



Review

Review of potential legal frameworks for effective implementation and enforcement of MPAs in the high seas

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Marine protected areas (MPAs) were initially introduced to protect coastal zones and are increasingly being proposed as part of a solution to an integrated approach in managing the oceans. There is also pressure for the use of marine reserves to play a part in the conservation strategy and management of mobile demersal and pelagic species in the high seas. However, as there is no coastal State, all States are free to use the open seas, and the relative success of MPAs depends on whether or not measures can be imposed on both domestic and foreign vessels. Therefore, the question is whether current international and national legislation is sufficiently effective to implement a solution to aid the success of MPAs or if new legal norms need to be introduced to aid the governance of the high seas. The implementation of a surveillance programme of maritime spaces would help to establish the efficacy of any review of the current legislation. New technical developments being utilized in surveillance have opened up the possibility of exploiting technology with a view to surveying and monitoring planet earth in an objective manner. But technical applications employed to manage risks can themselves be dangerous, as they create new risks for the maritime sector (e.g. espionage). The maritime domain is a difficult and unpredictable environment in which to operate and, therefore, precludes the assured presence of human beings to perform monitoring tasks. Technology offers us the opportunity to overcome the physical difficulties by putting into practice surveillance using more effective methods. Identifying the appropriate technology and providing funding is a priority.

Keywords: marine protected areas, freedom of the high sea, international governance, regional fisheries management organizations, precautionary approach, surveillance system, satellite imagery, maritime data, automatic identification system, long-range identification and tracking, vessel monitoring system.

Introduction

On 20–22 June 2012, at the United Nations Conference on Sustainable Development in Rio, the states reaffirmed the importance of sustainable conservation and exploitation of marine biodiversity in zones located outside national jurisdictions (A/RES/66/288). The depletion of coastal resources is linked to the development of more advanced technologies; both the high seas and deep oceans are under increasing threat from human activities. The combined effects of overfishing, bycatch, habitat degradation, shipping, deep seabed mining,

scientific research and bioprospecting have resulted in IUU fishing (activities) being significantly impacted. Climate change may cause broad-scale and uncontrolled changes to temperature levels and (affect the) current systems that sustain life throughout the oceans.

Amongst the tools that could slow down, if not stop, the loss of biodiversity, marine protected areas (MPAs) have a major role to play (Game *et al.*, 2009). Originally introduced to aid the preservation of coastal waters, they are more frequently being proposed as a solution for an integrated approach to managing the oceans

(A/RES/67/78). If managed effectively, MPAs can maintain an ecosystem, preserve habitats and protect endangered species, whilst permitting use of sustainable resources. MPAs are a frequently discussed topic with regard to biodiversity conservation, and in its strategic plan for biodiversity, the participating members of the Convention on Biological Diversity (CBD) agreed that by 2020:

at least 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem service, must be conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas (CBD COP 10 decision X/2).

The United Nations General Assembly has also reviewed the question of MPAs on a number of occasions, whilst drawing up new resolutions. It created two fora in which the issue of MPAs in areas beyond national jurisdiction is regularly discussed. The first one is the United Nations open-ended informal consultative process on Oceans and the Law of the Sea created in 1999 by Resolution 54/33 in order to facilitate the annual review by the United Nations General Assembly. The second and more specific forum is the *Ad Hoc* Open-ended Informal Working Group created in 2004 by Resolution 59/24 to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction. This group has to date met on six occasions, and the work undertaken is of particular relevance for the issue of MPAs.

However, views on how and when to use MPAs and what they can achieve can be controversial because there is often a lack of clarity with regard to both objectives and processes. For example, spatial-temporal closures, of which MPAs are one category, have a long history in fisheries management (FAO, 2011). There are indeed, several definitions available: the term embraces a wide range of different management approaches from fully protected areas where no extraction is permitted to multiple-use areas where a range of resource uses are allowed (Delfour-Samama, 2013).

MPAs are therefore a flexible tool that can be developed for a variety of different objectives (Coutansais, 2009). Thus, they can be used as a key mechanism for promoting an integrated approach to ecosystem-based ocean management.

Probably the most widely accepted definition of an MPA has been established by the International Union for Conservation of Nature (IUCN), which states that it is:

a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

This definition by the IUCN (Dudley, 2008) implies that the conservation of biodiversity is the first objective of a protected area; Article 2 of the 1992 CBD describes an MPA as “a geographically defined area, which is designated or regulated and managed to achieve specific conservation objectives”.

Following this legal definition, conservation measures were adopted without establishing a distinction between the diverse maritime environments. In 1982, the United Nations Convention on the Law of the Sea (UNCLOS) addressed the use and conservation of ocean environments and its resources by dividing the maritime spaces into different zones: internal waters, territorial sea, exclusive economic zones (EEZs), the continental shelf and,

finally, marine areas beyond national jurisdiction which encompass the high seas.

According to Article 1 of UNCLOS, the Area is defined as “the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction”. The Area and its mineral resources, whether solid, liquid or gaseous, have a specific legal status defined by a declaration made in 1967 at the United Nations by the Maltese Ambassador Arvid Pardo. According to Article 136:

The Area and its resources are the common heritage of mankind” and “activities in the Area shall therefore be conducted out for the benefit of mankind as a whole. (Art. 140)

The organization known as the International Seabed Authority (ISA) has been created as the international body through which state members “organise and control activities in the Area, particularly with a view to administering the resources of the Area” (Art. 157-1). ISA’s mandate also includes the protection of the marine environment, and it has developed norms aimed at ensuring an “effective protection for the marine environment from harmful effects which may arise from such activities” (Art. 145).

The high seas are negatively defined:

all parts of the sea that are not included in the exclusive economic zone, in the territorial sea or in the internal waters of a State, or in the archipelagic waters of an archipelagic State.

The legal status of the high seas applies to zones beyond national jurisdiction but excludes the soil and the subsoil that are classified as the international seabed zone and ultimately the extended continental shelf. In Article 87 of the Convention, the regime guarantees the freedom of navigation, overflight, fishing and scientific research to be practised. However, this does not mean that there are no rules to be respected: the high seas are not a lawless zone, and freedom of all the other Member States to practise must be observed

with due regard for the interests of other States in their exercise of the freedom of the high seas, and also with due regard for the rights under this Convention with respect to activities in the Area (Art. 87-2),

which encompasses the regulation of biological resources conservation (Art. 116–119) and the general obligation to “protect and preserve the marine environment” (Art. 192).

Yet, UNCLOS obligations balance the “freedom of the high seas” with the shared obligation of all States to protect the oceans against the destruction of ecosystems and the collapse of shared fisheries.

Stating that the high seas are free means that a State cannot claim ownership of a particular area. On the high seas, the jurisdiction of a State is exercised through its personal and exclusive sovereignty over the ship flying that particular State’s flag: in this case the only rules that can be applied to a ship are the ones applicable to the flag State. As a result only the flag State is permitted to implement proceedings in respect of any violation of the rules it has ratified. Therefore, the status of freedom upon the high seas with regard to the consequence of flying any one particular State flag, with its exclusive set of rules, poses an obstacle to the implementation of international governance for which MPAs could be a tool. At present, no authority exists that is able to establish MPAs on the high seas and which would have the power to regulate access and use of an area for more than one purpose. This situation has been seen to be a major obstacle to the establishment of MPAs to protect valuable pelagic resources (Game *et al.*, 2009).

In international law, nothing prevents the States from adopting a self-restricted regime based on cooperative principles, e.g. an MPA established on the high seas. Many bodies have established the case for this at a universal level, e.g. the 1992 CBD, the 1979 Convention on the Conservation of Migratory Species of Wild Animals, and the 1946 Convention for the Regulation of Whaling.

Till now, these obligations have only been implemented at a regional level; in Antarctica (1980 Convention on the Conservation of Antarctic Marine Living Resources), in the Mediterranean Sea (1995 Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean), and in the Northeast Atlantic (1992 Convention for the Protection of the Marine Environment of the North-East Atlantic). As a result, no competent authority exists to enforce established conservation measures, which thus rely on the goodwill of the individual States. This is even truer for third States: a treaty does not create either obligations or rights for a third State without its consent, as stated in Article 34 of the Vienna Convention on the Law of Treaties.

It would appear to be necessary to define a legal framework of governance for the high seas for establishing the rights, responsibilities, options and restrictions applicable to all the affected stakeholders, as well as for providing the basis for protection and enforcement of rights and responsibilities. Ultimately, the success of an MPA being used as part of a management tool is reliant upon effective implementation of the various treaties.

The legal framework

In order to address new environmental challenges, the juridical framework of the high seas must change by adapting existing regulations or by adopting new rules.

Adaptation of existing regulations

Several international and regional organizations are already competent to establish sectoral MPAs. Amongst the existing institutions, the Regional Fisheries Management Organizations (RFMOs) could perform a major role in designating and managing MPAs for pelagic species. The question has been raised as to whether or not fisheries management measures taken by the RFMOs should be considered as MPAs. Many RFMOs have utilized MPAs in the form of “closed areas”, whereby all or certain fishing activities are prohibited (Druel, 2011). These no-take reserves have benefited fisheries through stock enhancement and management. By protecting important habitats and the function of their ecosystems, MPAs are able to fulfil a broader conservation goal and promote an integrated ecosystem for ocean management. Therefore, it should be noted that the RFMOs’ use of MPAs depends upon their objectives: they have been created to manage and protect fish resources and its habitat.

The New York Agreement, dated 4 August 1995, on Straddling Fish Stocks and Highly Migratory Fish Stocks establishes new conditions for the States to exercise their freedom to fish pelagic species in the high seas. The primary objective of this Agreement is to implement the basic jurisdictional framework of UNCLOS through a modernized and more elaborate and operational regulatory framework.

The Agreement requires all fishing States cooperate in the management of fish stocks through a regional fisheries organization, as stated in Article 8 (3):

Where a sub regional or regional fisheries management organization or arrangement has the competence to establish

conservation and management measures for particular straddling fish stocks or highly migratory fish stocks, States fishing for the stocks on the high seas and relevant coastal States shall give effect to their duty to co-operate by becoming members of such organization or participants in such arrangement, or by agreeing to apply the conservation and management measures established by such organization or arrangement.

Thus RFMOs become the primary vehicle for the conservation and management of straddling and highly migratory fish stocks. The denial to non-members of RFMOs to access to fishery resources pursuant to Article 8 (4):

Only those States which are members of such an organization or participants in such an arrangement, or which agree to apply the conservation and management measures established by such organization or arrangement, shall have access to the fishery resources to which those measures apply is another strategy to protect MPAs and fish stocks. The exploitation of biological resources on the high seas is, therefore, forbidden to all States that are not part of a regional plan. This measure is reinforced by Articles 21 and 22, which contain carefully defined exceptions to the primacy of flag State jurisdiction on the high seas by granting limited enforcement powers to the State other than the flag State for the purpose of ensuring compliance with RFMOs’ conservation and management measures (Art. 21–1). The enforcement measures can only be applied to a vessel flying the flag of a Party Member of the Fish Stock Agreement, whether or not it is a member of an RFMO. Becoming a member of the Fish Stocks Agreement implies a flag State’s consent to enforcement on the high seas by non-flag States, even though the flag State is not a member of the relevant RFMO (Molenaar, 2011).

This measure does not concern third States as they are simply encouraged to become Parties and eventually persuaded not to carry out activities that would undermine the effective implementation of the Agreement. Dissuasive measures taken by State Parties must be consistent with international law, as stated in Article 33:

1. States Parties shall encourage non-parties to this Agreement to become parties thereto and to adopt laws and regulations consistent with its provisions.
2. States Parties shall take measures consistent with this Agreement and international law to deter the activities of vessels flying the flag of non-parties which undermine the effective implementation of this Agreement.

This concerns trade sanctions, such as the ban of imported fish catches by vessels that do not respect the conservation measures in RFMOs member States (LeHardy, 2005). The International Commission for the Conservation of Atlantic Tunas (ICCAT) was one of the first RFMOs to recommend to its Contracting Parties the adoption of non-discriminatory restrictive trade measures in order to prevent third country longliners diminishing the effectiveness of the ICCAT conservation and management measures (recommendation by ICCAT Concerning Trade Measures, 2006-13).

It is worth considering development of the expertise of the RFMOs in the field of MPAs, and this would require some amendments in order to transform their capacity to create multi-purpose MPAs. Indeed, not all the RFMOs have overcome their

intergovernmental basis to achieve a real institutional dimension. Only a limited number of RFMOs are able to implement binding measures on members in areas beyond their national jurisdiction (Ros, 2010), and even then this is on the condition that a Member State has not made an objection within a set period of time. These include the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the General Fisheries Commission for the Mediterranean (GFCM), the Northwest Atlantic Fisheries Organization (NAFO), the Northeast Atlantic Fisheries Commission (NEAFC) and the South East Atlantic Fisheries Organization (SEAFO). Other RFMOs are being negotiated/created, such as the recently negotiated South Pacific Regional Fisheries Management Organization (SPRFMO) adopted 24 August 2012, and the Southern Indian Ocean Fisheries Agreement (SIOFA) adopted 21 June 2012.

The CCAMLR, established by the Canberra Convention of 20 May 1980 to conserve marine resources of the Austral Ocean and the Antarctic, is innovative on several levels, and resources exploitation is conditioned in respect of the ecosystem balance. Conservation measures adopted by consensus and based on the best available scientific data are imposed on Contracting Parties, providing they have not made an objection within the time limit (Article 6). On this basis, an MPA was established on the high seas in the South Orkney Islands in 2009. This is a first step towards the creation of a representative network of MPAs in the Convention zone. The mechanism developed is based on a series of bans concerning fishing activities, with the exception of those activities conducted for scientific purposes, the disposal of waste at sea, and transshipment activities involving fishing boats. The control of these bans in the protected zone relies only upon the goodwill of the States. Fishing boats passing through the zone are simply encouraged to inform the CCAMLR secretary of their passage before penetrating the zone by stating their flag State, their size, their registration number and their maritime route. RFMOs that regulate deep-sea fisheries have begun to protect benthic marine environments on the high seas by introducing closure periods during which the use of certain gears, particularly of bottom-contact ones, is banned. For example, the GFCM has prohibited trawling in areas deeper than 1000 m and has declared three closed areas to protect sensitive habitats. These prohibitions are related to the view that:

integration of environmental concerns in fisheries management is a way to protect the structure and functioning of the marine ecosystems that are in turn fundamental to the overall production of the seas, including the exploited resources (REC-GFCM 30/2006/3).

A fourth fisheries restricted area is located in the Gulf of Lions and has been declared under recommendation 33/2009/1 to protect spawning aggregations and deep-sea sensitive habitats.

In the face of this, the international community has reiterated the vital role of RFMOs and the need for them to strengthen and modernize, even if the damaging influence of illegal, unreported and unregulated (IUU) fishing in the high seas by countries remains a major challenge for pelagic MPAs (Game *et al.*, 2009).

Another international organization, the ISA, may have some proficiency in the environmental field in areas beyond national jurisdiction. The ISA was established to regulate deep seabed mining beyond the limits of national jurisdiction and to protect the marine environment from any harmful effects of mining activities,

including exploration (Article 145 UNCLOS). It is currently developing criteria for a “preservation reference zone” in relation to nodule mining. The Pacific Ocean Clarion–Clipperton Zone, where a preservation area is being considered as part of the overall design for an MPA for use by seamounts and abyssal nodule provinces, can demonstrate this. In this particular zone, it is proposed that no mining or exploration should be permitted, but the proposal only concerns activities led in the Area and not ones conducted in the water column above it. This is why some proposals aim to transpose the mineral resources regime applicable to the deep seabed to the biological resources of the high seas. Individual appropriation logic would be replaced by a collective appropriation regime: if they become common goods, or common heritage of mankind (like mineral resources of the deep seabed), biological resources could be managed by a single authority with an integrated approach. This authority would have the authority to designate MPAs and enforce conservation measures. The solution is far from reaching unanimity beyond the States and it requires a revision of UNCLOS in order to make the legislative changes. However, such a revision of the text is unlikely to be possible (Bissuel and Benoit, 2010).

In this instance, instead of making punctual changes, another option would be to redefine the global legal framework by adopting a third UNCLOS agreement.

Revision of the present legal framework

The overlap of different agreements and the multiple institutions in charge of marine biodiversity and fora on reflection make the legal framework difficult to understand. The absence of an international authority in charge of designating MPAs beyond national jurisdiction restricts regulation at present and the conservation of biodiversity remains on a regional scale.

An international convention that is capable of creating a mandate on the high seas and of stipulating the standards by which such areas can be identified, established and managed, may be better able to achieve the international goals of conservation and environmental protection (Proutière-Maulion, 2007). However, this requires a consensus on the contents of such an agreement. Modern concepts of international environmental law could act as the bases for certain regional conventions, such as the Protocol Concerning Specially Protected Areas And Biological Diversity in the Mediterranean (1995). Particular attention must be drawn to the approach stated by the Rio Declaration on Environment and Development (Principle 15):

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

This attitude, far from recommending inaction, allows the legal norm to provide an answer to the complexity and changing characteristics of natural resources. Indeed, precaution is not based on scientific knowledge but uncertainty (Lucchini, 1999). On 1 February 2011, the Seabed Disputes Chamber of the International Tribunal of the Law of the Sea (ITLOS) recognized in its advisory opinion on the responsibilities and obligations of States sponsoring persons and entities with respect to activities in the Area:

The Chamber observes that the precautionary approach has been incorporated into a growing number of international treaties and other instruments, many of which reflect the

formulation of Principle 15 of the Rio Declaration. In the view of the Chamber, this has initiated a trend towards making this approach part of customary international law. (§135)

The precautionary approach can therefore play a major role in defining the scientific criteria that should be used to decide the creation of a network of MPAs. In 2008, the CBD conference of the Parties adopted a scientific criteria (COP Decision IX/20, paragraph 14) for identifying ecologically or biologically significant marine areas in need of protection and established scientific guidelines for designing a standard network of MPAs. These scientific criteria have been designed to apply to areas beyond national jurisdiction, however, the criteria are to be applied to the scientific identification of ecologically and biologically sensitive areas (EBSAs) and do not include management considerations.

Principle 2 of the Rio Declaration declares,

States have... the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

This principle, whose customary value is now well stated, applies to all States, and may limit the relative effect of treaties. The new Protocol, if adopted, would not be an exception to the rule that states that conventions bind only the States that ratified it. However, this principle, combined with the general obligations relating to environmental protection as adopted by many international conventions, is able to reinforce the idea that States should be forbidden to engage in activities that may damage biodiversity. The States would also be unable to claim the principle of freedom of the seas without taking into consideration the interest of the other States and in that sense, the high seas would be available exclusively for uses that do not threaten other legitimate activities (Scovazzi, 1998).

Amongst these interests, environmental protection and more precisely that of marine biodiversity, is of prime importance. ITLOS, in its advisory opinion of 1 February 2011, includes *erga omnes* character in the obligations relating to the preservation of the high seas environment (§ 180), i.e. all States must conserve biodiversity, and this implies that, even if they do not participate in establishing conservation tools, they cannot deprive these latter of their effects.

The recommendations were conceived at a point in time when natural resources were still considered inexhaustible, and the freedoms stated in Article 87-1 of the 1982 Convention must be now interpreted in the light of the new environmental challenges (Henriksen, 2009). This is emphasized by Article 87-2 of UNCLOS: "These freedoms shall be exercised by all States with due regard for the interests of other States." Maintaining the resources of the high seas in a good state of conservation and the urgency of the situation should encourage the States to adopt a new UNCLOS agreement. A new agreement would replace the current regional accord and establish a basis to implement universal legal freedoms on the high seas to create MPAs. The debates that are currently taking place within the forum established by the General Assembly of the United Nations seem to be moving in this direction. At the intercessional workshop of the *Ad Hoc* Open-Ended Working Group held in New York, 19–23 August 2013, it was noted that a new global mechanism would be able to provide international support for areas in need of protection, and it could be complemented by measures adopted at the regional level without any further precision

to the content of any future Agreement (A/AC.276/6). Initially focused on issues of the legal management of marine genetic deep-sea resources, the working group agreed in 2011 to push for the establishment of an intergovernmental negotiating process which would address a "package" of issues including: the question of the sharing of benefits, and measures for area-based management tools to include MPAs, environmental impact assessments, capacity-building and the transfer of marine technology (Doc A/66/119).

In 2013, discussions continued within the framework of two intercessional workshops that took place 2–3 May 2013 (dealing with marine genetic resources) and on 6–7 May 2013 (focusing on conservation and management tools). The main value of the workshops served to provide information to negotiators on these two topics and also provided an opportunity for States to reaffirm some of their positions (Druel *et al.*, 2013), e.g. "the need for regional fisheries management organizations to be strengthened" could be achieved by

expanding their mandates with a view to applying ecosystem approaches, including biodiversity considerations, conducting performance reviews, sharing best practices and improving their monitoring and surveillance mandate.

States also recognized that, in this context,

lessons could be learned from the experience of the Commission on the Conservation of Antarctic Marine Living Resources, including its application of an ecosystem approach, the use of a common database and information system and 100 per cent observer coverage. (A/AC.276/6. e 1)

At the same time, reservations were expressed about the use of MPAs in areas beyond national jurisdiction, noting that the OSPAR Convention and other regional seas conventions did not have the authority under the UNCLOS, nor the legitimacy, to take measures in areas beyond national jurisdiction, such as the establishment of MPAs. In this context the exclusive rights of the ISA in the area was emphasized. The process initiated by the United Nations will most likely take some years to be able to deliver results, even if the adoption of an international instrument appears to be the only route to ensure the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction.

The next step will be to resolve the implementation and monitoring of such a system.

Apropos the surveillance system as a key component to ensure the MPAs' success

New technical developments have widened the field of objectives in surveillance of the earth: ecological remote sensing (Goward *et al.*, 1994) monitoring movements of animal populations (Bethke *et al.*, 1996) etc., and the general use of such technical methods requires adaptations to the existing legal framework. Nevertheless, technical innovations question the current legal framework concerning such intrusive activities. Managing risks and threats requires tools that provide remote monitoring of human activities at sea, and information sharing is the key to any system designed to alert and warn. The current innovative projects extend not only the scope of the monitored area but also the duration of surveillance, which could lead to misinformation about maritime surveillance activities. Real-time remote-sensing stations are projects with the aim of implementing global surveillance (Brown, 2008).

Maritime surveillance is defined as the systematic monitoring of maritime space, on the surface and underwater, by all technical means available to locate, identify and determine ship movements (Ince *et al.*, 2000). Techniques and technical expertise play a key role in this process. Most of the management and surveillance of human and economic flows rely on information literacy. The techniques employed for marine surveillance aim at securing spaces based on data collection, and new legal instruments like MPAs call for new technical capabilities. The following will consider, from a European perspective, the existing surveillance systems and the relevant and necessary legal framework that needs to be established in the context of expanding innovative techniques.

Review of current operational surveillance systems

Information is at the heart of systems designed to monitor maritime spaces, and data collection methods define the very nature of its content and use at an operational level. The communication systems currently in use are based upon data capture to identify ships, e.g. the automatic identification system (AIS) and the Vessel Monitoring System (VMS). Other data emission and capture systems do exist, such as Long-Range Identification Tracking (LRIT). However, these systems have technical and legal limitations. The technology associated with these is unable to provide high-resolution imagery or permanent observation, and, in this case, capture of AIS, VMS or LRIT emissions constitute the only operational systems at present. Legally speaking, these types of communication systems are not obligatory for all ships, and the use of satellite identification tools may be contrary to individual rights.

AIS and VMS emissions capture

While the AIS are governed by international norms, VMS is monitored by the European Union and specifically dedicated to EC Fisheries control (EC Council Regulation No. 1224/2009). The 1972 Convention on the International Regulations for Prevention of Collisions at Sea (COLREG) states that all available means must be employed in order to determine any risk of collision (Rule 7a). The letter and the spirit of this rule refers to current and future technical developments, such as the creation of the Electronic Chart Display and Information System, in accordance with IMO Resolution A817(19). COLREG led to the establishment of AISs without specifying the vessels concerned (Dujardin, 2004). Annexed to the 1974 SOLAS Convention, COLREG did not universalize the AIS “on the high seas and in all waters connected therewith navigable by seagoing vessels”. However, the SOLAS Convention (Chapter V, Reg. 19) states that

all ships of 300 gross tonnage and upwards engaged on international voyages and cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size shall be fitted with an automatic identification system (AIS).

Only ships with the above specification are obliged to respect the international direction to carry, operate and maintain an AIS. On recreational boats, yacht racers already make use of AIS: they tend to be widely used, not because of the influence of national or international standards but for safety interests (Sonnich, 2008). Some national legislation extends the category of ships concerned by selecting smaller overall lengths. AISs are also used to control fishing activities, in addition to VMS (Leboeuf, 2013).

EC satellite monitoring aims to determine the presence and activities of ships in distant maritime spaces/areas. In some countries like France, it widens the scope of maritime surveillance as established by international law: fishing boats, recreational boats, and more generally for boats as small as 12 m.

The European Satellite-based VMS was originally instituted by EC regulations 686/97 and 1489/97. EC Regulation 2371/2002 for the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy (CFP) stated “a fishing vessel shall have installed on board a functioning system which allows detection and identification of that vessel by remote monitoring systems”. This carrying and transmission requirement was first specified in EC Regulation 2244/2003, and it has been binding as of 1 January 2006 for all fishing boats exceeding 15 m overall length. The regulation does not concern vessels operating exclusively within the 12 nautical mile limit or those spending no more than 24 h at sea. It does not concern either fishing boats used exclusively for exploitation of aquaculture or those who operate exclusively inside the baselines of EU Member States.

These regulations are now embedded in the Community system for control, inspection and enforcement, as defined by (CE) No. 1224/2009 and strengthened surveillance measures (Leboeuf and Proutière-Maulion, 2013). Member States will have to set up a monitoring system aimed at locating fishing vessels flying any one Member State’s flag and enabling the latter to communicate to the Member State responsible for the fishing zone within which they are operating. The data is automatically transferred to the Fisheries Monitoring Centre (FMC) a minimum of once every 2 h, giving details of the identification of the vessel, its most recent geographical position, the date, time and speed, and also the route of the vessel. Member States can then verify that transmissions and receptions of data correlate and try to prevent manual malfunction. The confidential data secured by the system and monitored by the States provides a guarantee against fraudulent use and increases the crews’ confidence in the programme. It should be noted that captains are often not inclined to publicly reveal their fishing zones (Corbier, 2004).

AIS and VMS, when applied to surveillance of MPAs outside a jurisdiction zone, constitute an important legal constraint, especially with regard to transponder and transmitting data directives. Without the establishment of such obligations at an international level, a fragmentary system would lead to an inefficient result. It would create a privileged rule for vessels flying a third State’s flag and result in outflagging.

In addition, content, liability and traceability of data varies from system to system. While VMS presents undeniable safety guarantees, AIS has the advantage of a quasi-continuous monitoring function, and an ideal system would combine these two aspects. Furthermore, compulsory transmission of information would require the purchase of new equipment, and compensation measures should be offered to prevent a strong resistance from the fishing actors/industry. Moreover, a surveillance system based on satellite communication would require substantial funds. Alternative modes of data transmission and observation are being set up, and national navies have begun to use autonomous unmanned aerial and nautical vehicles.

The current state of satellite imagery in Europe

Remote-sensing satellites are generally sun-synchronous, and orbiting and polar satellites observe the Earth when exposed to sunlight. They are used for scientific purposes, e.g. to measure the thickness of pack ice, for military purposes, and for meteorology. As part of their

function these systems are capable of analysing weather routing/patterns and detecting marine pollution. Telecommunication satellites permit data transfer from one terrestrial point to another. AIS, LRT and VMS transit data through these types of satellites. The data permits the identification of vessels in transit by other vehicles or by any authorized maritime organization using AIS. Please note that not all vessels are obliged to transmit their position. Positioning and navigation satellites allow us to know the exact position of an object on earth, in the air or in space. The Global Positioning System (GPS) and GLONASS (Russian) are two examples of systems accessible for use by the general public. The Advanced Research and Global Observation Satellite system can locate markers to a precision of 150 m, and there are ~20 000 markers, the smallest of which weighs just 5 g. One use for the markers, e.g., would permit the tracking of fishing boats and their activities. The imaging CleanSeaNet system, established by the European Maritime Safety Agency (EMSA), helps to prevent and detect maritime pollution. EC coastal States have direct access to the interface and are able to orientate the operational function to record all the elements of the suspected offence. The combination of images and data issued by other systems, such as SafeSeaNet (a maritime traffic-monitoring system, based on AIS transmission, also developed by the EMSA), enables identification of vessels present in a suspected pollution zone. SafeSeaNet records hundreds of millions of AIS position transmissions per month and stores them in a database, and this system is interlinked with several international conventions dedicated to the prevention of pollution and maritime security.

Generally these observation methods concern the most frequented or high-risk maritime zones. From the geostationary orbit, we are able to monitor and observe closely the ocean's colour and view privileged fishing zones, but the resolution does not permit the detection and identification of vessels: ground resolution is limited to ~500 m; airborne vehicles or drones must then be dispatched to observe the activity of the vessel (anchored, fishing, transshipping, etc.). A working example is in South Korea: at present it utilizes the COMS (Communications, Oceanography and Meteorology Satellite) system developed by Astrium, a European technical leader in the field of satellite technology. However, some constraints prevent a permanent and continuous use of this satellite tool: the image resolution provided by this system requires an *in situ* recognition of the real ship activity. These techniques reduce the number of people necessary for a control and surveillance mission but do not replace them. After the analysis and interpretation of the data, the deployment of operational means (aircrafts, patrol boats, etc.) can be put in place. This maritime data is of high importance because it represents the actions of the people being monitored as well as those who are implementing the surveillance.

... to a necessary international legal framework of the MPAs' surveillance

Human intervention was originally the only means available to obtain maritime data, and today it is collected by technical resources that have now reached a sophisticated level of operation. The system's expanded capacity has increased on an operational level, thus allowing a greater area than previously to be monitored and permitting access to distant data. These technical applications have improved the efficiency of control over a wide range of human activities and resulted in modern technologies being recognized as an aid in the decision-making process. Structured as a warning system, maritime data is recorded in compliance with its regulation. Environmental case law shows a tendency towards the

evolution of the legal status of the evidence (Markowitz, 2002). The diagnostic function of technological tools gives an innovative dimension to maritime surveillance. Far from being the maritime equivalent of an automated traffic offence detection centre, these technical applications are capable of laying the foundations for an automated surveillance system, which in turn gives rise to interesting questions in law.

Maritime data

Maritime data must present all the information gathered, directly or indirectly, in relation to activities carried out in or on the sea (Leboeuf, 2011a). The data collected concerns both people and land-based companies, vessels, manning/monitoring services and meteorology. Collecting maritime data leads to analysis that is able to identify threats or risks at sea. Maritime authorities use a variety of different methods for identification: analysis of photographs and satellite images, evaluation of the suspect vessel's trajectory, radio calls or refusal to respond, flag enquiries, etc. (Proia, 2010). The assessment of any threat or risk is based on a combination of all available means to prove the reality of a suspected offence, and this includes personal data. Moreover, national legislations differ on the protection given to any particular data. In France, the IT and Freedoms National Commission (CNIL) is the data privacy regulator that authorizes personal data collection and its use by public or private entities, and it can impose sanctions in the case of misuse or unauthorized use of such data. The USA permits public authorities the potential to use this type of sensitive data. Across the world, personal data has, therefore, a variable level of protection because at present there is no international convention pertaining to personal data. The 1966 International Covenant on Economic, Social and Cultural Rights does protect private life in its Article 17, without mentioning personal data protection. Note that the UN adopted non-binding Guidelines for the Regulation of Computerised Personal Data Files (Resolution 45/95, 14 December, 1990). The establishment of a legal framework for the technical surveillance of MPAs should observe the general principles of these 1990 Guidelines, which constitute the lowest acceptable level of protection, even if some States do not have a proper data protection authority (Australia, Japan, Thailand, Morocco, Tunisia ...).

Data transit must be reliable, uninterrupted and secured. As for the examples given earlier, the security of AIS and VMS information or any other data is essential to the durability and efficiency of the system: operational and judicial authorities share access to the same data. In the context of the establishment of a surveillance system of MPAs, connections between the institutions and modules of data exchange should be legally structured. No international convention has yet dealt with international data exchange for the purpose of criminal investigation. An example of the exchange of information between law enforcement authorities is given by the EU Framework Decision 2006/960/JHA. However, it does not impose any obligation on authorities to gather information in response to a request from an authority in another Member State or to obtain information by means of coercive measures. Besides, there is no obligation to communicate information that is likely to be used as evidence before a judicial authority (Article 1.4).

On reviewing all the elements, one solution might be the creation of an international authority that collects data on the behalf of the State Parties to an MPA convention, which would clarify its role and functions. Regarding fishing controls, the public availability of VMS data would lead to commercial conflicts because there is a high risk of the conservation of stocks to be managed by financial

principles that would prevent an ecosystemic understanding of fishing. The status of the collected data should also be clarified/declared.

Using data to prosecute offenders

The adage *nulla poena sine lege* is one key principle of the different legal systems of the international society. No one should be sentenced for doing something that would not be legally prohibited. However, in the case of the protection of the MPAs, could jeopardy become an offence and, if so, under what conditions?

If an international legal regime on MPAs did exist, it should include the MPAs that are beyond jurisdiction. We have formed the hypothesis that one of the major issues is the legal value of satellite images and radar printouts i.e. of technical elements. No legal international framework can help to solve this matter. At the national level, the regulations are fragmented, deriving from jurisprudence. Tribunals are facing a recurrent question: can a technical proof, used to establish the reality of the facts, be the basis of the sanction (Leboeuf, 2012)?

To create a legal framework for MPAs on the high seas leads us to question the jurisdiction that would be capable of punishing violators of its provisions. Could the creation of a specialized court compensate for the fragmented application of the flag State law? The answer may be found in an analysis of the RFMOs. RFMO members can now forbid access to their ports or the landing of illegal captures. They can impose commercial sanctions or extend their jurisdiction to national shipowners that have transferred their vessels to operate under the flag of a third State. However, the RFMOs have no authority to impose sanctions because they still depend upon the application of the flag State law.

On this basis, the solution might be, once again, the elaboration of an international convention that provides for the creation of a judicial international court to plan surveillance mechanisms and to encourage State Parties to act in the interest of the MPAs.

Conclusion: relevant surveillance techniques and effectiveness through dissuasive sanctioning power

Implementing new technical surveillance arrangements has cost implications. It is possible to observe the ocean via commercial satellites that minimize the cost of observation, but at present that reduces security guarantees, which renders legal action impossible. Effectiveness is also dependent on the transmission of the vessel's position. Preservation of biodiversity would then be the origin of a technical norm that would be applicable worldwide.

The choice of techniques affects the collection of data, its very nature, the way it is used and its legal value (Leboeuf, 2011b). It also affects the qualification and the training required of the employees who are assuming the responsibility for monitoring human activities in and surrounding the MPA (Marcadon, 1998; Antin, 2009).

At present no international legal regime specifically dedicated to the protection of MPAs on the high seas exists. If a convention is established, all the members of the international society should adopt and respect the measures instituted. At this time could the environment provide an instrument that would provide universal jurisdiction. Given the new challenges presented by climate change and its inherent negative impacts on marine biodiversity, the future of MPAs might lie in creative solutions developed for the high seas. We can assume that pelagic MPAs have now come of age as an important tool in the planet's last frontier of conservation management (Game et al., 2009).

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