Marine Protected Areas Management Challenges

DAKAR
SENEGAL
4-8 December 2014

SUMMER SCHOOL

BOOK OF ABSTRACTS

Organizers: Yves Du Penhoat IRD-Benin, Werner Ekau ZMT-Germany, Paulino Fortes UNI-CV

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MARINE PROTECTED AREAS
MANAGEMENT CHALLENGES

Dakar, Senegal 4-8 December 2014

PROGRAM

TIME	Thursday, 4 December	Friday, 5 December	Saturday, 6 December	Sunday, 7 December	Monday, 8 December
8:00 am	Registration	In situ monitoring of a MPA the exemple of Bamboung 03/11 (Oumar Sadio, IRD)	Bus DAKAR - SOMONE	MPAs: analysis of potential socioeconomic effects (Heino Fock, TI)	Ecological Indicators to monitor MPAs (Modou Thiaw, ISRA/CRODT)
8:30 am					
9:00 am		Use of underwater acoustics in MPAs (Patrice Brehmer, IRD/CRODT)		Governing MPAs: adaptative capacity, robustness and the problems of scale (Philipp Gorris, ZMT)	Banc d'Arguin (Safiétiou Sall Ba, PRCM/IUCN)
9:30 am					
10:00 am	Coffee break	Coffee break	Welcome to the "Réserve naturelle d'intérêt communautaire de la Somone" (Amar Fall, Conservator of the reserve), followed by the visit to the reserve (LAND)	Coffee break	Coffee break
10:30 am	Introductory talk (Barbara Lassen, GIZ)	Assessment of MPAs efficiency in web using several approaches (D. Duval-Diop, Rampao)		Marine spatial planning and spatial modelling aproaches I (Henrike Rambo, TI)	Implementation of artificial habitats: inside or outside the marine protected areas? Insights from a mathematical approach (Timothée Brochier, IRD)
11:00 am					
11:30 am	Introductory talk (Papa Ndiaye, IFAN UCAD)	Governance of MPAs – from understanding to action (Barbara Lassen, GIZ)		Marine spatial planning and spatial modelling aproaches II (Xochitl Cormon, IFREMER)	The Giant MPA (David Kaplan, VIMS)
12:00 pm					
12:30 pm	Lunch	Lunch	Lunch	Lunch	Lunch
1:00 pm					
1:30 pm					
2:00 pm	Management of aquatic ecosystems: MPAs based approach (Justin Kantoussan, UGB)	(Work Group) (Barbara Lassen, GIZ)	Visit to the reserve (SEE), folowed by a conversation session with the conservator	(Work Group) (H. Fock, TI+P. Gorris, ZMT)	Rap up discussion (Heino Fock, TI + P. Gorris, ZMT)
2:30 pm					
3:00 pm					
3:30 pm	Coffee break	Coffee break		Coffee break	Coffee break
4:00 pm	Round Table: MPA planning and the meta-population concept / MPAs: An Introduction to Governance (H. Fock, TI+P. Gorris, ZMT)	(Work Group) (Barbara Lassen, GIZ)		(Work Group) (Henrike Rambo, TI+ Xochitl Cormon, IFREMER)	Conclusions
4:30 pm					
5:00 pm			Bus SOMONE - DAKAR		
5:30 pm					
6:00 pm	Ice breaker	Dinner	Dinner	Dinner	Farwell dinner

AWA Summer School

Marine Protected Areas — Management Challenges

INTRODUCTION

AWA is a cooperative integrated research project including collaboration between Germany, France and West African countries. The project has three major lines of action:

(i) Improvement of fisheries management
(ii) Understanding the effects of global change and particularly climate change on marine living resources
(iii) Training of West African scientists to continue AWA work in their institutions.

All West African scientific communities are asking for better training and educational oceanography programmes. This event contributes to the capacity-building strategies as devised in the project, as well as for strategic partnerships between institutions and universities in the sub-region of West Africa.

The main objectives of this Summer School are:

- Understand the nature of MPAs, their history and origins, their global patterns and issues
- Recognise and appreciate the importance of socio-political issues relevant to management and conservation goals
- To gain familiarity with current theory of, and controversies associated with, management of marine wildlife
- Understand the historical perspective of processes threatening marine wildlife
- Comprehend the application of relevant field techniques
- Develop competency in marine reserve design
- Analyse the types and scales of threatening processes and how their effects are measured

ABSTRACTS

Governance of MPAs – from understanding to action: The IUCN guidelines on protected area governance and their relevance for marine and coastal environments

Barbara LASSEN

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The session will consist of inputs and short interactive group exercises.
It will aim to introduce basic concepts of PA governance, specific challenges in MPAs, the IUCN guidelines, and the steps to conduct PA governance assessments.
Participants will explore the concepts by applying them to their own examples and discuss how PA governance assessments can be conducted in marine and coastal environments.

Inputs:

- PA governance: basic concepts (definition, actors, levels, diversity, quality)
- Differences between governance in terrestrial and marine PAs
- Governance diversity: the four IUCN categories of PA governance and the IUCN matrix
- Governance Quality
- Brief overview of the steps for PA governance assessments

Group exercises and discussions:

- Identifying and sharing governance challenges in MPA examples familiar to the participants
- Situating the examples in the IUCN Matrix and the Governance Continuum
- How appropriate are the steps of the IUCN PA governance assessments in the marine environment? Would they need to be adapted and how?

La situation de la pêche sénégalaise et perspectives.

Papa NDIAYE

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Introductory talk.

Management of aquatic ecosystems: MPAs based approach

Justin Kantoussan

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The aquatic ecosystems throughout the world are now subject to natural (climate variability) and artificial (e.g. fishing pressure, pollution, etc.) constraints that affect their functioning, and act as forces that structure the ecosystem communities. Face to the great degradation and the complexity of the aquatic areas, the ecosystem approach management is preferred to achieve a good environmental status and preserves the values and services provided by ecosystems. In this context, the use of marine protected areas (MPAs) has taken on greater importance as management option for conservation of the natural heritage, cultural heritage and sustainable production. The studies carried out on the evaluation of the efficiency of the MPAs as useful tool for ecosystems management some showed positive effects with an increase of the fish population's mean trophic level, mean size, biomass and larger size spectrum with the increasing of maximum observed length, etc. However, the researches on the MPAs have to specify the conditions for efficient MPAs in the restoration and/or protection of the ecosystems.

Use of underwater acoustics in Marine Protected Areas

Patrice BREHMER

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The presentation reviews a broad range of material from a wide range of established scientists in the fisheries acoustics community. It is a timely and indispensable tool for fisheries scientist and manager dealing with Marine Protected Area (MPA), which needs efficient and standardized procedures for fish sampling. Today, fisheries acoustics is a central discipline for *in situ* observations of aquatic organisms extending from plankton to whales. Acoustic methods are needed for stock assessment exercises and for behavioural studies, starting from freshwater rivers and extending to the open ocean, including inland lakes and estuaries. Present uses of fisheries acoustics are not only directed at assessment methods, but also at ecological and management studies. The main advantage of acoustics is that it provides for the possibility of collecting information either in an instant or over an extended period, with observations being at all scales from mm to km; for example, from fish to schools at the 'micro-scale', school to a cluster of schools at the 'meso-scale' and clusters to populations at the 'macro-scale'. Observations can be made independently of intrusive fishing operations and are not constrained by the limits of visual observation methods. In fisheries science, whether the approach is at the ecosystem level or is just dealing with individual populations using classical models, fisheries acoustics methods are crucial for an accurate validation of some key parameters for MPA management. It should also be born in mind that the observation of marine organisms remains particularly difficult in comparison to aerial or terrestrial animals. Fisheries acoustics is thus very welcome to be used in MPA (non lethal technique). The techniques and methods of measurement have quickly evolved during the last decades. Formerly, analyses of acoustics data were limited to specialists and required a long time for processing. The developments in personal computers have increased capabilities in all domains such as in central unit processors, virtual memory, as well as in signal and image analysis. These developments now allow data collection, treatment and analysis using adapted software as a real possibility even to the non-specialists. Electronic tagging and tracking techniques of individual macro aquatic organism will be very quickly aborded, reflecting the regrettable 'separation' between the two scientific communities.

Adapated in 2014, for the AWA Summer school on MPA, from: Patrice Brehmer. 2006. "Fisheries Acoustics: Theory and Practice, 2nd edn". FISH and FISHERIES, 7, 227–228.

Implementation of artificial habitats: inside or outside the marine protected areas? Insights from a mathematical approach

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[5]Ministry of the Marine Economy and Fisheries - Ministère de l'économie maritime et des pêches, Direction des Pêches Maritimes (DPM), Dakar, Senegal
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At the world scale, many exploited species are currently threatened or undermined by human activities, particularly fishing. Given this situation, establishing Artificial Habitats (AHs) and Marine Protected Areas (MPAs) is seen as a way of both conserving biodiversity and managing fishing activities. AHs have two main effects: (1) they attract fish from the surrounding areas and concentrate them in the AH, and (2) they increase the capacity of the environment, as a result of the installation of new individuals or, in some cases, of new species. MPAs decrease fish accessibility by constraining the spatial distribution of the fishing effort. We have developed a system of ordinary differential equations (ODEs) that can be used to describe the evolution of fish density, fishing effort, and landings depending on whether AHs are deployed in a MPA or in a fishing area. The analytical study of the ODE system is simplified by means of assuming that processes occur on different time scales. Fish reproduction and landings were assumed to occur at a "slow" time scale, whereas fish displacement was assumed to occur at a "fast" time scale. For both scenarios of AHs implementation (in an MPA or in a fishing area), we show the existence of different equilibria according to hypotheses based on a purely attractive or purely productive effect of the AH. In all cases, the deployment of AHs in the fishing area leads to an equilibrium with lower fish biomass and lower fish landings than when AHs are deployed within the MPA. This suggests that AHs should not be fished in order to maximise long term fish productivity and fish landings in the surrounding areas. In addition, we attempt to establish a correspondence between our theoretical results and the management plan for artisanal fisheries on the Senegalese coast, which includes the implementation of both AHs and MPAs. This suggests that there is not enough coordination between the non-governmental organizations deploying the AHs and the institutions managing MPAs. Indeed, AHs are usually either immersed in an MPA or subject to local fishing ban, but in fact regulation is inadequate. In this context, the deployment of AHs as part of fisheries management would be premature and could have potentially adverse effects on the resource.

Potential socioeconomic effects in the implementation of MPAs

Heino O. FOCK

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Two general aspects are highlighted based on evidence from European and North American MPA examples: (1) changes in the spatial distribution of fishing, and (2) technical regulations affecting fleet structure in certain areas. Changes in fishing patterns lead to a displacement of effort into areas that were formerly less fished. Economic and ecological consequences of displacement are analysed. Specifying technical regulations for local fleets leads to constraints in technological development that may change the structure of a fleet in way that it is not competitive in markets outside the protected area. This has strong implications with regards to changes in MPA management. Data needs on fisheries distribution and fleet structure, methodological approaches to map and analyse displacement, and technological implications are shown.

Further reading:

Bastardie F, Nielsen JR, Eigaard RO, Fock HO, Jonsson P, Bartolino V (2014) Competition for marine space: modelling the Baltic Sea fisheries and effort displacement under spatial restrictions. ICES J Mar Sci in press

Beare D, Rijnsdorp AD, Blaesberg M, Damm U, Egekvist J, Fock HO, Kloppmann M, Röckmann C, Schröder A, Schulze T, Tulp I, Ulrich C, Hal Rv, Kooten Tv, Verweij M (2013) Evaluating the effect of fisheries closures: Lessons learnt from the Plaice Box. Netherlands Journal of Sea Research 84:49-60

Berkenhagen J, Döring R, Fock HO, Kloppmann MHF, Pedersen SA, Schulze T (2010) Decision bias in marine spatial planning of offshore wind farms: Problems of singular versus cumulative assessments of economic impacts on fisheries. Mar Policy 34:733-736

Pedersen SA, Fock HO, Sell AF (2009) Mapping fisheries in the German exclusive economic zone with special reference to offshore Natura 2000 sites. Mar Policy 33:571-590

MPA planning and the meta-population concept

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Connectivity between sites with viable sub-populations by means of dispersal of specimens during their migratory stage is a key process to sustain protected populations in designated MPA sites. Migratory processes for closely connected sites as well as for remote sites (i.e. seamounts) are compared. The use of tagging studies to derive key parameters for conservation will be shown, and 2 modelling approaches are introduced.

Further reading

Fock, H. O. & Zidowitz, H. Episodic recruitment to seamount populations: Evidence from Zenopsis conchifer (Lowe, 1852) at the Great Meteor Seamount (subtropical North-east Atlantic). Archive for Fishery and Marine Research 51, 287-293 (2004).

Munroe, D. M., Klinck, J. M., Hofmann, E. E. & Powell, E. N. A modelling study of the role of marine protected areas in metapopulation genetic connectivity in Delaware Bay oysters. Aquatic Conservation: Marine and Freshwater Ecosystems 24, 645-666 (2014).

Fock, H. O., Probst, W. N. & Schaber, M. Patterns of extirpation. II. The role of connectivity in the decline and recovery of elasmobranch populations in the German Bight as inferred from survey data. Endangered Species Research 25, 209-223 (2014).

Marine Protected Areas: An Introduction to Governance

Philipp GORRIS

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Presentation at Round Table on 4th of December 2014

Duration: ca. 15 min

This introductory talk deals with MPAs from a social science perspective and briefly elaborates basic concepts and approaches related to governance.

It was generally believed for centuries that the resources of the oceans are inexhaustible and can be seen as a stable source of food for humans. Today, marine ecosystems in many regions of the world show alarming signs of degradation and fish stocks all over the world are heavily depleted. Marine Protected Areas (MPAs) are perceived to provide an institutional solution for sustainable marine resource management. The many of these areas, however, are indeed officially protected but not managed effectively and provide only very little contribution to the protection and recovery of marine resources.

This presentation addresses the question why the implementation of MPAs may be difficult and why so many of them result in so-called “paper parks”. Drawing from recent theories on governing natural resources, participants will be given a brief overview of the common-pool resource concept and get introduced to governance approaches. Hereby, this talk seeks to provide the participants with an introduction to governing MPAs as an institutional arrangement for governing common-pool resources in order to set the stage for further discussions during the round table.

Governing marine protected areas: adaptive capacity, robustness and the problem of scale

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Talk on 7th of December 2014

Duration: 60 min

This presentation centers on the problem of scale-mismatches for governing MPAs and examines possibilities and constraints for robust and adaptive governance on a regional scale. MPAs frequently suffer from mismatches of scale and integrating larger marine territories into spatial planning and governance has been strongly promoted over the past decade. Yet, approaching governance at larger scales poses new organizational challenges. A particular challenge of MPA governance is that it requires rapid responses in context of complexity, diversity and unpredictable multi-scale dynamics, and at same time it needs to be robust. This constitutes the need to connect multiple stakeholders into a robust network that is capable of continuously generating appropriate social-ecological knowledge and of facilitating its accumulation at certain interfaces and decision-making bodies. This provides for the incorporation of social-ecological feedbacks into environmental governance systems to arrive at timely and informed management decisions.

The thematic talk is structured into two parts. In a first step, the problem of scale-mismatches will be elaborated together with the participants. Subsequently, two governance networks in Brazil and in Indonesia are presented and their strengths and weaknesses in context of robustness and adaptive capacity discussed. A particular focus is given to the relations among governance actors, how relations are structured into an overall network and how actors are positioned within networks. Hereby, this thematic talk seeks to improve the participants understanding of the problem of scale-mismatches for MPA governance and elaborates opportunities on how to address this challenge.

Marine spatial planning and spatial modelling approaches

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Since the World Summit of Sustainable Development in Johannesburg (2002) and its implementation plan calling nations to manage and conserve important marine areas, the use of Marine Protected Areas (MPAs) is on the top of the international agenda. However, in order to choose the area to be protected, it is necessary from an ecological standpoint to define the MPA's management objective, whether it is conservation of biodiversity, management of single species, specific life-stages, etc., and to understand their spatial distribution and dynamics. Spatial modelling techniques are of great use in these matters as they allow to map present distributions but also to predict future distributions depending on different environmental variables, e.g. temperature. In spatial fisheries ecology, there are two main modelling approaches: geostatistics and regression techniques, which can be combined. In this course, we will give an overview of these two approaches, compare their advantages and drawbacks and discuss their respective technical and/or statistical constraints,. We will finish the theoretical part with a discussion about the common issues related to marine spatial modelling with a focus on spatial autocorrelation challenges. The second part of this lecture will allow the application of the theory by using R and ArcGIS going through minimalistic examples and to discuss prospects for the students in their use of these techniques.
Keywords: spatial distribution modelling, geostatistics, regression techniques

Lecture 1, 07.12.14

- Brief introduction to different spatial management approaches such as marine spatial planning (MSP), with MPAs as key tool to conserve and facilitate conservation and sustainable management
    - Information needs for different objectives (e.g. to manage stocks, conserve biodiversity)
    - Importance of reserve design of MPAs
    - Need to know the distribution of (fish) species of interest, spatial modelling approaches to predict their distribution/ essential habitat to produce maps as information for decision making
- Brief and simple introduction to spatial modelling approaches
    - Presentation of different methods e.g. spatial regression approaches and geostatistics /different interpolation techniques and Eigenvector analysis
    - Statistical and technical constraints, pros and cons of presented methods

- Common issues and how to handle them (with focus on spatial autocorrelation), minimum data needs, issues of scale

Lecture 2, 07.12.14

- Brief recap from former lecture
- Introduction minimal scripts showing the steps to realise a spatial model to using R and GIS for spatial distribution modelling
    - Interactive course work using R/GIS, with very simple R code as example or GIS spatial analyst to interpolate data from the North Sea as example, showing output of work, maps in Arc GIS
    - Possibility to discuss participants own data, Q&A

Expertise

- Generalised linear models and eigenvector methods (Xochitl)
- Regression techniques (e.g. generalised additive models), regression and universal kriging (Henrike)

Ecological Indicators to monitor MPAs

Modou THIAW

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The Marine Protected Areas (MPAs) as a tool for fisheries management are often seen as a means to protect the exploited resources or increase incomes of fishermen and associated communities, when fishing pressure is high. MPAs are thus an important tool to protect habitats for reproduction and growth of the fish and shrimps juveniles. These areas can play a key role in the conservation of biodiversity of the ecosystems. Their effectiveness to fishery purposes is based on the following assumptions: effects within the MPA, effects outside the MPA ("Spillover") and effects to the ecosystem scale.

In West Africa, coastal ecosystems undergo both global changes and local anthropogenic pressures. The high exploitation of living resources, and other anthropogenic pressures especially in coastal areas, alters the biodiversity and ecosystem functioning and threaten the sustainability of their ecosystem services. This led to an ecosystem approach to the management of stocks and marine and coastal ecosystems. This approach attempts to take into account the human impact on all compartments of the ecosystem. The results show that some ecosystems may have dynamic collapse, resistance or resilience according the intensity and duration of resources exploitation.

The training allows participants to (i) improve their knowledge on coastal ecosystems and population dynamics of exploited resources and (ii) to understand the tools for analyzing the impact of anthropogenic pressures and methods of assessing the impact of management measures. For this, a set of ecological indicators and biodiversity and conservation-based indicators will be reviewed by providing details of their definition, the data required for their calculations, and their interest. This multidisciplinary training aims to train professionals and students for the development of responsible fisheries and integrated management of coastal zones and aquatic ecosystems.

Key words: Marine ecology, ecosystem approach to fisheries, food webs and ecological indicators

The Giant MPA

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Large Marine protected areas (MPAs) are increasingly being used for conservation of mobile pelagic and demersal species. Among the propositions for improving the status of these species with spatial management are large, offshore MPAs and "dynamic" MPAs that follow fish around for part or all of their life-cycle. For these and other proposed strategies for applying spatial management to pelagic and demersal species, issues surrounding mobility (fish, fisher or MPA) are central to assessing MPA efficacy and designing a successful MPA network for the global ocean. Due to the innovative nature of these type of MPAs, there are currently relatively few theoretical or empirical studies specifically directed at them. Nevertheless, existing MPA literature can be used to draw numerous basic lessons on how offshore and mobile MPAs are likely to impact marine ecosystems. For example, existing literature on diffusive movements and MPAs, fisher behavior after MPA creation, efficacy of MPAs for specific types of fish movement (e.g., spawning migrations), and detailed movement studies for some species can all be leveraged to understand how mobile and offshore MPAs are likely to function. In this presentation, I first provide an overall presentation of history and trends in the use of MPAs for mobile species, before launching into the theoretical underpinnings of our understanding of how MPAs for mobile species are likely to function and then ending up with several case studies that provide real-world insight into the value of offshore MPAs.

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