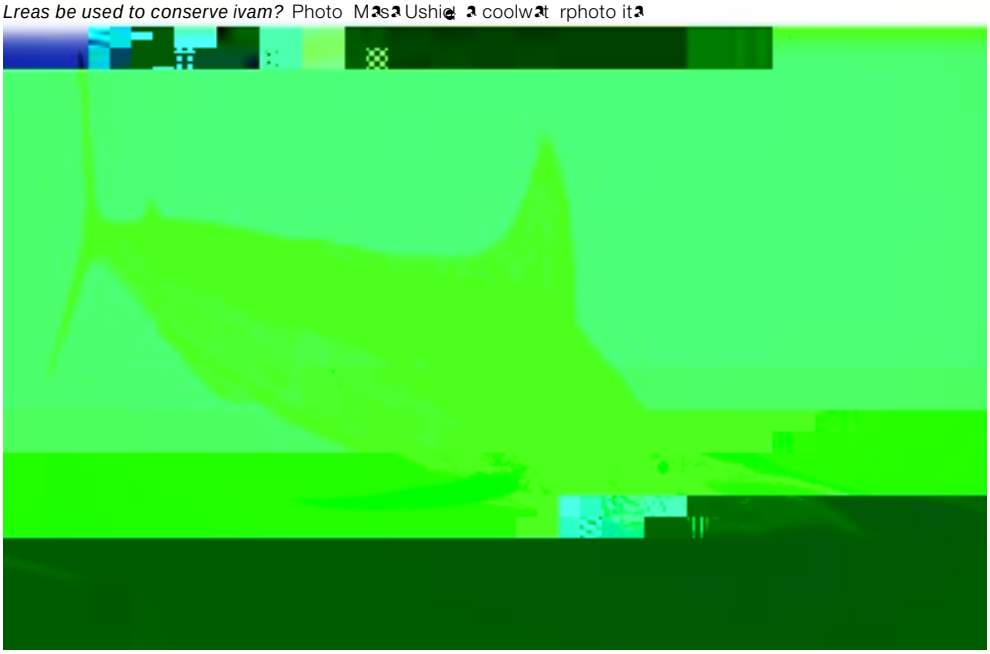
The first is that the open oceans are so poorly explored that they are still revealing their secrets. How can they need conservation when scientists are still making major discoveries? It is true that the sunlit blue epipelagic zone and the cold, black depths beneath them are still *terra incognita* and that scientists continue to uncover the mysteries of marine species and ecosystems. The aptly named 'megamouth' shark, *Megachasma pelagios*, measuring over five metres long and belonging to a new family, was discovered in 1976. From a few bones found on islands off New Zealand and Chile, scientists know that somewhere out there is a beaked whale species *Mesoplodon traversii* that has never been seen by humans. Only in the last few years have scientists taken the first photographs of giant squid *Architeuthis dux* in their deepsea habitat, and realised that there is another squid *Mesonychoteuthis hamiltoni*, even bigger than giant squid. It is not difficult to miss really large animals in the vastness of the open oceans.

Similarly, it was not until 1977 that scientists first discovered deepsea hydrothermal vent ecosystems that have since been found around the world. No less remarkable was the discovery in the 1980s and 1990s of extensive *Lophelia pertusa* coral reefs in the deepsea off Norway and Ireland. Scientists are still far from finding many of the world's seamounts, active and extinct undersea volcanoes that can rise thousands of metres from the deep seafloor. Indeed, only a few hundred of the many thousands of seamounts have been studied by biologists, but these few studies, combined with general understanding of ocean currents, tell us that seamounts are the deep ocean equivalents of islands. They are markedly different from benthic habitats that surround them, and the species that inhabit them are often endemic (species found nowhere else) to individual seamounts, seamount clusters or chains. Their value in biological diversity is consequently immense.

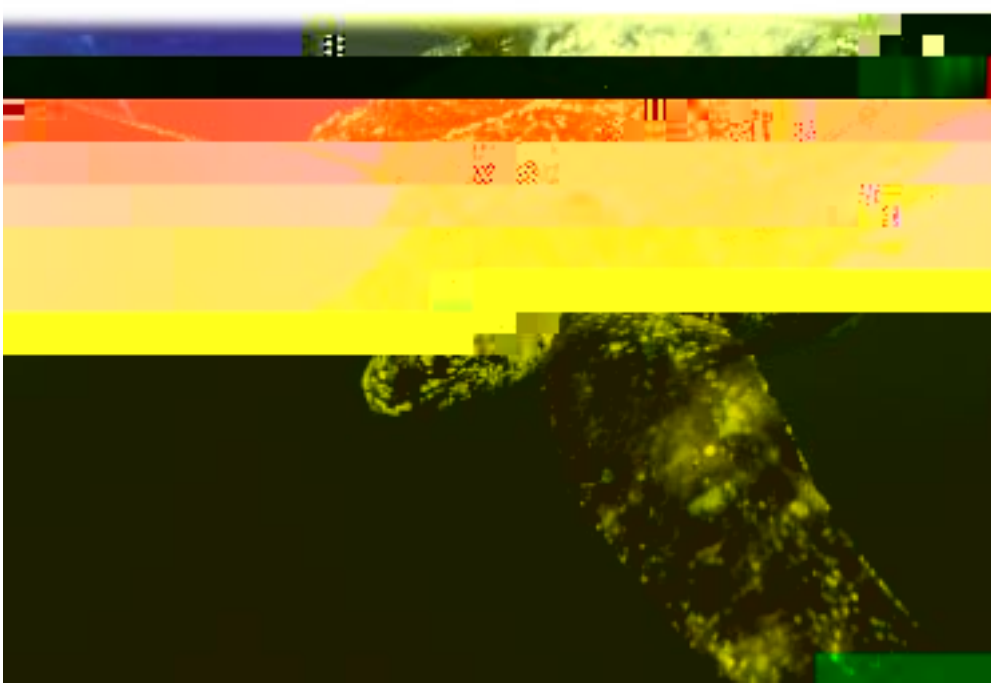
Although systematic scientific exploration of the open oceans began in the 1800s, we are still

haven't fully explored oceanic ecosystems does not mean it would be wise to wait bef f-6we start protecting them. On land, we will probably never see scientists announce the discovery of

Indo-Pacific blue marlin M kir m r , *Hawaii, USA. Many large animals (megafauna) living in the upper layers of the open oceaneLrenexquisitely adapted f fnt ving long distances between scarce but rich concentrations of food animals, or between places where ivalefeed and breed. Some migrate thousands of kilometres. Caneprotected Lreas be used to conserve ivam?* Photo M s Ushi coolw t rphoto it



bigfoot, chupacabras and mokele-mbembe, but a few large species continue to be found in the



see changes that portend devastating impacts in the near future from global warming. But by far the biggest human impact in the open oceans to this point is commercial fishing. Landmark scientific studies by Pauly *et al.* 1998, Watling and Norse 1998, Hutchings 2000, Jackson *et al.* 2001, Watson and Pauly 2001, Myers and Worm 2003, Lewison *et al.* 2004b and Devine *et al.* 2006, show that both the magnitude of impacts from fishing and the vulnerability of marine species and ecosystems are far greater than had been thought. The cornucopian view of the oceans is wrong.

A third reason why the concept of protecting places in the open oceans might seem strange is sensory. People's senses do not equip them to perceive the oceans' heterogeneity. We think of the land as a patchwork of places, but perceive the fluid medium above the seafloor as so interconnected and featureless that anything happening anywhere affects everywhere. Yet scientists know that the inscrutably wavy surface of the oceans conceals remarkable biological and geological heterogeneity. New scientific tools, including images showing phytoplankton abundance patterns in surface waters taken by orbiting satellites show that oceans have distinct places and, in marked contrast to places on land, some of these places move.

In this article, I explain why we need a far more expansive conservation vision for the open oceans, one commensurate with the growing understanding of our present and future impacts. An obvious starting place would be protecting seamounts, which are clearly definable biological hotspots rising above the seafloor. But we need to go further and identify the most important hotspots in the water column (the pelagic realm), and then to act decisively to protect them.

Although establishing a comprehensive and effective system of protected places in the open oceans will undoubtedly be a long, ongoing process – as protecting places on land and in coastal waters is – the confluence of rapidly growing need and opportunity suggest that we cannot afford to wait.

Conservation in the biggest ecosystem on earth

The marine environment covers more than twice the area of terrestrial and freshwater ecosystems combined, and constitutes perhaps 99% of the volume of the biosphere that is permanently inhabited by animals and plants (Norse 1994). The vast majority of attention to the sea concerns estuaries, enclosed seas, continental shelves and/or areas within nations' Exclusive Economic Zones (EEZs), where productivity of living things is highest, human impacts are greatest and research from shore-based facilities is easiest. However, these areas make up only a minority of the marine realm. Some 64% of it is high seas, beyond individual nations' jurisdictions.

Oceans are home to myriad species, perhaps millions of them, from seabirds flying above the waves and insects skating on the tropical sea surface to fishes and invertebrates dwelling in hadal 11-kilometre depths in the deepest ocean trenches. They range from microscopic bacterioplankton to gigantic blue whales *Balenoptera musculus*. More than 98% of marine animal species are benthic, living in, on or immediately above the seafloor (Thurman and Burton 2001). Nonetheless, the water column well above the seafloor is home to thousands of species. The large animals in these upper layers – the oceanic pelagic megafauna – are not only ones people care about, but ones which form the basis for some of the most important fisheries, and which are the top predators in these ecosystems.

In comparison with the sediment-and plankton-rich brown waters of estuaries and green waters usually overlying continental shelves, the blue surface waters and black depths of the open oceans are a much thinner broth. The upper epipelagic layer of the open oceans is low in nutrients and hence less productive of organic material per unit area. Phytoplankton there are eaten by zooplankton whose faeces sink below the epipelagic zone to the seabed, averaging nearly 4,000 metres below. This 'rain of poops' and other organic material, including dead whales and sunken wood, provides all of the food in the deepsea except for the food produced at hydrothermal vents and cold seeps.

If megafauna and commercial fishermen can locate moving hotspots in a dynamic ocean, so can those working to conserve oceanic wildlife.

Using static or dynamic protected areas to conserve epipelagic megafauna on the high seas will require more than a sound conceptual framework; it will also require political regimes capable of ensuring that neither legal nor illegal fishing undermines places meant to protect oceanic hotspots. At present, such regimes do not exist. Moreover, strong rules are not enough; effective enforcement is crucial on the high seas, far from shore-based and even ship-based observers. We will need to integrate new enforcement technologies, including vessel monitoring systems, event data recorders, radar satellite observation (which can pierce clouds and darkness) and satellites that use visual wavelengths whose high resolution images are capable of identifying individual fishing boats with the accuracy required in courts of law.

In a world where many nations are failing to protect marine animals within their EEZs, protecting pelagic megafauna might seem hopelessly farfetched. But new technologies have yielded crucial information about the movements of these species. More visionary thinking about MPAs that are either fixed or move as their habitats move, as well as about new integrated systems of enforcement tools, make this a real possibility. Compared with the increasing acceptance of protected areas on land and in nearshore waters, the idea of protecting oceanic megafauna on the high seas is surely the toughest conservation sell on earth. Whether or not humankind will do this is not a question of science or technology, but of political will.

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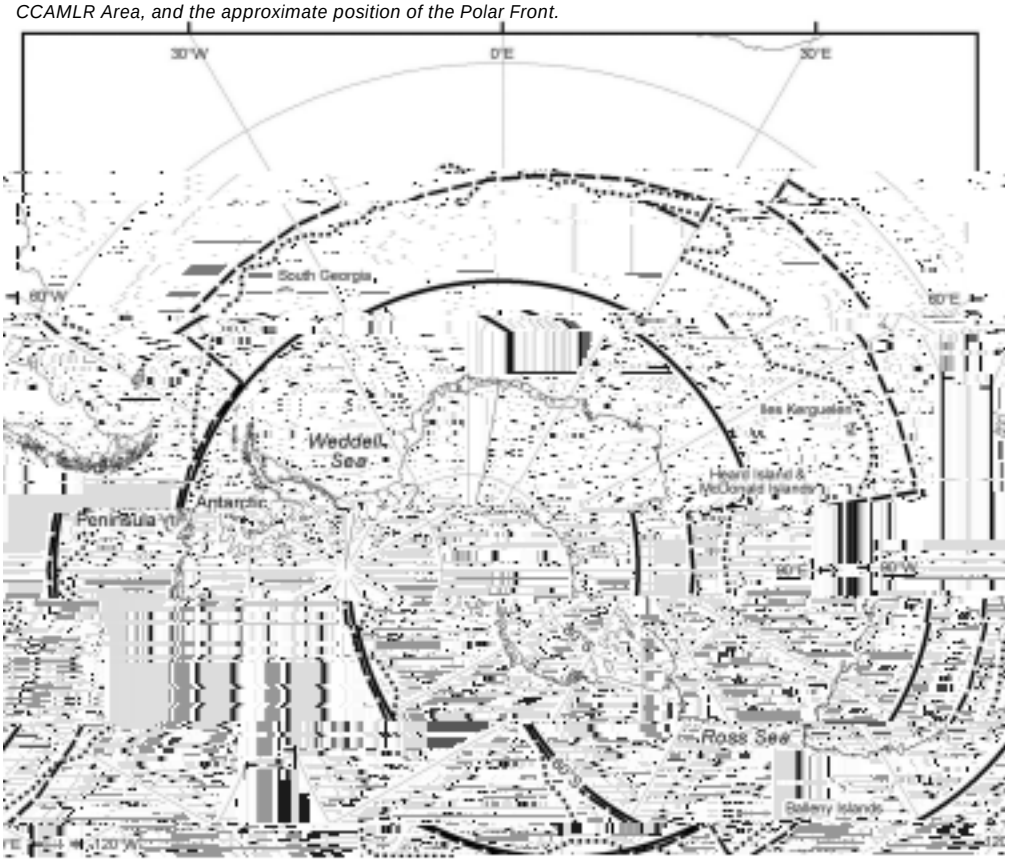
Legal framework: the Antarctic Treaty System

The Antarctic marine environment is afforded protection under the instruments of the Antarctic Treaty System (ATS). The ATS can be defined as the Antarctic Treaty itself, together with its associated instruments: the Convention on the Conservation of Antarctic Seals (CCAS), the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) and the Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol). The latter two instruments have the most relevance for the development of MPAs.

Fig re 1. *Map of Antarctica and the Southern Ocean showing the boundaries of the Antarctic Treaty Area and the CCAMLR Area, and the approximate position of the Polar Front.*



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The Antarctic Treaty and the Madrid Protocol apply to the entire area south of 60° S, however

groups and stakeholders, and the development of flexible decision-making and review procedures. To achieve maximum benefits, MPAs must be implemented within, and contribute to, a wider framework of sustainable fisheries management. There is a particular need for the development of new strategies for the protection of large marine ecosystems in the Southern Ocean (Ainley 2002), which may be best achieved through this type of combined approach.

A strategic approach to developing an MPA system for Antarctica should also include the application of recommendations or measures under instruments with global purview. Recommendations embodied in international agreements such as the Convention on Biological Diversity (CBD), as well as outcomes from, for example, the World Summit on Sustainable Development and the World Parks Congress, should be considered within the frameworks of the ATS to ensure that Antarctic marine ecosystems are included in a global, representative system of High Seas MPAs. Relevant principles and requirements include the formulation of guidelines and criteria for MPA establishment, the consideration of marine protection as a separate, but linked, issue to protection of other environments, and the development of more specific commitments on a timeframe in which an MPA system should be achieved.

Despite the necessity for improvements, there remains considerable potential for approaches developed within the ATS, and CCAMLR in particular, to contribute towards high seas MPAs strategies elsewhere. The concept of MPAs established under fisheries management frameworks (such as CCAMLR) but within a wider conservation context (such as that provided by the Antarctic Treaty with the Madrid Protocol) may be particularly applicable for high seas MPAs worldwide. Following the models established by CCAMLR, other RFMOs might be used or adapted for similar roles. For high seas MPAs to be fully effective, they must be complemented by comprehensive, ecosystem-based fisheries management, as well as a suite of other environmental protection measures, in the surrounding oceans.

Continuing work by CCAMLR on developing and testing MPAs will be an important contribution to global debates on high seas marine protection, particularly towards further work on MPA development related to fisheries management (COFI 2005), and the commitment to establish representative networks of MPAs by 2012 as set out by the World Summit on Sustainable Development. Establishment of an Antarctic MPA system is still at an early stage, but recent progress indicates the continuing potential for the Antarctic Treaty System to demonstrate leadership in the development of a wider strategy for high seas MPAs.

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Conservation on the High Seas – drift algae habitat as an open ocean cornerstone

RLO H HEMPHILL

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A CRITICAL MARINE HABITAT is being overlooked in the race to protect unique and vulnerable ecosystems of the planet's high seas. Drifting algae provide an important open ocean habitat for both unusual and commercially important fishes, invertebrates, sea turtles, and seabirds, serving as an irreplaceable nursery and grazing area for many species in stages of their lifecycles. In the global effort to advance a network of high seas marine protected areas (MPAs), attention to unique, vulnerable and largely unknown deepsea ecosystems such as seamounts, hydrothermal vents, deep coral reefs and 'black smokers' should not detract from much needed protection for the surface (or epipelagic) zone.

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as seagrasses and vegetation of terrestrial origin, are found in most tropical and temperate regions of the ocean. In shallow water areas where attached marine algae provide the dominant habitat biomass (e.g. kelp beds), some of these algae inevitably become detached and take on a new life, providing structural habitat as they drift around in oceanic currents. Species of kelp (M

to the seabed, along with seagrasses and vegetative debris of terrestrial origin, are well documented as regularly undergoing this transformation into pelagic habitat (e.g. Hirosaki 1960, Kingsford and Choat 1985). However, one genus of brown algae – *Sargassum* – has taken this role to the next step. In the Atlantic, two species of *Sargassum*, *S. natans* and *S. fluitans*, have become holopelagic – drifting continuously within the North Atlantic gyre system, never attaching to the seafloor during their lifecycle (Parr 1939).

Depending upon the region of the ocean and daily oceanographic conditions such as prevailing winds, drift algae can appear as occasional clumps supporting sparse associated fauna, or as expansive mats several kilometres in length, supporting a complex of associated plants and animals. It also forms windrows (elongated lines of algae on the surface) that are associated with upwelling nutrients and serve as 'oases' of abundant life in the open ocean.

Globally, at least 280 species of fish are known to be associated, at some point in their lifecycle, with drift algae (Hemphill *et al.* 2003). Many of these, such as the Atlantic tripletail *Lobotes surinamensis*, and various species of filefish (especially *Stephanolepis* spp.) appear to be nearly completely dependent upon drifting algae for refuge as juveniles. Numerous species of young jacks (*Carangidae*) are especially abundant, indicating that drift algae carries a resident assemblage of

Histrio histrio and the sargassum pipefish *Syngnathus pelagicus*, are endemic to pelagic *Sargassum*.

However, drift algae is not the domain of fish alone. A host of attached plants, fungi, invertebrates and non-fish vertebrates depend on this habitat. At least 100 invertebrates can be found in the Atlantic *Sargassum* complex, living either permanently attached or free-swimming amidst the fronds of drifting algae (Coston-Clements *et al*. 1991). Conspicuous invertebrate inhabitants include swimming crabs, shrimps, nudibranchs, polychaetes and the sargassum snail *Litiopa melanostoma*. As with fishes, numerous crustaceans will utilise the habitat as a nursery, while a few, such as the sargassum swimming crab *Portunus sayi*, will remain permanent residents. Many of these permanent inhabitants have developed unique adaptations, such as unusual shapes and colourations enabling them to camouflage in the drifting plants.

Additionally, non-fish vertebrates, such as four species of turtle – loggerhead *Caretta caretta*, green *Chelonia mydas*, Kemp's ridley *Lepidochelys kempi* and hawksbill *Eretmochelys imbricata* – are known to utilise drift algae as hatchlings. It is here that they forage and seek refuge during their 'lost year' (Carr 1987). Seabirds also rely on drift algae habitat. In the South Atlantic Bight, 26 species of seabird have been observed to feed and roost on *Sargassum* 'reefs'. Three of these – white-tailed tropicbirds

Progress in conservation of pelagic drift algae

Drift algae habitat is under increasing anthropogenic pressure from four distinct activities:

1. commercial take of drift algae;
2. commercial and recreational fishing in direct association with algal mats;
3. pollution; and
4. vessel traffic through drift algae habitat.

In recent years, drift algae, particularly *Sargassum*, has been subject to direct human take. *Sargassum* is rich in a number of elements, including calcium, potassium, sodium and iodine (Laihao *et al*. 2001). It is used in many parts of the world as food, livestock fodder, fertiliser, medicine, tea, and is extracted commercially for the production of algin and sodium alginate (Wang and Chiang 1994, Kaladharan and Kaliaperumal 1999). In addition to current take, the UN Food and Agriculture Organisation (FAO) (Naylor 1976) has highlighted the potential for development of 'standing stocks' of *Sargassum*, *Cystoseira* and *Macrocystis* in the waters of the Sargasso Sea, southern Italy, Yugoslavia, the Patagonian Sea, the North American Pacific Northwest, California, the Humboldt Region (Chile / Peru), and the entirety of the Indian Ocean

The way forward? A potential framework for conservation

Since Regional Fisheries Management Organisations (RFMOs) are not the appropriate mechanism for protecting high seas marine habitats from a broader range of threats and human uses beyond fishing, there exists only a very limited set of international legal instruments that may govern the growing number of potential impacts on drift algae habitat. First and foremost is the 1982 UN

international law for establishing such reserves. Since then, there has been a series of good work analysing both the 'where' and the 'how', including the IUCN / WWF / WCPA strategy for a network of High Seas MPAs (Gjerde and Breide 2003).

Likewise, options for governing and establishing MPAs beyond national jurisdiction, have undergone considerable analysis and evolution. At the *Defying Ocean's End* Conference, held in Los Cabos, Mexico in 2003, the concept of a 'policy enclosure' of the high seas commons emerged as a highlight of the meeting's outcomes (Gorina-Ysern *et al.* 2004). Moving away from a single-sector or single-fishery approach, this 'World Ocean Public Trust' would provide a framework based on UNCLOS for biodiversity conservation beyond national jurisdiction. Under the World Ocean Public Trust, all ocean uses would be sustainable, the *ecosystem approach* and *precautionary approach* would be applied, and the conservation of biodiversity would be maintained as a

With such momentum, the establishment of a comprehensive network of high seas MPAs may indeed become a reality. However, can this same mechanism address habitats such as oceanic fronts, which are ephemeral in both space and time? The traditional protected area concept cannot be easily applied to this type of process without establishing them on a geographic scale that may defy practical implementation and political will. However, known patterns or regions of oceanic fronts and eddies could be protected as dynamic or transient protected areas.

To accomplish this, a process could be implemented to identify and establish large-scale multiple use management areas in oceanic regions of high convergence activity such as the persistent frontal zones of the North Pacific Transition Zone and the area of warm-core ring frequency of the South Atlantic Bight, and adjacent areas of the Gulf Stream. Under non-frontal oceanographic conditions it could be business as usual, with sustainable uses proceeding without interruption. However, the transient fronts and eddies of the management area would receive a higher grade of protection. Compliance and enforcement of such a regime could be simplified by automatically conveying drift algae and associated flotsam the highest degree of protection as this would often, although not always, protect the front by default.

The biggest problem with this approach is that sub-tropical and temperate frontal systems are not always blessed with abundances of drift algae. Drift algae abundance is variable both regionally and temporally, as heavy wind conditions might blow drift algae onward despite the presence of a strong oceanic front. The abundance of *Sargassum* in the Western North Atlantic far exceeds typical drift algae present in the eastern Pacific. However, despite low abundances, sparse windrows of *Macrocystis* and associated flotsam are generally present on strong fronts such as the ones that regularly occur near the Channel Islands (Wallace J. Nichols *pers. comm.*). The key to regulating this discrepancy could be in the spatial degree of protection, for example, regulating activities within a certain distance of drift algae.

The strict protection of drift algae and the regulation of activities within a certain distance of it could thus protect a significant number of fronts and eddies. However, this still would not cover them all. There would still be some need to protect and regulate fronts themselves, independent of and in unison with the presence of drift algae habitat. Fishermen already utilise commercial satellite-based sea surface temperature (SST) and chlorophyll maps to focus fishing efforts. Enforcing agencies can do the same. Nevertheless, heightened protection for drift algae habitat would protect the very cornerstone of the pelagic ecosystem, while offering a visual cue that could aid in regulation and enforcement of a broader protection scheme.

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establishment of the Endeavour Hydrothermal Vents MPA constituted a significant step forward in the conservation and sustainable management of deepsea habitats. It was one of the first MPAs at a great depth which attempted to reconcile the conflicting objectives of deepsea conservation and continued access to hydrothermal vents for scientific research (Leary 2003).

The Endeavour MPA is divided into four zoned management areas with intensive scientific

effectiveness of MPAs will also hinge on how speedily the international community addresses the need for a more integrated approach to oceans governance.

Examination of the example of deepsea hydrothermal vents illustrates the complexity of the issues at stake. The unique biological communities associated with hydrothermal vents are of intense interest to science for their intrinsic values and for the potential that the microorganisms associated with these ecosystems offer for developments in biotechnology. Rich deposits of gold, copper and other minerals associated with hydrothermal vents are also of increasing interest to the mining industry. Mining, bioprospecting, marine scientific research (MSR) and other emerging activities such as tourism at hydrothermal vents pose as yet unquantified threats to deepsea hydrothermal vent ecosystems. With the exception of deepsea mining, which is explicitly addressed in the United Nations Convention on the Law of the Sea (UNCLOS), these activities are largely unregulated in areas beyond national jurisdiction under international law (Glowka 1999).

The most immediate legal issue relates to the extent of regulation of the exploitation of genetic resources derived from living organisms associated with hydrothermal vents. The question raised especially by representatives of Latin American countries is whether or not deepsea genetic resources should be regarded or subsequently designated as the Common Heritage of Mankind [sic], like the mineral resources of hydrothermal vents under UNCLOS. UNCLOS designated the seabed area beyond national jurisdiction and its mineral resources as the Common Heritage of Mankind. The central elements of the Common Heritage of Mankind regime are:

1. non-appropriation of the deep seabed beyond national jurisdiction;
2. common management through an International Seabed Authority of the mineral resources of the deep seabed beyond national jurisdiction; and
3. benefit sharing of the profits (Frakes 2003).

Black smoker chimney and Ridgeia tubeworm colony at the Endeavour Hydrothermal Vents Marine Protected Area (Juan de Fuca Ridge) in the north-east Pacific Ocean. Photo V r a Tu icli , U iv rsity o Victoria

However, the resources which fall under the benefit sharing regime created by UNCLOS are limited to mineral resources. A dispute is now emerging as to whether a broader definition of 'resources' should apply, so that the living resources of the deep seabed area would also be considered as the Common Heritage of Mankind and their exploitation subject to the Common Heritage of Mankind regime established by UNCLOS.

How far the Common Heritage of Mankind does or should extend beyond mineral resources is emerging as a very controversial international debate. However, this debate could go on for years, without productive results, while bioprospecting is already taking place in the deep seabed of the Area. In essence this debate is really about whether the benefits (including profits) derived from exploiting deepsea genetic resources should be shared by the international community and not just by the biotechnology companies who develop such new technology. As these profits are made from products sourced from the global commons, questions are now being asked as to whether such companies should share such profits with the global community, and particularly developing countries. A further complicating factor is the legitimate concerns of biotechnology companies that a cumbersome bureaucratic regulatory regime might impose unnecessary burdens on MSR and bioprospecting. Thus, there is a need for a more practical approach.

A compromise approach that may provide for equitable utilisation and sharing of benefits associated with the genetic resources of hydrothermal vents, without unduly regulating the biotechnology industry or discouraging marine scientific research, is clearly necessary. This article proposes one possible approach that does not require recourse to the concept of the Common Heritage of Mankind.

Many different proposals have been put forward for the sharing of oceans resources over time. These include a Global Commons Trust Fund, which essentially makes the use of commons resources dependent on dedicating part of the benefits to the protection of commons areas themselves (Stone 1993a). However, there are problems with the way such an idea has been developed in the past. Firstly, as Stone (Stone 1993b) explains, such a concept is based on the notion that the commons areas are the Common Heritage of Mankind. However, as noted above, the debate over the Common Heritage of Mankind may make agreement on this basis impractical. A way around this obstacle may be to link the Global Commons Trust Fund concept to the grant of patents in relation to the biotechnology derived from such commons resources, in this case patents derived from hydrothermal vent micro-organisms. While the micro-organisms from which biotechnology is derived are sourced beyond national jurisdiction, the exclusive monopoly to exploit such biotechnology is granted by individual States. If one addresses an act by a State, the status of these resources beyond national jurisdiction as the Common Heritage or otherwise does not have to be an issue.

The grant of a patent by a State could be made conditional on payment of a royalty to the Global Commons Trust Fund. A good bench-mark figure for royalties may be similar amounts already paid or agreed under access and benefit sharing arrangements within national jurisdiction. These figures may be a useful guide as they already take into consideration the return on investment required to justify undertaking research and development in relation to new biotechnology in the first place. Although costs of accessing genetic resources may be greater in the deepsea, these figures may be a useful guide. The fact that the actual sample extraction and much of the scientific research associated with product development is carried out by publicly funded academic and research institutions such as universities is also a factor that should be taken into account.

It would be preferable that any such royalty be linked to the actual sale of products derived from deepsea genetic resources. Linking the royalty payable to actual product sold would enable research on new uses of deepsea genetic resources to be carried out, without the added expense or burden of a tax on what may well turn out to be a speculative exercise

2. the Convention on Environmental Impact Assessment in a Transboundary Context adopted at the United Nations Economic Commission for Europe, which was modeled on the UNEP Guidelines;
3. the subsequent 1997 EC Directive (Council Directive 97/11/EC, 1997 OJ (L73) 5);
4. the lending decision-making processes of the World Bank and regional development banks; and
5. the Madrid Protocol to the Antarctic Treaty, which provides for detailed environmental impact assessment of all activities in Antarctica. It is clear that environmental impact assessment is now a widely utilised mechanism under international law and is also found in many domestic legal systems.

The Madrid Protocol to the Antarctic Treaty provides the most interesting example of how an environmental impact assessment regime can be utilised to manage the environmental impact of scientific research in areas beyond national jurisdiction. The significant innovation introduced by the Madrid Protocol was a graduated scheme of environmental impact assessment for activities in Antarctica. Under this regime activities undertaken in the Antarctic Treaty area pursuant to scientific research programmes, tourism and all other governmental activities are subject to prior assessment of the impacts of those activities on the Antarctic environment or on dependent or associated ecosystems. The nature of the environmental impact assessment required varies depending on whether those activities are identified as having:

a) less than a minor transitory impact;
b) a minor or transitory impact; or
c) more than a minor or transitory impact.

There are three important benefits to the process established by the Madrid Protocol. Firstly, it allows parties to make informed decisions with respect to any proposed activity, as decisions are made only after rigorous scientific scrutiny. Secondly, it introduces transparency and accountability into the process through its requirements for wide public circulation of environmental evaluations of major projects. Thirdly, it rests responsibility for implementing the requirements for impact assessment on the parties, though decisions are taken only after full consideration, review and the advice of the Committee for Environmental Protection, a permanent body established pursuant to the Madrid Protocol.

A regime applicable to MSR in areas beyond national jurisdiction could be modeled on the provisions of the Madrid Protocol and implemented via domestic law.

Compliance with an environmental impact assessment regime could be enhanced by making government funding for scientific research conditional on adequate environmental impact assessment and sustainable research practices for scientific research in areas beyond national jurisdiction, as already occurs in some countries. In Canada, for example, Federal Government funding for scientific research is linked to an environmental impact assessment process under the Canadian Environmental Assessment Act 1992. Most MSR conducted by Canadian researchers based in universities and other research institutions is funded by grants provided by the Natural Sciences and Engineering Research Council of Canada (NSERC). The NSERC routinely screens all applications for funding to determine whether the environmental assessment processes required by this Act applies to the activities for which funding is sought. If the legislation is triggered then the NSERC is prohibited from releasing funding unless the provisions of the legislation have been complied with.

Conclusion

The experience of MPAs within areas of national jurisdiction show that MPAs are one significant tool which, if managed effectively, can assist humanity to sustainably manage marine

environments and ensure that the wonders of the ocean survive for future generations. Recent developments within national jurisdiction, especially with respect to seamounts and hydrothermal vents, show that MPAs can be effective in managing vulnerable deepsea habitats. There is now an urgent need for the creation and effective management of MPAs in areas beyond national jurisdiction. But in moving forward the global agenda to establish MPAs beyond national jurisdiction, governments will also need to address the many other complex issues such as bioprospecting and the environmental impacts of marine scientific research and other current and emerging activities. This article has offered some suggestions on how some of these issues may be addressed either as part of a regime for high seas MPAs or in parallel to such a regime.

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Conservation de l'Haute mer – l'habitat d'algues en dérive comme base de l'haute mer

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Conservation et gestion des écosystèmes vulnérables des eaux profondes dans les zones au-delà de la juridiction nationale : les aires marines protégées sont-elles suffisantes ?

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Resumenes

Proteger la última frontera de la Tierra: por qué necesitamos un sistema global de redes de áreas marinas protegidas en Alta Mar

N FFOLEY

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Perspectivas de las áreas marinas protegidas en Alta Mar: marco legal y avances recientes

KRISTIN M G ER E Y GR EME KELLEHER

C si os t rcios los oc os s cu tr u r l s u s t rritori l s y o s co mic s xclusiv s EE l s cio s cost r s L xt si l co c pto r s m ri s prot s MPs l s u s cio l s st o – lt M r – s u t r compl j Es s ci l l coop r ci mu i l, y u los s u r os p r st l c r u os iv l s m s ltos prot cci p r o s co cr t s justars r cho i t r cio l

Muchos o i r os r co oc hoy u l s MPs lt M r y l s r s MPs so i strum tos u m t l s p r prot r l i iv rsi lt M r, p r t r u i ustri p u r sost i l , y p r pr s rv r l structur , l s u cio s y los proc sos los cosist m s Si m r o, s r ui r mucho tr jo p r s rroll r m c ismos si ci , cr ci y sti MPs y sus r s lt M r Simult m t , h r u h c r r t m s como l p sc rr str o s vul r l s lt M r p r u t s l s ctivi s s ll v c o m r sost i l y co u poyo ci t ico s o

E st rt culo s proporcio u p rsp ctiv r l m rco l l p r l s MPs lt M r, s r sum los pro r sos r li os r ci t m t , y s ti ic l u os los si ui t s p sos u m t l s h ci l st l cimi to r s r pr s t tiv s MPs lt M r

Mejora de la gobernanza de los océanos para conservar la biodiversidad en Alta Mar

ELI ETH FOSTER, FLOO LIS IR GR M Y M RTIN EXEL

El st l cimi to r s m ri s prot s MPs los oc os u r l juri icci cio lt M r p r l co s rv ci l i iv rsi s u compromiso u los o i r os uiri ro l Co r ci l s P rt s l Co v ci iv rsi iol ic 004, y l Cum r Mu i l s rrollo Sost i l 00 Pl cci oh s ur o Si m r o s l s ctu l s isposicio s o r los oc os, l s MPs lt M r so , mom to, h rr mi t s p r u co s rv ci ic l i iv rsi l u s los s spir

L s isposicio s o r p r l s MPs lt M r o so muy s s Cu ui r icio u s pu sp r l st l cimi to l s MPs s v r ilit o por l us ci u m rco sti co o y ic , y m i s co s rv ci plic l s U o r ctiv t r u i clui isposicio s p r l s uimi to, co trol y vi il ci , sp ci lm t i impe ir l p sc o r ul El cost co mico l sti s r co r l E st rt culo s r uy u xist u c ur t m jor r l isposicio s o r los oc os t s st l c MPs lt M r T m i s c s rio m jor r u ll s m i s sti u r ui r u co trol r ul or p r justi ic r los cost s sti tr v s u ic ci m jor L s Or i cio s R io l s O ci P u r RFMO proporcio j mplos p sos co cr tos os h ci l sti sost i l los r cursos tur l s l m rco l s ctu l s isposicio s o r L Visi M uk , scrit l pr s t rt culo mu str c mo l i ustri p u r , l s or i cio s o u r m t l s ONG m io m i t l s y los o i r os pu u irs p r s rroll r visio s y u s comp rt os u o l ici ci s l o r l s o s lt M r partir st s xp ri ci s, l rt culo su i r l u s s so r isposicio s o r r t l s u p r ll r lt rr o p r l st l cimi to MPs ctiv s lt M r

Razones económicas para el establecimiento de áreas marinas proteento1

Conservación en Alta Mar – el hábitat de las algas flotantes como base del mar abierto

RLO H HEMPHILL

E la carr ra para prot r cosist mas icos y vul rabl s u ra d la juris d icci acio al, posibl m t s st pasa d o por alto u o d los h bitats oc icos m s importa t s a p sa d su pr s cia la sup r ici d l oc a o El h bitat oc ico d cir, p l ico d las al as lota t s s cu tra la mayor a d las r io s m s t mpla as y subtropical s d l oc a o Empuja o por las corri t s oc icas, st h bitat proporcio a u lu ar s ci a d cr a, r poso, pu sta y alim to para u a s ri d p c s, i v rt bra os, tortu as y av s mari as, ta to sp ci s importa t s d d l pu to d vista com rcial como otras sp ci s m os comu s cumul d os a m d o a lo lar o d l mit s ro tal s, st h bitat d marca, oasis d pro uctivi a y d iv rsi a oc ica Si mba r o, l h bitat p l ico d al as lota t s s r ta tambi al impacto a tropo ico, i clu os la r col cci para la pro ucci d ali o al ico, xtractos m d ici al s y pi so para a a o E EE UU , r ci t m t s ha impl m ta o m d i as para prot r st importa t h bitat, p ro t d av a alta m d i a d co s rvaci lta Mar u u las ormas tra icio al s d r as prot i as p d r a s rvir para prot r los pic tros d al as lota t s como l Ma d los Sar a os, s r q ui r u u vo co c pto d r a mari a prot i a MP para prot r la atural a tra sitoria d la mayor a d las co c tracio s p l ica d al as lota t s y los proc sos oc a o r icos asocia os Las al as lota t s pu d h cho, proporcio ar u a r r cia visual para posibilitar la marcaci MPs d i micas, actua o como u a sombrilla para la prot cci d u a ama m s amplia d h bitats p l icos

Conservación y gestión de ecosistemas vulnerables de aguas profundas en zonas fuera de la jurisdicción nacional: ¿son suficiente las áreas marinas protegidas?

VI LE RY

El pr s t art culo s basa la opi i d q u las r as mari as prot i as MPs pu s r u a h rrami ta ica para co s rvar y stio a d ma ra sost ibl o as co cr ta d los oc a os u ra d la juris d icci acio al, y d q u d b r a al t ars los s u r os d los Esta os co d as a i s

El art culo d scrib prim r lu ar l pro r so d las MPs cr a as para los cosist mas d l o d o mari o pro u d o spu s d d u a p rsp ctiva m s amplia a r um ta q u , por s mismas, las MPs o s r su ici t para ara ti ar la sti sost ibl lta Mar y d l o d o mari o pro u d o u ra d la juris d icci acio al la hora d d is ar u sist ma i t r acio al ica para la sti sost ibl sta vasta o a, s c sario abor ar u a s ri d cu stio s compl jas Los cosist mas asocia os co las chim as hi rot rmal s d las pro u d i a s mari as s utili a a u como st d io d caso E l art culo s d scrib d bat sobr si los r cursos vivos d l o d o mari o pro u d o u ra d la juris d icci acio a d b r a co si rars como part d l Patrimo io Com d la Huma i a sic virtu d la Co v ci d las Nacio s U i as sobr l r cho d l Mar UNCLOS Tambi s obs rva q u st d bat p d r a o r solv rs cilm t E l art culo, s pr s ta u a propu sta q u p d r a s rvir como u compromiso a cua o combi ar la co c si d r chos d propi d a i t l ctual para los r cursos ticos d las pro u d i a s mari as a u o d o para d sarrollo sost ibl La sti d st o d o p d r a star al car o d i stitucio s como l Fo d o Mu ial para l M d io mbi t GEF y part d los i r sos p d r a ayu ar a cubrir los cost s d d sarrollo d MPs u ra d la juris d icci acio al Otra cu sti q u hay q u abor ar s l posibl impacto m d io mbi ta d la i v sti aci ci t ica mari a, y si l impacto d d icha i v sti aci d b r ulars y c mo Hay q ui ar um ta q u la r ulaci por part d la propia comu i a ci t ica o s r a su ici t E l art culo s pr s ta u a propu sta para la r ulaci d la i v sti aci ci t ica mari a q u i cluy u proc so d valuaci d l impacto m d io mbi tal basa o l sist ma d t rtico

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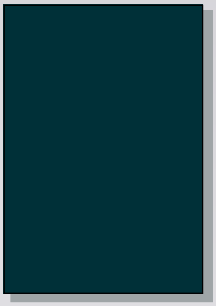

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