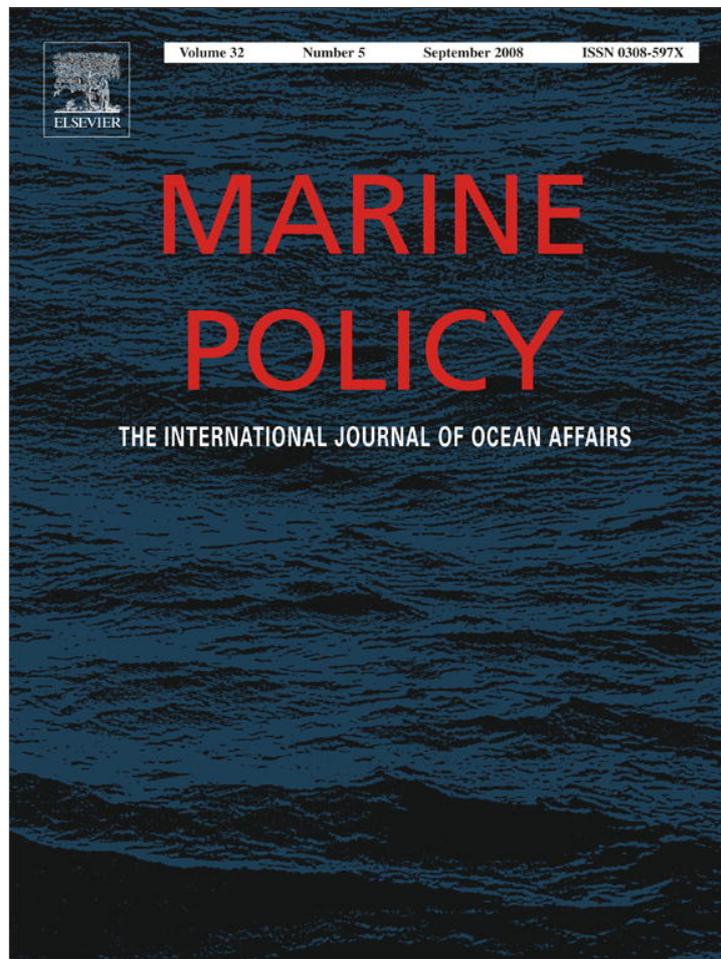


Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

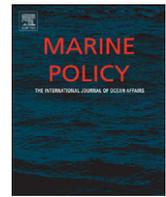
In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Marine spatial planning in the high seas

Jeff Ardron^{a,*}, Kristina Gjerde^{b,1}, Sian Pullen^{c,2}, Virginie Tilot^{d,3}^a German Federal Agency for Nature Conservation, Isle of Vilm, D-18581 Putbus, Germany^b IUCN Global Marine Program, ul Piaskowa 12c, 05-510 Konstancin-Chylice, Poland^c Marine Science and Policy, 1 Helston Drive, Emsworth PO10 7TP, UK^d Département Milieux et Peuplements Aquatiques, Muséum National d'Histoire Naturelle, 55 Rue Buffon, 75005 Paris, France

ARTICLE INFO

Keywords:

high seas
 Marine spatial planning
 Marine protected area (MPA)
 Ecosystem approach

ABSTRACT

Although high seas resources are being exploited, reciprocal legal obligations to protect its environment have not been met. Marine spatial planning (MSP) is clearly a practical way forward, particularly for the high seas, where non-spatial monitoring is difficult, and where data gaps obstruct conventional management approaches. To ensure the effective application of MSP in the high seas, however, some institutional reforms are necessary. This paper outlines the main hurdles, summarizes existing high seas spatial protections, presents an example of a high seas marine protected area that resulted through MSP, identifies three institutional priorities, and suggests three immediate steps.

© 2008 Elsevier Ltd. All rights reserved.

1. Introduction: freedoms and obligations in the high seas

Countries have enjoyed traditional high seas⁴ freedoms as codified under the UN Convention on the Law of the Sea (UNCLOS) including the freedom to fish, navigate, overfly, lay cables and pipelines, construct artificial platforms, and conduct marine scientific research. However, countries have not yet fully implemented UNCLOS's reciprocal obligations to protect and preserve the marine environment, rare and fragile ecosystems, and vulnerable species; conserve high seas marine resources; prevent pollution; and control the behavior of their nationals and vessels; in addition to the general obligation to cooperate to achieve these ends. Though under both UNCLOS and the Convention on Biological Diversity (CBD), nations are committed to preventing harm to the environment and biodiversity beyond national jurisdiction, few countries have developed assessment procedures or other oversight mechanisms to identify potentially harmful activities under their jurisdiction or control (see also Maes in this issue).

While marine spatial planning (MSP) is not explicitly specified in UNCLOS or the CBD, it is clearly a practical way forward that would assist states to fulfill their obligations under these international conventions. The full application of MSP in the high seas will be a challenge, but one which the international community will need to address to ensure long-term productivity and resilience of high seas ecosystems and services, upon which we all depend. Some promising first steps have been taken and will be outlined below. This is followed by a brief analysis of both institutional reforms and short-term actions that may be required to address gaps in high seas governance to enable the effective application of MSP beyond national jurisdiction.

2. Gaps in high seas governance

Though UNCLOS provides a valuable framework for oceans governance, it is in itself not comprehensive with regard to addressing specific high seas planning issues. UNCLOS does, however, allow for implementing agreements at both the global and regional levels to address these issues, such as the UN Fish Stocks Agreement. This 1995 Agreement, which came into force on 11 December 2001, is designed to implement and build on UNCLOS provisions with respect to straddling and highly migratory fish stocks. While a step forward, many high seas fisheries are either not covered by the Agreement or occur in an area of the ocean that is not yet regulated by Regional Fisheries Management Organizations (RFMOs).

Even within one sector, such as fisheries, there is seldom a common mandate for ecosystem-based and precautionary management between RFMOs and regional seas organizations in the same area. Furthermore, many RFMOs lack the legal capacity and/

* Corresponding author. Tel.: +49 38301 86129/+49 1520 5998556;
 fax: +49 1520 5998556.

E-mail addresses: jeff.ardron@gmail.com (J. Ardron), kgjerde@it.com.pl (K. Gjerde), sianprior9@hotmail.com (S. Pullen), v.tilot@wanadoo.fr (V. Tilot).

¹ Tel.: +48 22 737 2300.

² Tel.: +44 1243 375152.

³ Tel.: +33 143544623.

⁴ In UNCLOS *high seas* is a legal term defined to indicate the water column beyond national jurisdiction (generally beyond the 200 nm exclusive economic zones of states), and the international seabed is termed the *Area*. In this paper, however, *high seas* will be used in its more vernacular understanding to mean all marine areas beyond national jurisdiction, including the international seabed and the water column, unless otherwise indicated.

or their members lack the political will to close areas to fishing for purely biodiversity purposes [1]. This can lead to poor cooperation and the consequent failure to achieve globally and regionally agreed biodiversity conservation objectives. Moreover, only four regional seas agreements include areas beyond national jurisdiction (Southern Ocean, Northeast Atlantic, the Mediterranean and Central Pacific) [2]. Consequently, outside of these four regions there is no institution able to coordinate and/or regulate most activities on the high seas, a seeming prerequisite for MSP.

Shipping and waste dumping are two high seas activities in addition to fishing that are specifically regulated at the global level. However, these too have their limitations. For example, the rules in MARPOL 73/78 and its Annexes [3] governing ship discharges of oily wastes, chemical residues, sewage and garbage are based on a distance from land approach that dates from an era when it was not realized that offshore ecological resources are not necessarily less valuable and/or less sensitive to impacts, and that the open ocean cannot absorb greater levels of pollution. As a result, mass concentrations of marine debris and oil slicks are accumulating in high seas “sink” areas, such as ocean gyres, with serious repercussions for marine wildlife, seabirds, fish, and fisheries [4].

Therefore, serious gaps in authority exist. Human activities currently unregulated at the international level include, *inter alia*, many discrete high seas fisheries, most directed shark fisheries, new and emerging fisheries such as capture of tuna for ranching in national waters, bioprospecting, marine scientific research, and military activities. Also lacking for the high seas are specific provisions agreed at the global level relating to conservation and sustainable use of biodiversity, strategic environmental assessment, cumulative impact assessment, marine protected areas (MPAs), water quality protection (from activities other than shipping or dumping), and noise pollution. Worryingly, there are few regulations in place to govern the rapid proliferation of new ideas for sequestering CO₂ in the marine environment, such as ocean iron fertilization⁵ or at-depth injection of CO₂,⁶ which take advantage of the informal markets for carbon offsets but whose efficacy and ecological safety are questioned by many scientific experts [8].

UNCLOS is premised on the duty of cooperation, but it did not create a mechanism to coordinate and discuss substantive implementation issues, share best practices, or promote compliance. As acknowledged in the 2006 report of the UN Secretary General, “(...) mechanisms for horizontal integration among different levels of government and vertical integration among agencies with different mandates are essential for the application of an ecosystem approach” [9]. While this quotation refers to areas of national jurisdiction, it is equally applicable to areas beyond national jurisdiction, where at present there is no such mechanism. Without such a mechanism, it is hard to imagine that inclusive MSP could occur, except perhaps in a few special cases, as discussed below.

3. Existing spatial measures in the high seas

As can be seen in the summary table (Tables 1a and 1b), several arrangements exist under which some high seas spatial protection

⁵ Though these proposals to sequester CO₂ in the oceans may in fact be covered by the 1972 London (Dumping) Convention and its 1996 Protocol, the parties to the London Convention and Protocol have yet to consider the issue. In the meantime, commercial entrepreneurs have been proceeding as if the Convention does not apply [5].

⁶ However, one regional seas convention, OSPAR, has already passed a decision that forbids deposition of CO₂ directly on the seabed [6], and has developed measures and reporting requirements regarding sequestration in deep sea geological formations [7].

measures have already been taken. These include some fisheries closures and restrictions enacted through RFMOs, calls for precautionary closures by intergovernmental forums,⁷ and arrangements under the Antarctic Treaty. The Agreement Concerning the Shipwrecked Vessel RMS Titanic is another example of how individual states can choose to protect a feature in the high seas cooperatively, despite the fact that it is not intended to protect biodiversity and does not have the same legal status as global agreements. The Pelagos Sanctuary for Mediterranean Marine Mammals, a planned MPA that spans territorial and high seas waters, will be discussed later in this paper.

Existing spatial measures vary in levels of protection provided and the number of activities they address. Arrangements that are available for some areas of the high seas are not available for others. The criteria used in the selection (or rejection) of areas is often not available, and appears to vary widely. Clearly, the overall picture is not one of organized MSP. Nevertheless, the broad variety of existing arrangements clearly demonstrates that some high seas management and protection is already achievable within current arrangements, albeit in a very piecemeal fashion. (This does highlight the need for overarching institutional arrangements to enable comprehensive MSP, as discussed later in this paper.) Moreover, management assessments have generally not been conducted, making it difficult to judge how effective these existing measures have been, particularly with regard to compliance or enforcement.

Furthermore, all the possible arrangements currently available have not been applied. For example, the International Seabed Authority has the basic authority to advance MSP with respect to seabed mining activities in the Area, and can designate preservation and reference areas to restrict high seas seabed mining activities. However, it has yet to draw on these powers [12]. This is probably because seabed mining is still in an early, exploratory phase. A more pressing concern is the slowness of many RFMOs to use their full powers to protect vulnerable marine species and ecosystems through the use of spatial and temporal measures.

4. The need for spatial planning for fisheries in the high seas

Human activities have been affecting high seas species, habitats and ecosystems for centuries, and in recent decades fisheries that stand out as having the most significant direct and harmful impacts [13].⁸ Historically, however, it was probably not fisheries but whaling, dating back to the 19th century, which represented the first major high seas impacts.⁹ After nearshore cetacean populations had been extirpated in earlier centuries,

⁷ An important intergovernmental resolution not listed in Table 1, because the deadlines for action have not yet arrived, is the 2006 UN General Assembly resolution 61/105, §§83 a–b that calls upon States and regional fisheries management organizations to identify “vulnerable marine ecosystems” in the High Seas and consider whether individual bottom fishing activities would have significant adverse impacts on these ecosystems. Furthermore, if it is assessed that these activities would have significant adverse impacts, they should be managed to avoid such impacts, or not authorized to proceed. This UNGA resolution calls for such assessment to be completed by 2008 for those areas with RFMOs as well as interim measures by 2007 for those areas of the high seas that do not yet have RFMOs (§85) [10].

⁸ Indirect human impacts, such as global pollutant transport, ocean acidification and climate change, also carry significant ecological consequences in the high and deep seas, but since the causes of these impacts are not readily addressed in a MSP context, they will not be considered in this paper. It is very likely, however, that ecosystem-based MSP would increase ecological resilience to these indirect human impacts.

⁹ While the 16th and 17th century cod fishery on the Grand Banks off the coast of Newfoundland likely extended into what is now known as the High Seas (water column), the ecological effects are hard to quantify. That this fishery survived in various forms until the 20th century, however, indicates that it was likely

Table 1a
Summary of arrangements under which geographically specific high seas protection measures have already been adopted [11]

Arrangements	Current measures
Regional Fisheries Management Organizations (RFMOs)	SEAFO: 10 bottom fishing closures; NEAFC: 8 bottom fishing closures; NAFO: 4 bottom fishing closures; GFCM: 3 trawl closures and trawl ban > 1000 m
RFMOs in development	SPRFMO: precautionary trawl restrictions, and “frozen footprint”
Regional Seas Conventions	Barcelona Convention: Pelagos Sanctuary SPAMI; OSPAR Convention: Portugal has 1 MPA on its claimed extended continental shelf
Antarctic Treaty and CCAMLR	Antarctic Treaty: 16 ASPAs, 3 ASMAs; CCAMLR: several species-specific closures as well as 2 full fisheries closures, 2 CEMP monitoring sites, and area-wide gillnet ban and trawl ban
Other international conventions	IMO (through MARPOL): 2 Special Areas; IMO can also designate PSSAs, but there are none in ABNJ; IWC: 3 ocean basin whale sanctuaries
International agreements	Pelagos Sanctuary for Mediterranean Marine Mammals (IT, FR, MC); Agreement Concerning the Shipwrecked Vessel RMS Titanic (US, UK, [FR], [CA])—square brackets signify not yet ratified
Inter-governmental organizations voluntary measures	Pacific Islands Forum: a ministerial call for precautionary trawl restrictions in the Western Tropical Pacific Islands Area SIODFA: 4 voluntary trawl closures on seamounts

For the meanings of acronyms, see Table 1b. Source: Ref. [11].

whaling extended further and further offshore to become a global phenomenon, with likely deep ecological repercussions, as hundreds of thousands of these top predators were removed from the world's marine ecosystems [16]. Near the end of the 20th century, however, the pressure shifted to high seas fish stocks.

As of 2006, about 75% of global fish stocks are either fully exploited or over exploited. This poor situation extends to areas beyond national jurisdiction, where the Food and Agricultural Organization (FAO) reports that two-thirds of the assessed straddling and non-tuna high seas fish stocks are already overexploited or depleted and more than half of the assessed stocks of highly migratory oceanic sharks are overexploited or depleted [17].

As nearshore stocks yield ever lower landings, the percentage of fish from the high seas and deep seas rises, such that deep-seas fisheries¹⁰ are already becoming over-fished (“senescent” in FAO language; Fig. 1).

At the same time, it is becoming known that many deep-seas species exhibit idiosyncratic characteristics, such as slow growth and later maturity, which require more precautionary management considerations than their continental shelf cousins [20]. Indeed, it has even been suggested that some high seas fisheries might be intrinsically unsustainable, given that the size of the vessels and the fuel necessary to travel these distances necessitates catches that are too large to be sustained [21].

Thus, while fisheries experts may still debate analysis details [18], there is growing awareness that high seas biodiversity needs greater protection, particularly with regard to the effects of fisheries. While spatial measures for fisheries management, such as closures or MPAs, would be just one aspect of comprehensive

(footnote continued)

sustainable in earlier centuries, with less dramatic ecological impacts as were seen at the end of the 20th century, when it collapsed [14,15].

¹⁰ FAO reporting uses 200 m depth to delineate “deep seas” fisheries.

Table 1b
Acronyms used in Table 1a

ABNJ	Areas Beyond National Jurisdiction
ASMA	Antarctic Specially Managed Area
ASPA	Antarctic Specially Protected Area
CA	Canada
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CEMP	CCAMLR Ecosystem Monitoring Program
FR	France
GFCM	General Fisheries Commission for the Mediterranean
IMO	International Maritime Organization
IWC	International Whaling Commission
MARPOL	International Convention for the Prevention of Pollution from Ships (MARine POLLution)
MC	Principality of Monaco
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	North East Atlantic Fisheries Commission
OSPAR	Oslo-Paris (NE Atlantic)
PSSA	Particularly Sensitive Sea Area
RFMO	Regional Fisheries Management Organization
RMS	Royal Mail Steamer/Steam-Ship/Ship
SEAFO	South East Atlantic Fisheries Organization
SIODFA	Southern Indian Ocean Deepwater Fishers' Association
SIOFA	Southern Indian Ocean Fisheries Agreement
SPAMI	Specially Protected Areas of Mediterranean Interest
SPRFMO	South Pacific Regional Fisheries Management Organization (in development)
UK	United Kingdom
US	United States

high seas spatial management planning, they would clearly be an important aspect.

In November 2006, the UN FAO held a workshop of experts on deep-sea fisheries in the high seas. The conclusions from that workshop were extensive, and a few key points are highlighted (emphasis added):

- (...)Four main characteristics that make the management of deep-sea fisheries on the high seas particularly problematic: *the vulnerability of low productivity stocks, the vulnerability of the habitats, gaps in international legal regimes* for the management of high-seas fisheries and insufficient coverage by Monitoring, Control and Surveillance systems [22].
- (...)Even short-term deep-sea fishing can result in significant impacts on the target species, bycatch and habitats. This further highlights the need for urgent management action. In particular, experience in management of low productivity deep-sea fisheries has demonstrated that *effective regulation is extremely difficult and traditional approaches to assessment and management may fail* to prevent resource depletion and habitat destruction [23].
- *Spatial and temporal management tools such as MPAs, spawning closures and seasonal closures, are particularly useful in data-poor situations such as encountered in the deep seas (...)* [24].

To summarize, in the high seas, conventional management options are generally more difficult to enforce, and spatial protection, e.g., MPAs, could be particularly efficacious, particularly in data-poor situations, as are commonly encountered.

5. Toward networks of high seas marine protected areas

To date, the development of MPAs, which represent one critical component of an ecosystem approach through MSP, has been a priority for global marine conservation efforts. 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

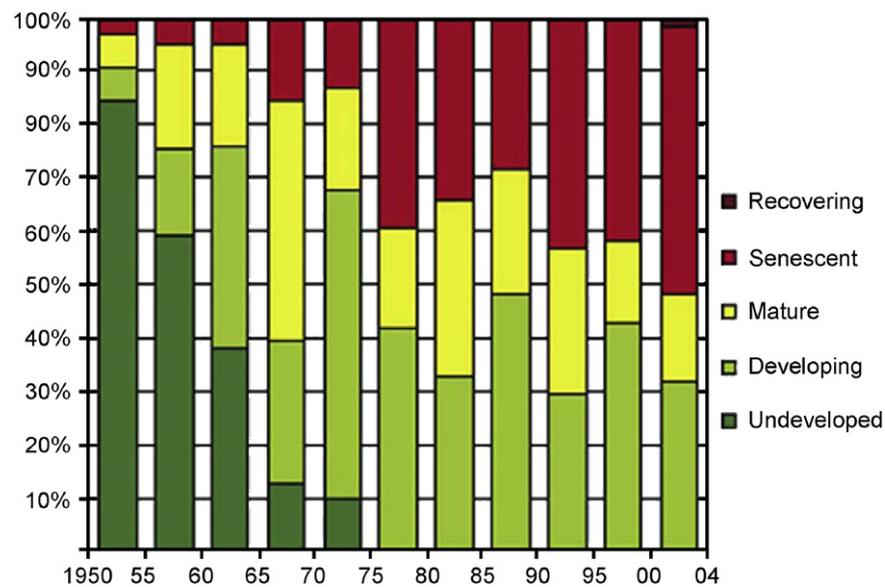


Fig. 1. Percentage of the world's top oceanic deep-water fisheries resources in various phases of development, 1950–2004 [19]. Adapted from FAO Fisheries Technical Paper 495 United Nations Food and Agriculture Organization, 2007.

have occurred in 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 [25].

In response to a need identified by the CBD Protected Areas Working Group, the Canadian government hosted a workshop on criteria for “ecologically and biologically significant areas” in December 2005. Next, a workshop in Mexico City in January 2007, coordinated by the University of Mexico, the National Commission for the Study and Utilization of Biodiversity and the Institute of Marine Sciences and Limnology, Mexico, UNESCO, IOC, and IUCN discussed the development of a comprehensive biogeographic classification of open ocean and deep seabed areas beyond national jurisdictions. Thirdly, the government of Portugal is hosted a CBD expert working group in October 2007 that considered the results of these two previous workshops and developed a consolidated set of criteria for identifying ecologically and biologically significant areas, and for evaluating representative networks of MPAs. Additionally, progress in developing the Global Open Oceans and Deep Seabed (GOODS) biogeographic classification was considered.

1. identifying ecologically and biologically significant areas;
2. developing biogeographic classification systems; and
3. identifying representative networks of MPAs.

Discussions have also occurred within the UN Ad hoc Open-ended Informal Working Group to consider issues related to the conservation and sustainable use of marine biological diversity in the high seas. Its first meeting took place in February 2006, and the second meeting took place April/May 2008. In 2006 the European Union (EU) introduced a proposal for a new implementing agreement to UNCLOS to provide for, among other things, establishment and management of high seas MPAs. Though there is wide support for action to improve high seas biodiversity conservation, some countries feel that the need for an UNCLOS implementing agreement has not yet been established. However, such an agreement could provide an important vehicle for implementing the ecosystem and precautionary approaches into

high seas management, including through MPA networks and wider MSP.

The principles for the selection of high seas MPAs, as were discussed and developed at the CBD experts' workshop (2–4 October 2007, the Azores), follow the principles already well established for national waters.¹¹ For example, the OSPAR Convention's Maritime Area contains up to 40% high seas,¹² and employs seven ecological criteria in the identification and initial prioritization of potential MPAs, in both national waters and the high seas of the Northeast Atlantic: threatened and/or declining features, important species and habitats/biotopes, ecological significance, high natural biological diversity, representativity, sensitivity, and naturalness [26].

Additionally, after these primary ecological criteria have been applied, the OSPAR parties have agreed that the following secondary practical considerations can be used to continue the prioritization process: size, potential for restoration, degree of acceptance, potential for success of management measures, potential damage to the area by human activities, and scientific value [27].

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)¹³ has identified as a priority the protection of scientific areas to assist in distinguishing the effects of harvesting and other human activities from natural ecosystem changes as well as providing opportunities for understanding of the Antarctic marine ecosystem without interference [30].

¹¹ These criteria are under consideration at the CBD conference of parties (COP 9), 19–30 May 2008, Bonn, Germany.

¹² This is the estimated area of the water column beyond national jurisdiction. Due to ongoing national claims of extended continental shelves, it is unclear how much of the seafloor will be beyond national jurisdiction (i.e., the “Area”).

¹³ The Antarctic Treaty, entered into force in 1961, with presently 46 nation members including 28 as Consultative Parties. The Treaty promotes freedom of scientific investigation and holds all territorial claims in abeyance. The Treaty system has grown up around the original Treaty and includes the Protocol on Environmental Protection to the Antarctic Treaty (Madrid, 1991) and the Convention on the Conservation of Antarctic Marine Living Resources (Canberra, 1980) which establishes a Commission to manage the area of the Convention. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) includes 24 Members and 10 Parties to the Convention [28,29].

Norse et al. [31] have pointed out that high seas MPAs can initially be expected to protect two general classes of high seas features: fixed benthic formations such as seamounts, reefs, and hydrothermal vents; and variable pelagic formations such as convergences, upwellings and gyres. Such areas are also often associated with increased productivity. Mandatory satellite tracking of fishing vessels would make the protection of both types of features relatively straightforward to monitor, and is already occurring, for example, with regard to the closures of five seamounts and four cold water coral reefs in the Northeast Atlantic. The spatial protection of mobile, yet persistent, pelagic features that are important fish habitat has been generally thought to pose a greater challenge [32] but is one that researchers are already beginning to address and demonstrate as being feasible, at least in some cases [33].

6. Toward ecologically appropriate fishing areas in the high seas

While attention has understandably been focused on the development of high seas protected areas, MSP requires that all human activities are considered proactively, i.e., not just where they cannot occur, but also where they can occur. The following four approaches are suggested here as ways by which ecologically appropriate high seas fishing areas could be identified.

- *Reversing MPA criteria.* This is probably the most obvious approach, whereby if an area is known to *not* reflect the criteria for an MPA, then it is a possible fishing area. It might be asked if this gives us anything new, since we would still be dealing with MPA criteria. The answer is, surprisingly, yes. Because of the patchy nature of data collected far offshore and in the deep seas, there may well be data for an area that indicates it is not a nursery area and not a cold water coral area, for example, even though we do not actually know where the nursery and coral areas are. MPA criteria are well known, and have been outlined above. One simply puts the word “not” in front of them.
- *Areas of low bycatch.* Ecologically sustainable fishing can be expected to have low levels of bycatch, i.e., unwanted (or endangered) fish species, seabirds, turtles mammals, and benthic organisms such as corals. Low and high bycatch areas are usually well known among the fishers themselves, can be determined by observer data, and can also be identified through a meta-analysis of various scientific trawl, sampling, and research data.
- *Areas that are already heavily impacted.* Marine zoning would presumably reflect the general ethos as it has been applied on land, whereby some areas could be treated as “industrial” zones, and as such have lower standards for disturbance than other zones. On land, such industrial zones are often situated in places that have already suffered a great deal of degradation. Some places may be found to still harbor ecological importance and potential, which would justify their recovery, and where necessary, restoration; but other areas may not. These heavily impacted zones without significant ecological values still intact could be candidates for fishing areas. This approach is akin to “freezing the footprint,” but is more sophisticated in that it recognizes that some fished areas should still be protected, based on their ecological values and potential. However, this approach is one that would require great care in its implementation to avoid the deliberate destruction of habitats to “claim” them. Properly implemented, however, this approach could encourage the fishing industry to apply better stewardship principles to the areas for which they can be assured will remain open to them indefinitely.
- *Areas where other less harmful fishing methods are possible and/or necessary.* Fishers, like most of us, are creatures of habit. That is, they can be expected to continue destructive activities, such as bottom trawling, simply because it has worked in the past. Spatial zoning of such areas to encourage the development of less harmful practices would facilitate innovation and change. While the zoning of fishing areas offer the prospect of a powerful management approach not in current use, it will also be necessary to balance the needs of other sectors to access the high seas. In addition, it must be acknowledged that high seas spatial planning will not replace non-spatial regulatory and incentive-based measures (see Ref. [36] in this issue). Hilborn et al. [34] observe that, “[W]hile the potential value of marine reserves for the protection of habitat and biodiversity is clear, their potential for improving fisheries management and particularly fisheries yields will be limited unless the roots of fisheries management failures are addressed.” Thus, with respect to high seas fisheries, it will still remain necessary to eliminate opportunities for illegal, unreported or unregulated fishing (IUU); to rein in flags of convenience; and to convert ecologically unsustainable gears and practices to sustainable ones. Thus, efforts to address the underlying weaknesses and gaps in the high seas governance regime must also continue to be addressed.

7. Marine spatial planning in the high seas: the example of the Pelagos Sanctuary for Mediterranean

As we have seen within areas of national jurisdiction, MSP on a range of scales is a way of improving decision-making and spatial coherence in the management of marine activities both within and outside of protected areas [35]. When based on a shared vision, harmonized mandates, and a strategic assessment of ecological and socio-economic resources and impacts, MSP facilitates integrated, forward-looking, and consistent decision-making. Because many marine activities spatially overlap, MSP can help minimize conflicts of use and help address the resultant cumulative ecosystem effects of such impacts. It also provides a framework for responding to new and emerging activities and a clear easily accessible mechanism for stakeholder involvement [36].

The Pelagos Sanctuary for Mediterranean Marine Mammals (formerly the International Ligurian Sea Cetacean Sanctuary) is one of the first high seas intergovernmental MPAs¹⁴ and was accompanied by an innovative dedicated process for high seas MSP. It was created with the objective of establishing a sanctuary for marine mammals and managing the negative impacts of human activities [37,38]. Ratified through a formal agreement with France, Italy, and the Principality of Monaco in 1999, it entered into force in 2002 [39,40]. In 2001, it was accepted by the Barcelona Convention as a Specially Protected Area of Mediterranean Interest (SPAMI). The Sanctuary is in the Corso-Ligurian marine area, northeast of the western Mediterranean sea, spanning internal and territorial waters of France, Italy, and the Principality of Monaco, as well as international waters. A total of 46,371 km² of the 87,492 km² area of the Sanctuary is in the high seas (water column).

The presence in the area of a permanent frontal system, and consequent upwellings of deep, nutrient-rich waters is responsible for the substantial primary productivity in the area, a striking contrast with most of the Mediterranean pelagic

¹⁴ Considering the varying definitions of an MPA, it is difficult to say what was truly the first High Seas MPA. However, the efforts of the Antarctic Treaty/CCAMLR, as well as the IWC, should be recognized.

domain. The high abundance of the Mediterranean euphausiid, *Meganyctiphanes norvegica*, of cephalopods and of fish attracts eight species of cetaceans including fin, sperm, Cuvier's beaked, long-finned pilot whales, striped, Risso's, bottlenose, and short-beaked common dolphins. The habitats of these pelagic cetaceans lie largely in international waters.

In the Mediterranean Sea, where exclusive economic zones have not been created, management and conservation of these high seas (water column) resources beyond 12 nautical miles can be problematic. A special area of ecological protection (ZPE) was created by France, Italy, and Monaco in 2004 within the sanctuary to enforce the law against negative impacts of pollution and scientific research. Several international conventions and instruments have been employed to lend support to the Sanctuary.

The management plan is based on an ecosystem approach and adaptive management [41]. Stakeholders were involved from the beginning in the development of the management plan, and support it. Management measures have been adapted to each zone, setting limits with the objective of balancing conservation and the sustainable use of resources, including both traditional and commercial uses. Regulated activities within the region include, *inter alia*, fisheries, aquaculture, commercial and leisure navigation, offshore racing and other high-speed maritime transportation, prospecting, exploration, coastal urbanization, tourism, whale-watching, military activities, and scientific research.

8. Priorities for the improvement of institutional coherence

Notwithstanding inspiring exceptions such as Pelagos, for MSP to occur in most of the high seas, states will need to greatly improve coherence among and between global and regional agreements, institutions, and national administrations. Three priorities and related actions for improving institutional coherence are identified below to stimulate further discussion and action. They include:

1. Reform existing institutional arrangements to better support conservation and sustainable use of high seas biodiversity. This can be done by:
 - *Adopting a common mandate of conserving ecosystem composition, structure and function* to provide a consistent level of basic protection. This will require the review of existing institutional mandates and/or the development of an overarching global agreement such as the UNCLOS implementing agreement proposed by the EU;
 - *Establishing standards for strategic environmental assessment and environmental impact assessment* of ongoing and proposed activities together with requirements for national implementation; and
 - *Developing cooperation across jurisdictions and sectors* through formal and informal agreements and mechanisms, to harmonize the above activities.
2. Provide high-level global support and coordination. This can be done by:
 - *Establishing a body* within the UN system with a broad mandate to ensure coordination, coherence and cooperative action among sectorally focused institutions at the global and regional level; review and assess compliance with duties to protect the marine environment; and provide technical assistance and incentives for compliance;
 - *Developing agreed overarching governance rules* to ensure institutional accountability, transparency, consistency and responsibility, as well as allowing for broad stakeholder participation;

3. Provide regional support through global programmes, such as:
 - *An independent scientific advisory body* to help regional (and global) bodies implement the ecosystem approach and the precautionary approach, including MSP;
 - *A global cooperative MSP and protected areas program* to link the planning efforts of regional bodies and to help roll out a globally representative network of MPAs for the high seas by 2012.

9. Conclusion and next steps

To summarize, there is emerging agreement that for high seas fisheries, MSP, and spatial measures such as MPAs, spawning closures and seasonal closures, are particularly useful in data-poor situations such as encountered in the high seas. Furthermore, it is likely that these conclusions are applicable to other high seas human activities as well. The broad variety of existing institutional arrangements clearly demonstrates that some high seas spatial management and protection is already achievable within current arrangements. However, the fragmented and piecemeal nature of existing measures, combined with the increasing pressures of high seas human activities, suggests a pressing need for overarching institutional arrangements to better coordinate comprehensive MSP in the high seas.

In order to be able to move closer towards MSP in the high seas, there are some key steps that should be taken in the immediate future. Three are listed here:

1. *Begin practicing multi-sector cooperation and decision-making—especially with fisheries and environment.* Moving toward MSP as part of a wider ecosystem-based approach in the high seas will take time and effort. A first step will be to better link single-sector (or single-species) management institutions, at national, regional, and international levels, such that MSP becomes based on multi-sector, multi-species consideration—as will be necessary in the near future with regard to deep sea mining. However, multiple sector/species management is still not the same as ecosystem management. An ecosystem approach will ultimately require the development of a single, holistic approach involving overarching analyses that considers cumulative impacts—probable gains and losses—from prospective management actions. Nonetheless, building multi-sector communication, cooperation, and decision-making is a necessary first step. Bridging the traditional gaps between fisheries management and environmental protection, for example, would be a very good place to begin.
2. *Identify “vulnerable marine ecosystems”* in the high seas and manage activities that may have significant adverse impacts to avoid such impacts, or do not authorize such activities to proceed, in line with UN General Assembly 2006 resolution 61/105, §§83 a–b (see footnote 7) [42]. This is clearly an ambitious undertaking and the non-RFMO areas in particular would benefit from international cooperation in which to take this work forward, perhaps in the form of a working group of international experts.
3. *Develop incentives and deterrents linked to codes of conduct.* Some scientific bodies, such as InterRidge and the German Marine Consortium, have developed codes of conduct for scientific research, that include the high seas, and OSPAR is currently drafting a scientific code of conduct for the deep and high seas of the Northeast Atlantic. These examples should be followed and expanded. Such codes of conduct should be linked to permissions regarding high seas activities and to funding provided to support such activities (whether operated by a vessel flagged under the laws of the nation, or by a private

citizen or public corporation, including the beneficial owners of vessels). Although an FAO Code of Conduct for responsible fisheries has existed since 1995, it has not been linked to fishing privileges or subsidies, and is largely ignored. Clearly, this needs to be addressed.

In addition to these priorities, there are three additional aspects that should be considered in the context of moving MSP forward in the management of the high seas. These include:

1. *The need to know versus the need to act.* In almost all decision-making, one must balance the need to know with the need to act. Put another way, this is accounting for scientific uncertainty, while also acknowledging the Precautionary Principle (that stipulates a lack of full scientific certainty should not postpone measures to avoid probable environmental threats). Enough is known to initiate high seas planning and conservation actions. Indeed, more is known about high seas features than is commonly acknowledged. That said, there remains a pressing need to pull this disparate information together through global data integration and cooperation.
2. *Technology.* High seas fishers have invested in the best available technology to locate and catch fish, such as satellite imaging, sea surface temperature, advanced sonar, weather faxes, and floating GPS beacons. This same technology can also be used to identify areas that should be protected, and to communicate this to the fishers and to other users.
3. *Delay.* Delay only benefits those who are ignoring their reciprocal duties, breaking the existing rules by flying flags of convenience or non-compliance, and are otherwise unaccountable, i.e., illegal, unreported and unregulated fishing (IUU). Allowing these “roving bandits” [43] to continue their practices is clearly harming high seas biodiversity, and in effect undermines the efforts of those states and participants in high seas activities who do follow the existing rules, and believe in behaving responsibly and sustainably, and who would very likely support the application of MSP in the high seas.

Acknowledgments

Thank you to Harlan Cohen for his review of an earlier manuscript. We would like to give special thanks to the Dutch Department of Nature, Ministry of Agriculture, Nature and Food Quality, for financial support for preparation of one of the key reports underpinning this article: *The Ecosystem Approach: Demystifying the Concept and its Application in the Marine Environment*, submitted by IUCN to the Seventh Meeting of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea, New York, New York, 12–16 June 2006. Jeff Ardron and Kristina Gjerde would like to thank the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, and the German Federal Agency for Nature Conservation, for supporting the IUCN Berlin Countdown 2010 workshop, 18–20 April 2007, out of which several of the paper's recommendations were first developed. Ardron also thanks to the German Federal Agency for Nature Conservation for supporting the research that produced Table 1. Gjerde wishes to thank the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, IUCN, the J.M. Kaplan Fund and the Pew Fellows Program in Marine Conservation of The Pew Charitable Trusts for supporting her research on high seas governance. Virginie Tilot wants to thank the governments of France, Italy and to the principality of Monaco, and in particular to the Secretariat of the international agreement on “Pelagos,” the

Sanctuary of marine mammals in the western Mediterranean sea. The opinions given herein belong solely to the authors and do not represent the views or policies of the organizations mentioned.

References

- [1] Willock A, Lack M. Follow the leader: learning from experience and best practice in Regional Fisheries Management Organizations. WWF International and TRAFFIC International, 2006.
- [2] Kimball L. The international legal regime of the high seas and the seabed beyond the limits of national jurisdiction and options for cooperation for the establishment of marine protected areas (MPAs) in marine areas beyond the limits of national jurisdiction. Technical series no. 19. Secretariat of the Convention on Biological Diversity, Montreal. Available at: <<http://www.biodiv.org/doc/publications/cbd-ts-19.pdf>>; 2005.
- [3] International Maritime Organization. International convention for the prevention of pollution from ships 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), Annexes I, II, IV and V. MARPOL (consolidated edition, 2006). London: IMO; 2006. ISBN 9789280142167.
- [4] Raaymakers S. The problem of marine debris-risks, regulation and the IMO regime. Asia Pacific Economic Cooperation Derelict Fishing Gear and Related Marine Debris Seminar, Honolulu, HI, 13–15 January 2004.
- [5] United States submission to the International Maritime Organization. Scientific Groups of the London Convention and Protocol. Planktos, Inc., Large-scale Ocean Iron Addition Projects, LC/SG 30/INF.28, 1 June 2007.
- [6] OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic. Decision 2007/1 to prohibit the storage of carbon dioxide streams in the water column or on the sea-bed.
- [7] OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic. Decision 2007/2 on the storage of carbon dioxide streams in geological formations.
- [8] International Maritime Organization. Scientific groups cautious over iron fertilization of the oceans to sequester CO₂. IMO Briefing, 13 July 2007. London: IMO; 2007.
- [9] UN Report of the Secretary-General A/61/63. UN General Assembly sixty-first session, 2006.
- [10] UN General Assembly. Sustainable fisheries, including through the 1995 agreement for the implementation of the provisions of the United Nations convention on the law of the sea of 10 December 1982 relating to the conservation and management of straddling fish stocks and highly migratory fish stocks, and related instruments. General Assembly resolution 61/05, 2006.
- [11] Ardron JA. Existing high seas spatial measures and proposals with relevance to high seas conservation. Report to the German Federal Agency for Nature Conservation, 2007.
- [12] Kimball L. The international legal regime of the high seas and the seabed beyond the limits of national jurisdiction and options for cooperation for the establishment of marine protected areas (MPAs) in marine areas beyond the limits of national jurisdiction. Technical series no. 19. Secretariat of the Convention on Biological Diversity, Montreal. Available at: <<http://www.biodiv.org/doc/publications/cbd-ts-19.pdf>>; 2005.
- [13] Roberts CM. Deep impact: the rising toll of fishing in the deep sea. *Trends in Ecology and Evolution* 2002;17:242–5.
- [14] Kurlansky M. Cod: a biography of the fish that changed the world. Vintage Canada edition, 1998.
- [15] Myers RA, Hutchings JA, Barrowman NJ. Why do fish stocks collapse? The example of cod in Atlantic Canada. *Ecological Applications* 1997;7(1):91–106.
- [16] Estes J, Demaster DP, Doak DF, Williams TM, Brownell RL, editors. Whales, whaling, and ocean ecosystems. London: University of California Press; 2006.
- [17] FAO. The state of world fisheries and aquaculture 2006. Fisheries and Aquaculture Department, Food and Agricultural Organization of the United Nations, Rome, 2007.
- [18] Letters by Murawski S, Methot R, Tromble G, Hilborn RW, Briggs JC. With response by Worm B, Barbier EB, Beaumont N, Duffy JE, Folke C, Halpern BS, Jackson JBC, Lotze HK, Micheli F, Palumbi SR, Sala E, Selkoe K, Stachowicz JJ, Watson R. Science commentary. Biodiversity loss in the ocean: how bad is it? *Science* 2007;316:1282–4. <http://myweb.dal.ca/bworm/Worm_et_al_2007a.pdf> [accessed 2.08.07].
- [19] FAO. The state of world highly migratory, straddling and other high seas fishery resources and associated species. FAO Fisheries Technical Paper 495. Adapted from Fig. 58. Fisheries and Aquaculture Department, Food and Agricultural Organization of the United Nations, Rome, 2006.
- [20] Koslow A. The silent deep: the history, ecology and conservation of the deep sea. Chicago: University of Chicago Press; 2007.
- [21] Roberts C. An unnatural history of the sea. Washington, DC: Shearwater Books, Island Press; 2007.
- [22] FAO. Report and documentation of the expert consultation on deep-sea fisheries in the high seas, Bangkok, Thailand, 21–23 November 2006. FAO Fisheries report no. 829, Rome, Italy, 2007 (advance copy), §10, emphasis.
- [23] FAO. Report and documentation of the expert consultation on deep-sea fisheries in the high seas, Bangkok, Thailand, 21–23 November 2006. FAO Fisheries report no. 829, Rome, Italy, 2007 (advance copy), §11, emphasis.

- [24] FAO. Report and documentation of the expert consultation on deep-sea fisheries in the high seas, Bangkok, Thailand, 21–23 November 2006. FAO Fisheries report no. 829, Rome, Italy, 2007 (advance copy), §110e, emphasis.
- [25] Gjerde KM, Kelleher G. High seas marine protected areas on the horizon: legal framework and recent progress. *Parks* 2005;15(3):11–8.
- [26] OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic. Guidelines for the identification and selection of marine protected areas. Adopted 27 June 2003, Bremen. Reference 2003/17: Annex 10, Appendix 1.
- [27] OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic. Guidelines for the identification and selection of marine protected areas. Adopted 27 June 2003, Bremen. Reference 2003/17: Annex 10, Appendix 2.
- [28] Antarctic Treaty System web site. <<http://www.ats.aq/>> [accessed 3.09.07].
- [29] Commission for the Conservation of Antarctic Marine Living Resources web site. <<http://www.ccamlr.org/put/E/cc/intro.htm>> [accessed 3.09.07].
- [30] Commission for the Conservation of Antarctic Marine Living Resources. Report of the twenty-fourth meeting of the commission, Hobart, CCAMLR-XXIV-2005, paragraph 4.14.
- [31] Norse EA, Crowder LB, Gjerde K, Hyrenbach D, Roberts C, Safina C, et al. Place-based ecosystem management in open ocean. In: Crowder L, Norse E, editors. *Marine conservation biology: the science of maintaining the sea's biodiversity*. Washington, DC: Island Press; 2005.
- [32] Norse E. Pelagic protected areas: the greatest park challenge of the 21st century. *Parks* 2006;15:33–40.
- [33] Alpine JE, Hobday AJ. Area requirements and pelagic protected areas: is size an impediment to implementation? *Marine and Freshwater Research* 2007; 58(6):558–69.
- [34] Hilborn R, Stokes K, Maguire J, Smith T, Botsford LW, Mangel M, et al. When can marine reserves improve fisheries management? *Ocean and Coastal Management* 2004;47:197–205.
- [35] Gubbay S. Marine protected areas and zoning in a system of marine spatial planning. A discussion paper for WWF-UK 2005.
- [36] Ehler C, Douvère F. Visions for a sea change. Report of the first international workshop on marine spatial planning. Paris: UNESCO Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides, 2007; 46: ICAM Dossier, 3.
- [37] Tilot V. Pelagos. The international sanctuary for Mediterranean marine mammals: a high seas Marine Protected Area based on an upwelling ecosystem. Communication at the first international workshop on marine spatial planning. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. Paris: UNESCO, 8–10 November 2006.
- [38] Le Hardy M. La protection des mammifères marins en Méditerranée. L'Accord créant le sanctuaire corso-liguro-provençal. *Revue de droit monégasque*, 2001. p. 95–139.
- [39] Scovazzi T. The Mediterranean marine mammals sanctuary. *The International Journal of Marine and Coastal Law* 2001;16(1):132–45.
- [40] IWC Conservation Committee. Pelagos sanctuary for marine mammals in the Mediterranean. Submitted by France in the name of the secretariat of Pelagos and the three parties of the agreement—Monaco, Italy, France. International Whaling Commission Conservation Committee, 2007. IWC/59/CC8, 27-04-07.
- [41] Tilot V. Plan de Gestion du Sanctuaire pour les mammifères marins en Méditerranée “Pelagos”. Version finale adoptée par la France, l'Italie et Monaco, 2004.
- [42] UN General Assembly. Sustainable fisheries, including through the 1995 Agreement for the implementation of the provisions of the United Nations convention on the law of the sea of 10 December 1982 relating to the conservation and management of straddling fish stocks and highly migratory fish stocks, and related instruments. General Assembly resolution 61/05, §83, 2006.
- [43] Berkes F, et al. Globalization, roving bandits, and marine resources. *Science* 2006;311:1557–8.