



Commission Sous-Régionale des Pêches
Sub-Regional Fisheries Commission



International Conference ICAWA 2016

Extended book of Abstract

THE AWA PROJECT
Ecosystem Approach
to the management
of fisheries and the
marine environment
in West African waters

Cap-Vert

Mauritanie

Sénégal

Gambie

Guinée BISSAU

Guinée

Sierra Leone

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Trilateral German-French-African research initiative

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The AWA project

« Ecosystem Approach to the management of fisheries and the marine environment in the **West African Waters** »



Build the Foundation of a West African observatory

Create a sub-regional task force on the ecosystem approach to the management of fisheries and the marine environment in the West African Waters under the effect of climate change

PREFACE

The three prefaces of the ICAWA 2016 book of abstract are taken from the opening address of the international conference ICAWA 2016.

Les trois préfaces de cet ouvrage sont extraits des discours d'ouverture de la conférence internationale ICAWA 2016.



ICAWA 2016 participants (Belgium, Benin, Brasil, Cabo Verde, Canada, Cameroun, Chile, Espagne, France, Germany, Guinea, Guinea Bissau, Ivory Coast, Japan, Mauritania, Morocco, Netherland, Norway, Senegal, Sierra Leone, Swiss and The Gambia), December 2016, Hotel les Almadies VACAP, Dakar, Senegal.



S.E. Omar GUEYE,
Minister of Fisheries
and Marine Economy

Monsieur le Représentant Résident de l'IRD au Sénégal ; Madame le Représentant de l'Ambassadeur d'Allemagne au Sénégal ; Monsieur le Représentant de l'Ambassadeur de France au Sénégal ; Mesdames, Messieurs les Représentants les Ambassadeurs des Etats membres de la Commission Sous-Régionale des Pêches ; Madame le Secrétaire Permanent par intérim de la Commission Sous-Régionale des Pêches ; Mesdames, Messieurs les Directeurs Généraux et Directeurs ; Mesdames, Messieurs les Représentants des institutions de recherche ; Mesdames, Messieurs les Partenaires techniques et financiers ; Honorables invités en vos rangs et qualités respectifs;

Mesdames et Messieurs,

C'est pour moi un grand plaisir de présider pour la deuxième année consécutive, en ma qualité de Ministre de la Pêche et de l'Economie maritime, cette importante conférence que le Gouvernement de la République du Sénégal a l'immense plaisir d'accueillir en terre sénégalaise de la Téranga.

Je voudrais au nom de Son Excellence, **Monsieur Macky SALL, Président de la République, de Monsieur le Premier Ministre Mahammad Boun Abdallah DIONNE**, de l'ensemble des membres du Gouvernement et à mon nom propre souhaiter la bienvenue à nos chers invités.

Ces mots de bienvenue s'adressent également aux Représentants des Partenaires techniques et financiers et aux nombreux Experts régionaux et internationaux qui nous ont honorés par leur participation à cette seconde conférence scientifique internationale.

Je me réjouis particulièrement de la tenue de cette conférence dont j'apprécie à sa juste valeur la pertinence des objectifs visés et le rôle que nos pays et leurs partenaires devraient jouer pour contribuer à la mise en place des bases scientifiques nécessaires pour une gestion durable des pêches et de l'environnement marin en Afrique de l'Ouest.

Les États africains de la façade Atlantique doivent relever de nombreux défis, notamment la gestion des ressources halieutiques face à la raréfaction de celles-ci et à de rapides changements hydro-climatiques. Les conséquences de ces deux phénomènes sur les ressources halieutiques et l'environnement marins sont au cœur des débats entre les gestionnaires et les chercheurs de la sous-région.

A cet effet, je note avec satisfaction que ces préoccupations sont prises en considération par le projet tripartite « **Approche écosystémique de la gestion des pêches et de l'environnement marin dans les eaux ouest-africaines - AWA** » dont la présente conférence permet le partage successifs des résultats et d'ouvrir d'intéressantes perspectives pour le Sénégal et toute la sous-région.

Pour ma part, il me plait de relever la participation effective à la Conférence d'Experts régionaux et internationaux compétents dans des domaines multidisciplinaires à travers la présence d'halieutes, d'écologistes, de bio-géochimistes, d'océanographes physiciens, de socio-économistes et de climatologues. Assurément, cette diversité des experts devrait nous permettre de poser très prochainement les bases d'un observatoire pour la surveillance, la simulation et la prévision des paramètres clés qui influent sur la dynamique et l'organisation des écosystèmes, afin de mieux appréhender les effets sur les ressources marines et de leurs habitats dans notre région.

Je profite de l'opportunité qui m'est offerte aujourd'hui dans le cadre du projet « **Approche écosystémique de la gestion des pêches et de l'environnement marin dans les eaux ouest-africaines - AWA** », pour remercier chaleureusement l'ensemble des partenaires techniques et financiers pour leur soutien à l'organisation de cet important évènement. Je veux nommer la GIZ, le GEOMAR, l'IUEM, le SCOR, le TI-HAMBURG et la ZMT aux cotés du Ministère Français de l'Enseignement Supérieur, le Ministère Français des Affaires Etrangères et Européennes et le Ministère Allemand de l'Education et de la Recherche pour leur appui financier.

Permettez-moi enfin, de saisir cette occasion pour inviter tous les Partenaires à continuer à appuyer techniquement et financièrement les initiatives de recherche dans notre sous-région et d'accompagner la CSRP dans ses efforts de renforcement de capacités de nos Etats membres.

Je reste persuadé que les conclusions de cette Conférence, les échanges et les recommandations qui en découleront, seront des jalons importants dans l'atteinte des objectifs stratégiques de la CSRP.

Je ne saurai terminer mon propos sans souligner l'intérêt particulier que **Son Excellence, Monsieur Macky SALL, Président de la République** accorde au secteur de la pêche d'une manière générale, intérêt qui a valu d'être inscrit parmi les axes stratégique et prioritaire du plan Sénégal Emergent (PSE).

A ce titre, il me plait de vous transmettre le message de soutien de **Son Excellence, Monsieur Macky SALL, Président de la République et de l'ensemble du Gouvernement du Sénégal** qui demeurent très attentifs au renforcement des mécanismes qui permettront d'atteindre une bonne gouvernance de la gestion des pêches en Afrique de l'Ouest.

En Souhaitant un plein succès à vos travaux, je déclare ouverte la Conférence Internationale ICWA 2015.

S.E. Omar GUEYE,
Minister of Fisheries
and Marine Economy



Mr. Pierre-Yves BERTRAND

Conseiller régional développement durable (Afrique de l'Ouest)
Représentant de l'Ambassadeur de France

M. le Directeur des pêches maritimes, représentant le Ministre des pêches et de l'économie maritime, Mme la Secrétaire permanente de la Commission sous-régionale des pêches, Mme la représentante de la GIZ – Ambassade d'Allemagne, M. le représentant régional de l'IRD.

J'ai eu la chance d'assister aux deux précédentes éditions de la Conférence ICAWA, et de suivre ainsi, année après année, les avancées du programme AWA, sur l'approche écosystémique de la gestion des pêches et de l'environnement marin dans les eaux ouest-africaines.

J'avais eu l'occasion de prendre conscience du caractère multidimensionnel du secteur : enjeux socio-économiques, de sécurité alimentaire, enjeux nutritionnels et environnementaux ; et, du coup, de saluer la multidisciplinarité qui caractérise le projet, en tâchant de répondre à cette complexité des enjeux.

Depuis deux ans toutefois, un fil conducteur est venu le structurer, marquant en fait l'ensemble de la recherche pour le développement : celui du changement climatique, qui était depuis longtemps une préoccupation des chercheurs, mais qui – il faut le reconnaître – n'a vraiment fait l'objet d'une prise de conscience dans le monde des décideurs que depuis la signature de l'accord de Paris.

Je vois que la présente conférence a été labellisée CoP22, comme la précédente édition l'avait été pour la CoP21.

Les deux dernières CoP climat ont en effet porté un accent particulier sur la question des océans. Les pays représentés dans cette salle, en particulier, n'ont pas ménagé leurs efforts pour que l'océan soit considéré comme un élément-clé de la problématique du changement climatique : pouvant à la fois influencer sur les **causes** du changement et en subissant également les **effets**, notamment sur sa biodiversité et donc sur ses ressources halieutiques.

La France s'est efforcée de mettre les océans au centre de la COP21 qu'elle présidait et elle a poursuivi ce soutien à Marrakech :

- Déclaration "*Because the Ocean*" (à laquelle la France et le Sénégal ont participé)
- Soutien à la création d'une Alliance des initiatives Océan & Climat

- Coalition sur l'interdiction des sacs plastiques
- Plaidoyer pour l'élaboration d'un rapport spécial du GIEC sur les océans
- Réduction des émissions de GES dans le secteur des transports maritimes,
- ODD 14 : conserver et exploiter de manière durable les océans, les mers et les ressources marines aux fins du développement durable.

"La CoP n'a jamais été aussi bleue" a déclaré l'ambassadeur des Seychelles aux Nations Unies, le 17 novembre dernier.

Nous nous réjouissons également de l'accent mis sur les écosystèmes littoraux, sur ce trait de côte particulièrement important pour les populations humaines, puisqu'il concentre à la fois les potentialités (la zone littorale concentre 70% du PIB au Sénégal) et les risques anthropiques et climatiques qui menacent sa biodiversité, sa productivité et même parfois son intégrité.

Il est indispensable que la recherche y travaille également. De nombreux projets appuyés par le PNUD, la Banque mondiale, l'AFD, sont portés par les États de la sous-région et devront, pour relever les défis du développement durable et du changement climatique, s'appuyer sur les résultats de vos travaux.

En effet, quels que soient vos disciplines et vos objets d'étude, vous travaillez directement ou indirectement, sur le développement humain durable. Pour cela, je vous souhaite des échanges fructueux au cours de ces trois journées. Je vous remercie.



Laurent VIDAL

Représentant de l'IRD
Cabo Verde, Gambie, Guinée, Mauritanie, Sénégal

Monsieur le Directeur des pêches maritimes représentant Monsieur le Ministre de la pêche et de l'économie maritime, Mme la Secrétaire Permanent de la Commission Sous Régionale des pêches, Monsieur le représentant de Monsieur l'Ambassadeur de France au Sénégal, Madame la représentante de la GIZ, Chers Professeurs, cher étudiants, Chers collègues de Mauritanie, du Cabo Verde, de Guinée, de Gambie et du Sénégal, Chers Collègues de l'IRD.

Un an après notre dernière rencontre, c'est une grande satisfaction d'être là, pour cette 3^{ème} édition de la conférence Internationale AWA (ICAWA). En effet les actions menées par le Consortium AWA sont pour l'IRD exemplaires pour plusieurs raisons.

- Il s'agit d'une initiative internationale (pays d'Afrique de l'Ouest, Allemagne, France) à fort enjeu sous régional (grâce à la CSRP)
- Elle est au service de questions au cœur des agendas scientifiques et de développement internationaux. Je pense ici à l'évolution de la ressource halieutique sous contrainte de transformations du climat, particulièrement repérables au niveau des océans
- Le choix d'une approche pluridisciplinaire et intersectorielle pour fonder des systèmes de gestion des océans et de ses ressources qui sont rationnels (de l'océanographie à l'économie en passant par la climatologie)
- Une prospective : avec la mise en place d'un Observatoire ouest-africain des pêches
- Enfin je félicite les porteurs du projet pour l'obtention de la caution internationale via la labellisation COP 21 et 22

Aussi on voit combien il y a un avenir à « l'esprit AWA » et l'IRD y contribuera via ses chercheurs et ses dispositifs et je pense notamment à son Laboratoire mixte international ECLAIRS et sa Jeune équipe associée LEHAO, le tout en étroite partenariat avec l'UCAD.

Je formule donc le vœu que cette conférence puisse tracer les lignes de cet avenir

Je vous souhaite à toutes et à tous d'excellents débats et pour nos collègues venant au Sénégal à cette occasion un agréable séjour à Dakar en cette fin d'hivernage.



M^{me} Marième Diagne TALLA

Secrétaire Permanent p.i.
de la Commission Sous Régionale des Pêches (CSRP)

Excellence Monsieur le Ministre de la Pêche et des Affaires Maritimes de la République du Sénégal, Excellence Monsieur le Ministre de l'Environnement et du Développement durable ; Excellence Monsieur l'Ambassadeur, Délégué de l'Union Européenne au Sénégal, Excellence Monsieur l'Ambassadeur de la République Fédérale d'Allemagne au Sénégal, Excellence Monsieur l'Ambassadeur de la République de France au Sénégal, Excellences Mesdames, Messieurs les Ambassadeurs des Etats Membres de la CSRP au Sénégal et autres Etats partenaires, Mesdames, Messieurs les Directeurs Généraux et Directeurs, Mesdames et Messieurs les Représentants des institutions de recherche, Mesdames, Messieurs les Partenaires techniques et financiers, Honorables invités, chers participants.

Au nom du Secrétariat Permanent de la Commission Sous régionale des Pêches que j'ai l'honneur de diriger, je m'acquitte ce matin, d'un agréable devoir en souhaitant la bienvenue à nos honorables hôtes ; des sommités scientifiques de renommée internationale du secteur de la pêche, de la recherche qui ont accepté de faire le déplacement à Dakar pour participer à la Conférence Internationale ICWA 2016.

Cette conférence, à la suite des précédentes en 2014 et 2015, est le fruit d'un long processus de collaboration tripartite entre le Ministère Fédéral Allemand de l'Education et de la Recherche, l'IRD sous le patronage du Ministère Français de l'Enseignement Supérieur et de la Recherche et le Ministère français des Affaires Etrangères et Européennes et les Etats de l'Afrique de l'ouest. Cette collaboration s'est faite à travers la Commission Sous Régionale des Pêches mais également avec les pays associés comme la Côte d'Ivoire et le Bénin sans oublier tous les laboratoires scientifiques mondiaux impliqués dans le cadre du projet.

Mesdames et Messieurs

Il me plait de vous rappeler que dans le cadre des activités qui ont été mises en œuvre depuis le lancement officiel du projet en septembre 2013, que nous avons eu l'honneur de travailler avec les Directions des pêches et les institutions de recherche des Etats de la région Ouest africaine. Ces quatre dernières années ont été marquées par un effort croissant de renforcement des capacités des chercheurs et des institutions de la sous région. Dans ce cadre, le projet AWA a facilité la participation des chercheurs d'Afrique de l'ouest à une douzaine de campagne de recherche scientifique à bord des navires tels que le « THALASSA » et l'« ANTEA ». La CSRP en collaboration avec le projet a organisé la réunion des doctorants qui a permis de rassembler des experts régionaux et internationaux afin de discuter des effets

de la variabilité de l'environnement et du changement climatique sur les ressources halieutiques de la sous région et la prise en compte de ces facteurs dans la gestion de nos ressources. C'est dire que ICAWA est une tribune d'échanges de savoirs et de résultats sur les thématiques retenus

Dans ce cadre, le projet AWA a permis l'organisation de conférences scientifiques internationales exerçant les chercheurs africains à la publication et au partage des résultats de recherches scientifiques aussi bien dans le secteur de la pêche que de l'environnement marin à travers les « book of abstract » édités après chaque conférence.

Aussi, plusieurs sessions de formations et d'échanges d'expériences ont été réalisées en plus des appuis à des formations universitaires diplômantes et des mises à la disposition des institutions de matériels scientifiques de pointe. Les premiers résultats des initiatives de recherches engagées depuis quatre ans vous seront restitués durant ces trois prochains jours à l'instar des conférences des années précédentes.

Particulièrement cette année, année de clôture du projet, les meilleures contributions des chercheurs seront admises pour publication dans une grande revue scientifique internationale « Aquatic resources ».

Je me réjouis aussi de vous informer de la perspicacité du coordonnateur de projet le Dr Patrice BREHMER qui a réussi à faire labelliser encore une fois la conférence à la COP22 tenue à Casablanca, afin que les questions de l'Océan soient ancrées aux conséquences du changement climatique.

Mesdames, Messieurs,

Dans le cadre des efforts entrepris par la CSRP pour la mise en œuvre de son plan Stratégique 2011-2015, plusieurs programmes d'appui au développement de la recherche d'excellence dans la sous-région ont été appuyés par nos partenaires techniques et financiers. A ce sujet, il me plaît d'exprimer nos sincères remerciements aux pays frères et amis ainsi qu'aux partenaires au développement pour leur disponibilité et l'intérêt manifesté pour ces programmes ambitieux pour lesquels ils ont consenti des financements. Aussi, je les encourage à soutenir les plans à venir.

Mesdames, Messieurs,

Pour conclure, je tiens à vous transmettre le message de soutien de **Son Excellence, Monsieur André LOUA, Ministre des Pêches, de l'Aquaculture, et de l'Economie maritime de la République de Guinée, Président en exercice de la Conférence des Ministres de la CSRP et de tous les Ministres des Etats membres de la CSRP**, qui sont très attentifs au renforcement des mécanismes d'une bonne gouvernance de gestion des pêches en Afrique de l'Ouest.

Je vous remercie de votre aimable attention.

Mme Marième Diagne TALLA

Secrétaire Permanent p.i.
de la Commission Sous Régionale des Pêches (CSRP¹)

¹La Commission Sous-Régionale des Pêches (CSRP) est un organisme intergouvernemental créé le 29 mars 1985 par voie de Convention. Elle regroupe sept Etats Membres : le Cap Vert, la Gambie, la Guinée, la Guinée Bissau, la Mauritanie, le Sénégal et la Sierra Leone. Le Sénégal abrite le siège de la CSRP. Le conseil des ministres est l'organe suprême et de décision de la CSRP. Elle est constituée des Ministres en charge des pêches des différents Etats Membres. La Conférence des Ministres est présidée à tour de rôle par chacun des Etats Membres suivant l'ordre alphabétique français du nom des pays, pour une période de deux ans. Elle se réunit une fois tous les deux ans en session ordinaire et chaque fois que cela est nécessaire, en session extraordinaire.

Acknowledgments

On behalf of all organizers and participants from Europe and Africa, we would like to thank the sponsors of 2016 edition the ICAWA. Special thanks to:

- SRFC: Sub Regional Fisheries Commission;
- IRD : Institut de Recherche pour le Développement ;
- GIZ: Gesellschaft für Internationale Zusammenarbeit;
- PNUD/GoWAMER
- NEPAD
- GREENPEACE

This third edition of ICAWA conference should set the stage for continue to regular event in West Africa allowing both researchers and students working on the West African ecosystem to come together and contribute towards improving coastal and fisheries management in a spirit of synergy involving all stakeholders.

High level authorities were present, the conference brought together over two hundred fifty (250) participants (including co-authors) over twenty one (21) nationalities and almost one hundred (100) institutions. The conference was organized in five (5) sessions and six (6) side events and brings together the top scientists working over the sub region as the main fisheries research centers.



Synopsis on the AWA tripartite project

The Consortium

The AWA consortium includes ten (10) countries (including the 15 associated partners) and more than forty (40) laboratories.

Joint proposals by the Federal Ministry of Education and Research (BMBF/Germany) and the Institut de Recherche pour le Developpement (IRD/France) under the patronage of the French Ministry for Higher Education and Research (MESR) and the French Ministry of Foreign and European Affairs (MEDI ex-MAEE).

Locally implemented by the SRFC Sub Regional Fisheries Commission (Dakar, Senegal).

A trilateral German-French-African Research initiative in Sub-Sahara Africa.

To add a new dimension to the long history of cooperation in Science and Technology (S&T) between Europe and Africa, Germany and France have decided to join their efforts to strengthen S&T cooperation with Sub-Sahara Africa, building on mutual strengths and interests.

Goal

AWA project is a strategic partnership among Germany, France and West African countries that will be capable of developing a vision and the scientific basis for an ecosystem approach to the management of fisheries and the marine environment ('EAMME') in West African with a long-term endeavor focusing on small pelagic.

Combining process studies of ecosystem functioning, long-term biological and physical monitoring and modeling, the final goal is to develop indicator-based management and adaptive decision support tools for EAMME in the context of global change and regional cooperation, since the same stocks are shared by several member States of the Sub-regional Fisheries Commission (SRFC).

To achieve this goal, the laboratories involved will work in two main areas of research: the monitoring of oceanic biological resources (assessment) and the functioning and modeling (ecological processes) of their environment. These are both research areas of outstanding importance in the broader scientific context of the analysis of global climate change, and of paramount relevance of their impacts on fisheries resources for West Africa. Both research activities will be done with a particular interest in capacity building of West African.

Project structure

WP 0: Project coordination and management

WP 1: Observations and modeling of ocean physics and biogeochemistry supporting the ecosystem approach to marine management

The lack of historical perspectives, continuous monitoring and regular forecasts of ocean physics and biochemistry parameters increase the vulnerability of the fragile economies of West African Countries. WP1 will concentrate on the observation and modeling of four key parameters that are at the heart of the assessment, understanding and anticipation of the ocean response to ongoing future changes: upper ocean temperature, sea level, chlorophyll concentration and dissolved oxygen.

Tasks

- Task 1.1. Assessing a highly variable oceanic environment
- Task 1.2. Modeling the variability of the environment
- Task 1.3. Observation and simulation synthesis: towards prescription and early warning tools.

WP 2: Variability of pelagic productivity in West-African waters

Pelagic productivity in the West African upwelling sustains one of the world's largest small pelagic fisheries. However, key ecosystems processes and stock dimensions are still not clearly understood. WP2 will link process data and operational observational data (e.g. satellite data, physical oceanography) in order to establish long-term modeling and forecasting capabilities of pelagic productivity and exchange processes in the West African upwelling and estuarine interface.

Tasks

- Task 2.1. Indicators of productivity of oceanic small pelagic in nurseries, shelf and deep water/oceanic habitats.
- Task 2.2. Pelagic key components at the interface between subtropical gyre and coastal upwelling
- Task 2.3. Exchange processes and pelagic productivity at the estuarine interface.

WP 3: Physical-biogeochemical coupling: processes and small pelagic fish control

Within the eastern boundary currents, pelagic fish are strongly dependent on their environment, which defines their habitat, the availability of food and probably also drives their spawning, growth recruitment success, spatial distribution and health. WP3 will increase understanding of the physical/biochemical environment of small pelagic fish in West Africa in order to apprehend the bottom up processes that impact on their life cycle and also identify useful indices in a context of climate change.

Tasks

- Task 3.1. Key biogeochemical processes: control of primary production and oxygen minimum zone
- Task 3.2. The spatio-temporal variability of small pelagic spawning
- Task 3.3. Recruitment of *Sardinella aurita*
- Task 3.4. Temporal evolution of fish habitat defined from coupled modeling approach

WP 4: Economics integrated into the ecosystem approach to marine management

WP4 goal is to determine the optimal management of key fish species, taking into account economic (including profits by fleet) and ecological drivers and needs. A special focus will be on the effects of environmental variability and climate change on economics performance and indicators.

Tasks

- Task 4.1. Optimal economic-ecological management of selected key-species under environmental uncertainty.
- Task 4.2. Spatial economic-ecological approaches
- Task 4.3. Ecosystem, economic, and fish based indicators of global change in West Africa

WP 5: Education, Training and Capacity-building

There is a strong demand for capacity building strategies as well as strategic partnerships between institutions and universities in the sub region of West Africa. WP5 will encourage the development of common data formats and sampling protocols, as well as communication to exchange data and information between project partners and other institutions. WP5 will also develop the advancement of local scientific expertise in marine environment management. In each WP, individual training opportunities are provided to PhD students and MSC candidates from African partners. In particular MSC require a high degree of mentoring as envisaged under WP2 and WP4 (in Task 4.2 with the questionnaire work) and therefore require a strong component of capacity building. The goal is to achieve 17 graduations with funding from AWA (European MSC do not need funding)

Tasks

- Task 5.1. To coordinate and reinforce existing training capacities in the oceanography field
- Task 5.2. Enforcement of local scientific expertise

**SESSION reports, recommendations
and
book of abstract**





Thematic Session 1: « Observation and modelling of ocean physics supporting the ecosystem approach to marine management ».
Afternoon 13rd December 2016: Signara 2 room

CHAIRMEN: Dr Bamol Ali Sow (UASZ, Senegal), Heino Fock (TI, Germany) and Dr Alban LAZAR (UPMC, France)

The session as a whole illustrates the diversity and richness of the research themes that have been developed during the AWA program, in particular realistic nearshore ocean modelling, multi-scale investigation of the dynamical drivers behind present-day hypoxia off West Africa, state-of-the-art in situ and satellite observation in WA. The session participants and chairmen have engaged in a discussion about the next steps.

The discussion followed three lines, which shall be useful to guide these future steps:

(1) The potential of identifying key parameters in models (length structure of populations as biological key parameter, etc.). These key parameters should be used as basis to establish consistent and efficient biological sampling programs, and ultimately provide scientific Information to the end-user.

(2) The importance of increasing inter-disciplinary research. And particularly to enhance our ability to apprehend the complex links between marine ecosystems and their physical/biogeochemical environment. To accomplish this, comprehensive in-situ observation making use of state-of-the-art sensors is imperative. The Senegalese buoy MELAX is one example where a multi-sensor strategy covering physics, geochemistry and marine organisms would be highly beneficial.

(3) The need to make progress over the wide range of time and space scales that are key to end-users. Temporal scales from intraseasonal to multi-decadal all have key socio-economic implications (e.g. on catch fluctuations, conservation and exploitation decisions). At finer ~ daily scale, the environment is still highly variable. This variability determines the resource distribution to a degree and through processes that remain largely unknown. More generally, at all those scales fundamental work is underway, e.g. in the context of AWA. To a large extent, AWA related research is still catching up with the research conducted in other parts of the world ocean, in particular the other upwelling systems. One advantage of this situation is that inspiration and lessons on how to make progress are numerous.

(4) The need to understand better (through modelling and observation) the processes implicated extreme events with high impact on human populations, with swell and coastal erosion as a priority (see ICAWA side event 3, page 146).



(Left) Bamol Ali Sow vice rector of UASZ during ICAWA 2017, and (right) subcommission room where the WP1 session took place (AWA 2017, © SRFC-IRD)

The best oral presentation and the best poster of the thematic session were attributed to Lala Kounta and Moustapha Sow, respectively.



Session 01

First year of an ocean-atmosphere mooring in the senegalese coastal upwelling

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Abstract

The Joint International Laboratory ECLAIRS set up an oceanographic and meteorological buoy, dedicated to monitoring and analysis of the short and long-term changes in climate, atmosphere and marine environment within the Senegal coastal upwelling. The buoy "MELAX" was deployed early 2015 in the heart of the Senegalese upwelling by 30 m-depth at (14,20°N, 17,14°W). Data collected are, for the atmosphere, surface wind, solar radiation, humidity and rain, and for the ocean, temperatures, salinity, and currents (from the surface to the bottom) and oxygen. We present the first year and a half of observations, in particular the relationship between wind, sea surface temperatures, and hydrology. Satellite and model data are used to provide a larger-scale context to the local monitoring.

The southern Senegal coastal ocean: a low enrichment-high retention upwelling center

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Abstract

The circulation associated with coastal upwelling is well understood in simple 2D alongshore invariant situations. Southern Senegal is the southern tip of the Canary upwelling system. Its coastal ocean hosts an upwelling center which shapes sea surface temperatures over several degrees in latitudes, ~ between 12 and 15N. Near this latter latitude, the Cape Verde headland and a sudden change in shelf cross-shore profile are two major sources of heterogeneity present in the southern Senegal upwelling sector (SSUS), whose dynamics is herein investigated by means of primitive equation numerical simulations, using the hydrodynamical Regional Ocean Modeling System (ROMS). Configuration realism and resolution ($dx \sim 2$ km) are sufficient to reproduce the frontal system present during the upwelling season in the SSUS. Our main focus is on the 3D upwelling circulation which turns out to be profoundly different from 2D theory: coastal upwelling is strongly concentrated within a few tens of kilometers south of Cape Verde and largely arises from flow divergence in the alongshore direction; most injections of cold water onto the shelf take place in the same northern area; a significant fraction of the upwelled waters are retained nearshore over long distances while travelling southward under the influence of northerly winds. Another source of alongshore complexity, regional scale alongshore



pressure gradients, also contributes to the overall retention of upwelled waters over the shelf. Varying the degree of realism of atmospheric and oceanic forcings does not appreciably change these conclusions. The study sheds light on the dynamics and circulation underlying the recurrent SST pattern observed during the upwelling season and offers new perspectives on the connections between SSUS physical environment and its ecosystems.

Keywords: Canary upwelling system, sea surface temperatures, Cape Verde headland, southern Senegal upwelling sector, Regional Ocean Modeling System (ROMS).



West African upwelling waters and the circulation in the North-east tropical Atlantic

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Abstract

With the help of an eddy-permitting NEMO (Nucleus for European Modelling of the Ocean) numerical simulation and dataset from the COPERNICUS observation program, we explore the subsurface dynamics and circulation of the north-east Atlantic ocean (5oN-20oN – 15oW - 30oW). This area is characterised by a slow subsurface circulation shaped by several important features: a thermal dome named Guinea dome situated near the termination of the North equatorial countercurrent (NECC); a seasonal poleward slope current near the African continent which is referred to as Mauritanian current in summer when it is surface intensified). We are mostly concerned with the pathways of the water that upwells in the Senegal-Mauritania coastal upwellings, hence a focus on a relatively light density class (σ_0 comprised between 25.2 and 26.7). The model simulations which compare favorably with available observations offer interesting insight into the regional circulation, e.g. with respect to the slope current seasonal cycle. A Lagrangian analysis using the ARIANE tool reveals the origin of Senegalese upwelling waters: owing to reduced mean flow and important stirring by mesoscale turbulence and zonal jets, they originate from a broad sector of ocean to the south and west of Dakar.



Observations of mesoscale eddies in the eastern tropical North Atlantic

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Abstract

A combination of multiple ocean observing system elements (moorings, Argo floats, satellites, ships, gliders) is used to assess the mesoscale eddy activity in the tropical Atlantic off northwestern Africa (12-22°N and 15-26°W). Considering just the rotation direction of the surface flow field, eddies can be categorized into cyclonic and anticyclonic eddies. If vertical stratification is considered additionally, a refinement can be made by distinguishing between anticyclonic and anticyclonic mode-water eddies (ACMEs, also intra-thermocline eddies). ACMEs are characterized by a subsurface mode of rather homogenous water located between upward and downward displaced isopycnals. Consequently, these eddies may transport large hydrographic anomalies in a relatively narrow density range. The different eddy types could be identified and classified from space by the investigation of a combination of three sea surface parameters: Sea level anomaly (SLA), sea surface temperature (SST) and sea surface salinity (SSS). Anticyclones/cyclones are associated with an elevation/depression of SLA and enhanced/reduced SST and SSS in their cores. However, 20 % of all anticyclonic eddies are associated with reduced SST and SSS instead and could be identified as ACMEs. In the area of interest, about 146 ± 4 eddies per year with a minimum lifetime of 7 days are identified (52 % cyclones, 39 % anticyclones, 9 % ACMEs). All observed eddies are isolated and serve as transport agents, exporting water from the coast into the open ocean (~ 2.1 Sv; $1 \text{ Sv} = 10^6 \text{ m}^3 \text{ s}^{-1}$). In addition oxygen depleted waters are identified in cores of cyclones and ACMEs, which could be related to enhanced primary production at the surface (enhanced chlorophyll) and an associated elevated respiration rates (3-5 times higher than the background) within the isolated eddy cores. On average the apparent oxygen utilization rate (aOUR) for cyclones (ACMEs) in their isolated cores is 0.10 ± 0.12 (0.19 ± 0.08) $\mu\text{mol kg}^{-1} \text{ day}^{-1}$. If the aOUR is continuously active during a typical eddy live time hypoxic or even suboxic conditions in the eddy cores can occur. The emerging oxygen minimum in the eddy cores has profound impacts on sensible metazoan communities and marine life. The compression of the habitable volume in the mixed layer above



the eddy core (strong increase in integrated zooplankton abundance) increases the abundance of higher trophic levels (such as small pelagic forage fish and their predators), which benefit from the dense prey field. The analysis of mesoscale eddies in the eastern tropical North Atlantic shows that these anomalous environments associated with eddy cores occur more frequently than previously expected and can be observed even in the proximity to the equator (8°N).

Keywords: ocean observing system, anticyclonic and anticyclonic modewater eddies, Sea level anomaly, sea surface temperature, sea surface salinity, oxygen minimum, northwestern Africa.



Impact of the tide and the swell on the hydrodynamic circulation in the Tulear lagoon : modelling, description and analysis

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Abstract

In coastal and meso-tidal Tulear lagoon, the coral reef barrier can be temporarily submerged at high tide and partially exposed at low tide. Which causes highly specific lagoon dynamics. To understand those dynamics, some simulations were performed in the area studied. The main approach of simulations is based on the 3D hydrodynamic model CROCO (Coastal Regional Communion Model) generated from ROMS (Regional Ocean Modelling System) and solve the Navie-Stockes équations. The bathymetry used in this model originated from an interpolation of bathymetry maps performed by the 'Service Hydrographique et Océanographique de la Marine (SHOM/MOP)'. From this bathymetry and change we have made in CROCO model, tree types, simulations goals were performed: Intermediate Simulation (SIM_INT): the coral barrier has been considered as an impervious barrier inhibiting any flow above the barrier. No-wave forcing is considered. Reference Simulation (SIM_REF): the reef is simply considered as a flat portion of the bathymetry, raised to a constant given elevation and characterized by an increased drag coefficient. No-wave forcing is considered. Simulation with coupling swell and tidal (SIM_TIDWA): They are based on the SIM_REF simulation for which wave is supposed to break on the reef. Wave height is kept constant during each simulation and varies from simulation to another. The SIM_REF and SIM_INT are forced only by the M2 semi-diurnal tide. Their comparison in order to test the effect of water exchanges above the reef on the overall lagoon dynamics in the absence of wave. In the SIM_TIDWA, Water fluxes induced by wave breaking on the reef are parameterized in the model using the empirical law determined from in situ measurements of ADCP (Acoustic Doppler Current Profile). The results of this simulations have allowed to calibrate and validate the CROCO model over the Tulear lagoon.



Thematic Session 2: « Variability of pelagic productivity in West-African waters ». All day 13rd and morning 14th December 2016, Plenary room Dara

CHAIRMEN: Dr Aka Marcel KOUASSI (CRO, Ivory Coast) Dr Idrissa Lamine BAMY (CNSHB, Guinea) and Dr Osvaldina SILVA (INDP, Cabo Verde)



Chairman of the ICAWA in plenary session 2; Osvaldina SILVA presidente of INDP (Cabo Verde), Aka Marcel KOUASSI deputy director of CRO (Ivory Coast), and Idrissa Lamine BAMY director general of CNSHB (Guinea) (AWA 2017, © SRFC-IRD).

La productivité de l'upwelling dans la région ouest africaine maintient l'une des plus grandes pêcheries de petits pélagiques au monde. La plupart des exposés ont **essayé d'établir un lien entre les upwellings et les données associées aux observations opérationnelles afin de modéliser et de prédire dans le long terme les capacités de productivité pélagique et les processus d'échange entre les upwellings et les estuaires. Les présentations ont essentiellement porté sur l'effet de la variabilité climatique sur la composition, le recrutement et la productivité des petits pélagiques dans les eaux ouest africaines à partir de la détermination des indices d'abondance par la méthode acoustique ; la variation saisonnière des conditions océanographiques des eaux et sur l'effet des paramètres environnementaux sur la structure des communautés zooplanctoniques/micronectonique; l'étude des structures démographiques de quelques espèces dans les eaux ouest africaines et l'évaluation de la diversité du statut des poissons à partir des campagnes scientifiques démersales côtières et enfin l'utilisation de nouveaux outils (Smartphone et GPS...) pour la récolte de données halieutiques et environnementales à partir des zones de pêche. Dans l'ensemble, les présentations ont été bonnes et les objectifs ont été clairement définis par les présentateurs. Plusieurs questions pertinentes ont été posées aux présentateurs et s'en est suivi des débats pour répondre à ces différentes questions. Deux présentations ont retenues l'attention du présidium par leur qualité et leur contenu et en conséquence ont été primés : il s'agit des présentations de Ousmane Diankha du Sénégal pour la communication orale et de Elizandro Rodrigues du Cabo Verde pour les posters. En terme de**



recommandations, il ressort les points suivant : **Encourager l'équipe AWA pour la mobilisation des financements en vue de pérenniser les acquis du projet ; Appuyer l'usage des Smartphones/tablettes pour la collecte des données halieutique et environnementale ; Approfondir l'analyse des données collectées par les laboratoires nationaux notamment : les campagnes acoustiques qui ont l'avantage de présenter des séries de données plus récentes et une meilleure couverture spatiale et saisonnière ; Intégrer à l'avenir les travaux de recherche sur les données des campagnes d'observation des cétacés, composante qui n'a pas été abordée au cours des éditions ICWA et que l'on souhaite introduire dans le future de par les compétences sous régionale existante.**



Session 02

Seasonal change of oceanographic condition in Murdeira Bay, Cabo Verde, Northeast Atlantic: bottom-up effect on productivity

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AWA © MS WP2_S2_17**Abstract**

The present study aimed to analyze the seasonal changes in physical, chemical and biological parameters of the water column and sediments of Murdeira Bay, Sal Island, Cabo Verde. In addition, possible interactions between those parameters should be identified to better understand shifts in oceanographic conditions at different seasons. Two field surveys were conducted in the periods September/October 2006 and May/June 2007, representing the hot and cold seasons, respectively. At Murdeira Bay the two study periods, September 2006 and June 2007, showed two different oceanographic conditions, signaling seasonal differences driven by the wind regime and changes in temperature. September 2006 was characterized by a stratification of the water column resulting from an increase in temperature and a reduction in the intensity of the trade winds. As a consequence, this led to a reduction in the nutrient exchange between the bottom and the surface layer, and therefore to lower productivity (relaxation period). In June 2007, the much higher wind intensity caused a mixing of the whole water column. Anoxic sediment conditions recorded in this period can be explained either by deposited organic matter from surface waters after a breakdown of the stratification and/or after an inflow of Subtropical Underwater. From September 2006 to June 2007 a large increase was recorded in the phytoplankton community, both in terms of abundance and diversity, explained by the differences in oceanographic conditions. The same trend was observed in the zooplankton, though the differences were identified only in terms of abundance, a bottom-up effect initialized by the increase on nutrients.



Session 02

The contribution of small scale fishing constraints on *Sardinella* landings in Senegalese waters

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Abstract

Over the last decades, small pelagic fisheries have shown an increasing development in Senegal, especially those targeting *Sardinella aurita* and *S. maderensis*. Their landing and fishing effort quickly increase for both species, from less than 100,000 tons with 35,035 trips in the early 80's to a peak of over 400,000 tons with 86,427 trips in 2008. The Senegalese small scale pelagic fisheries, targeting both species, accounts for more than 86% of the artisanal fishery landing in biomass. We investigated the effects of small scale fishing over ten years (2004-2013) with generalized additive model fitting techniques using landings vs. fishing effort per gear and type of fishing gears in the Northern and southern parts of Senegal. The study revealed that these effects are more pronounced in the Northern area for *S. aurita* while they are more significant in the Southern area for *S. maderensis*. The purse seine, i.e the main Senegalese fishing gear targeting *Sardinella*, provides the most significant effects on *S. aurita* landings in both areas, while for *S. maderensis*, the most significant effects are shared between two fishing gears: purse seine in the Northern area and encircling gill nets in the Southern area. Spatio-temporal patterns of the effects of small scale fishing are described and the relative importance of fishing effort and fishing gear on both species at seasonal and inter-annual scales are discussed.

Keywords: effects of fishing; generalized additive model; *Sardinella aurita*; *Sardinella maderensis*; purse seine, encircling gill nets, Senegal.



Session 02

Use of multi-metric indices for monitoring fisheries exploitation and fishing effects on aquatic ecosystems

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Abstract

The high demand for fish products has led to important economic issues including the emergence of new markets, especially in developing countries where fishing represents an important economic sector and the main source of animal protein for local communities. This increased demand for fish, associated with advanced fishing technologies including the development of sophisticated fishing and fishery resource conservation methods, have resulted in an overexploitation of many fish stocks. Amongst the devastating impacts of this overexploitation on fish communities are reductions in genetic diversity of wild populations, which may have resulted in the extinction of certain fish species. Fisheries assessment was traditionally based on the analysis of fishery statistics by global, analytical and stock-recruitment models. Although these monitoring tools and management based on empirical models developed to estimate total production of ecosystems from the environmental characteristics have provided successful results, most fisheries in the world are experiencing degradation or overexploitation. To improve the assessment and management of the fisheries resources and ecosystems, a new approach based on the biological indicators are being developed as an alternative. The currently most used biological indicators-based have been successfully used for comparative studies at both community and population levels. Thus, management approaches based on biological indicators in the recent years has improved our understanding of the structure and functioning of ecosystems, and facilitated the interpretation of biological phenomena.



Session 02

Acoustic study of water masses over Senegalese continental shelf: effect of environmental variable on the structure of zooplankton layers

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Abstract

The macrozooplankton organisms aggregate at specific depths and occur as scattering layer on echosounder records. They constitute an important component in the marine food web in direct contact with primary producers. We review phytoplankton and zooplankton literature in Senegal, and then characterized the Senegalese water masses of the “Petite côte” on physicochemical and biological criteria using an *in situ* data set collected during an acoustics survey (ECOAO) led onboard FRV Antea in 2013. Then we described at fine scale spatial and temporal variation of macrozooplankton layers in relation with their environment. Two areas with different characteristics have been discriminated: the upwelling's cell area and the upwelling's offshore area more stratified, warm and sharply separated from the other area by a strong thermal boundary. The spatio-temporal variation of scattering layer's thickness of macrozooplankton is strongly influenced by depth and time of the day. The scattering layer's thickness increases with depth along a coast-high sea gradient, but no variation is reported along longitudinal plane *i.e.* North-South. In both areas nocturnal layers are thicker and deeper than diurnal ones. The hydrological structure of the water column also influence the macrozooplankton scattering layer. The scattering layer requires "stable" physical conditions which support vertical stratification. In the upwelling's area cell, the parameters correlated to scattering layer thickness during night time are chlorophyll 'a' and dissolved oxygen. In the upwelling's offshore area, temperature, water density and



chlorophyll 'a' concentration have a significant effect on the scattering layer's thickness during the daytime. However, during the nighttime, chlorophyll 'a' has no significant effect on the scattering layer's thickness. This absence of correlation between chlorophyll 'a' and scattering layer thickness could be explained by an inverse diel vertical migration of a macrozooplankton group. On this basis we assume that trophic relationship between phytoplankton and macrozooplankton operate during the day at the surface.

Keywords: Trophic behavior, Plankton, Scattering layer, Echo-sounder, Macrozooplankton, Upwelling.



Seasonal variation of copepod communities in the Senegal-Gambia waters

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Abstract

The analysis of the seasonal variation of copepods in the Senegal-Gambia maritime area, using a comparative approach (cold season (May) and warm season (November)) was carried out using data collected during ecosystem cruises aboard the Norwegian vessel Fridtjof Nansen in November 2011 and May 2012. Zooplankton samples were collected between 0 and 50 m depth using a multinet of 80 µm mesh, towed obliquely behind the vessel, over the continental shelf. Post processing of the samples (n = 34) were made in laboratory by microscopy and the copepod were identified to the lowest possible taxonomic level and counted, using appropriate identification keys. *Paracalanus parvus* was dominant with 22 % followed by *Oncaea venusta* (19 %) and *Temora stylifera* (12 %) in the cold season. In contrast, in the warm season, these two species (*P. parvus* *O. venusta*) still dominant with 26% and 13 %, respectively. A total of 34 species of copepods were identified during the cold season, compared with 27 species during the warm season. In one hand, during the cold season, an area of high concentration of copepods was found off the mouth of the Casamance River. On the other hand, during the warm season, two areas of high concentration were identified off the peninsula of Cap-Vert and Casamance. The copepod group which represents 2/3 of the zooplankton would be an ideal indicator for the identification of signatures of changes in phenology and / or latitudinal displacement of species in relation to climatic variations. All of these aspects reflect the interest of this study in improving knowledge of the responses of marine organisms to climate change in the south part of the west African east border upwelling.

Keywords: Seasonal variation, Copepods, Upwelling, Maritime area, Senegal, Gambia.



Demographic parameters of silky shark, *Carcharhinus falciformis* (Bibron, 1839) in the marine waters of Benin

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Abstract

Carcharhinus falciformis, requin soyeux (Bibron, 1839) est une espèce cosmopolite. Avec *Prionace glauca* (Linnée, 1785), elle co-domine les débarquements de requins carcharhinidae au Port de Pêche Artisanal de Cotonou. La présente étude a pour objectif de déterminer les paramètres démographiques du requin soyeux dans les eaux marines béninoises. Les différentes routines du logiciel FISAT II v 1.2 associées aux équations empiriques de Froese et Nohland, 2000 ont permis d'évaluer les différents paramètres démographiques du requin soyeux dans les eaux marines du Bénin. D'aout à décembre 2015, 302 individus dont la taille varie entre 86 cm à 296 cm ont été échantillonnés. La relation taille-poids établie donne un coefficient d'allométrie $b = 3,036$ avec $R^2 = 0,97$. La longueur asymptotique totale obtenue est de 310, 10cm avec un taux de croissance de $0,26 \text{ an}^{-1}$ ce qui indique que l'espèce a une croissance rapide la longueur totale optimale de l'espèce étant de 210,5cm. L'âge de première maturité de l'espèce est de 4ans et une longévité de 13 ans. Le taux d'exploitation est $E = 0,75$ avec la mortalité totale qui est de 2,4, la mortalité naturelle de 0,6 et la mortalité par pêche qui est de 1,8. Le sex-ratio s'inversant en fonction des saisons.

Keywords: Requins Carcharhinidae; *Carcharhinus falciformis*; paramètres démographiques; exploitation.



Session 02

Influence of climatic variables on *Sardinella* recruitment dynamique in Senegalese waters

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Abstract

Several authors, with estimated abundance index, attempted to study the dynamic of *Sardinella* populations in relation with to their environment fluctuations in West African region. However, this relationship still poorly understood because of the complexity and difficulty to estimate this abundance index that depends on a variable difficult to identify, the fishing effort from artisanal fisheries. This study is a contribution to better understand the link between the variability of environmental conditions and the dynamic of *Sardinella aurita* and *Sardinella maderensis* in Senegalese waters using generalized additive model. Recruitment data of these two species estimated from the virtual population analysis model, sea surface temperature, coastal upwelling index, wind speed, surface chlorophyll concentration and north Atlantic oscillation index within 2004-2013 period were used. Our results showed that recruitment of these two small pelagic species are closely linked to changes in the climatic variables tested. However, variables playing the most critical roles differ from one species to another. For the *S. aurita*, the index of coastal upwelling is the most important factor, while for *S. maderensis* is the SST which plays the leading role. This study also reveals the existence of temperature, intensity of upwelling, wind speed, concentration of chlorophyll-*a* and north Atlantic oscillation index thresholds above or below which *Sardinella* recruitment success is low.

Keywords: climatic variables, *Sardinella*, Senegalese waters, recruitment.



Session 02

Evaluation de la diversité et du statut ILR des poissons des côtes sénégalaises à partir de données de campagnes scientifiques démersales côtières (2001-2015)

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Abstract

Fish diversity on the Senegalese coast (718 km, 16 ° 04 N At 12 ° 20N, West Africa) is estimated from data from 22 warm and cold seasonal surveys conducted from 2001 to 2015 in northern, central and southern areas, aboard N/O Itaf Dème du Center de Oceanographic Research of Dakar-Thiaroye (CRODT / ISRA). Targeting coastal demersal stocks (10-200 m), these scientific fisheries were financed by the national budget and / or partners: EU, JICA and AECID. The working file comprises 1,253 trawls or stations and 23 variables (3 identifiers, 7 temporal, 9 spatial, 3 biological and 1 related to the diagnosis established by the International Union for the Conservation of Nature (IUCN) in terms of status (vulnerable, threatened, endangered, etc.) The statistical rests on the determination of elementary parameters (minimum, maximum, mode, median, mean, standard deviation and coefficient of variation / CV), the determination of total wealth (biodiversity), specific wealth (number of taxa / trait), occurrence (stations where a taxon t is present / total number of stations), Jaccard and Sorensen indices, of the red list indicator, (ILR). On the balance sheet, 405 fish taxa (87% Osteichyans and 13% Chondrichthyans), divided into 109 families (14 of Osteichyans and 85 of Osteichthyas) dominated by Soleidae, Serranidae, Carangidae, Sparidae, Scorpaenidae and Haemulidae (at least 10 represented) were counted. This biodiversity increases from the north (267 taxa) to the south (316) through the center (296). More important in the warm season (340) than in the cold season (316), it also decreases from morning to evening and offshore with a multiplication factor of 2.5 when moving from the 10-50 segment (345 taxa) to that of the 150-200m (138 taxa). The specific richness varies from 1 to 47 taxa with a 34% CV, a mode, a mean and a median very close (\approx 19-20) and suggesting a normal distribution. Except *Chelidonichthys gabonensis*, which can be assimilated to a frequent taxon (53% occurrence) and



15 occasional taxa (25-50%), including black and yellow, Rouget, Saint-Pierre, Angola's belt and dentate. The remaining 389 taxa are rather rare (occurrence <25%). The Jaccard indices, comparable between the 3 zones taken 2 to 2, show 38.47% between the center and the north, 38.44% between the north and the south, 37.80% between the center and the south. The same is true for Sorensen's: 1.25, 1.25 and 1.22, respectively. For the ILR, 2 taxa (*Squatina aculeata* and *S. oculata*) are critically endangered, 7 are endangered, 229 are almost threatened and 13 are vulnerable, or 61% of the 405 taxa identified. The discussion focuses on the quality of aggregated data over such a long period, inaccuracies on some taxa and lessons to be learned in terms of threats to biodiversity on the Senegalese coast.



Session 02

State-space hierarchical models for predator-prey relationships and abundance estimates

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Abstract

Scientific monitoring of fishery resources is difficult or, in some cases, impossible or too costly. When completed, they provide only one (or two) biomass estimate per year. The development of approaches based on interpreting vessel behavior to infer prey abundance would provide a reliable alternative to provide in-real-time indices of abundance and better describe activity and identify the effort to which the resources are subject. This poster aims to present the development of Markovian and semi-Markovian hierarchical models in state space by using VMS (Vessel Monitoring System) data. Once trajectories are interpreted, they can be used to fine-tune the activities carried out by ships during their tides and to validate these estimates by observing data. The domains of application of these models range from the determination of abundance indices to the mapping of prey distributions (target species). The 5-state model (fishing, day-trip, night-time and night-road), developed here, allows for night data ignored by other two- or three-state models. Thus, the total effort becomes quantifiable.



Session 02

Seasonal distribution of fish eggs and larvae along the Senegal-Gambia marine area

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Abstract

The study of the distribution of eggs and fish larvae between cold (May end of upwelling season) and warm (November beginning of upwelling season) seasons along the Senegal-Gambia maritime zone was carried out using ichthyoplankton data. The data were collected between 0 and 50m depth using a multinet of 80 µm mesh during ecosystem cruises aboard the Norwegian vessel Fridtjof Nansen in November 2011 and May 2012. The sampling scheme consisted in oblique tow, and covered the continental shelf of Senegal-Gambia area. In laboratory, 36 samples were analyzed and the fish eggs and larvae were identified by microscopy to the family and counted, using appropriate identification keys. Analysis of eggs abundance shows dominance of Sparidae with 14% and low abundance of Myctophidae (4%) and Clupeidae (3%) during the warm season (November). Conversely, Myctophidae eggs were dominant in the cold season (May (45%)) followed by Carangidae (34%). Fish larvae were dominated by the Clupeidae (52%), followed by the Myctophidae (19%) in warm season (November). In May (cold season), the larvae of these two families were still dominant, but with higher proportions for Myctophidae (29%) and lower for Clupeidae (23%); Sparidae larvae were also fairly well represented (19%). At the spatial level, during the warm season, an area of high eggs concentration was founded between the south of the Cap-Vert Peninsula and the Gambia. During the cold season, two areas of high concentrations were observed, located off Kayar and off the mouth of the Casamance River, respectively. On one hand, an area of high larval concentration was identified at the mouth of the Casamance River in November. On the other hand, during the



cold season, high concentrations were noted off the entire study area, with higher concentration off the Cap-Vert peninsula. The study allowed, within its limits, the spatial and temporal location of critical habitats, where environmental conditions are more favorable to the retention of eggs and larvae as well as for their feeding. Such results are of relevant interest for conservation of resources and fisheries management.

Keywords: Seasonal distribution, Ichthyoplankton, Upwelling, Marine area, Senegal, Gambia



Session 02

Diagnosis of coastal demersal surveys carried out in northern Senegal by the Dakar - Thiaroye Oceanographic Research Center

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Abstract

The Senegalese coast is split into 3 zones: North, Central and South. The northern zone, predominantly of soft bottoms, extends from Saint-Louis (16 ° 04N) to the Almadies (14 ° 36N) in the Dakar region. Its main fishing sites are Lompoul, Mboro, Fass - Boye and especially Yoff, Saint - Louis and Kayar. The latter houses various migrant or indigenous actors who can also practice market gardening. State measures for resource management and conservation and fisheries management are noteworthy in the northern zone: immersion of artificial reefs, creation of marine protected areas (Kayar and Saint-Louis) and a maritime national park (Langue de Barbarie, in Saint-Louis), among others. In addition to this, there are local initiatives, such as the Kayar Fishermen's Committee, to regulate fishing effort (daily outings, on-board fishermen, etc.) and landings, restrict the use of certain fishing gear (sticky nets and monofilaments) and promote the management of the marine environment and sustainable social peace. Nevertheless, the scarcity of local fishery resources prompt Saint-Louis fishermen to operate in neighboring Mauritanian waters at the cost of many restrictions, even loss of materials and human lives. The reasons for the apparent failure of all these measures are analyzed. The point is also made regarding the local fishery resources (biodiversity, annual evolution of yields, place of noble species, etc.) in the light of the diagnostic report from the series of 8 surveys of coastal demersal trawls carried out from 2001 to 2008 by the team of the Oceanographic Research Center of Dakar - Thiaroye (CRODT / ISRA). Ultimately, recommendations are made for a more drastic regeneration of resources, better preservation of the ecosystem and optimal management of local fisheries, all of which can help to improve the situation of the particips, Saint-Louisiens in particular.



Analysis of zooplankton samples from AWA scientific research on board of R/V Thalassa 2014 using the zooscan approach

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Abstract

Zooplankton organisms are crucial in nutrient cycling and energy transport, as they constitute the largest marine animal biomass and represent the main link between phytoplankton and other secondary consumers. Zooplankton is dominated by copepods and in many cases the Calanoids stand out by the number of species and/or biomass. In 2014 a scientific research was carried out along the coast of West Africa (Mauritania, Senegal and Gambia) on board of R/V Thalassa. Zooplankton samples were collected at day and night at 4 different stations along a coast-to-open ocean transect (station 1 inshore, station 4 offshore from R3) and 5 different depths using a multinet. Samples were analysed at the INDP laboratory using the zooscan approach. In short, the samples were fractionated into three size fractions (small < 500; medium 500-1000; and large > 1000 µm) and imaged using a flatbed scanner. “Vignettes” small thumbnails and image characteristics of all objects were extracted from the image data with ZooProcess and sorted into 39 categories using Plankton Identifier and then manually validated. Copepods represented 91% of the total abundance; gelatinous organisms such as siphonophores, chaetognaths, salps and, appendicularians represented 5%; other crustaceans, such as euphausiids, ostracods, amphipods and decapods 2%; eggs and molluscs 1%. At the copepod level, calanoids were the most dominante group (total abundance percentage 88%), followed by cyclopoid and harpacticoid copepods (6%). Each oithonidae and eucalanidae families were (2%), oncaeaidae (1%) and nauplius copepods were 1%. In general, the total abundance of copepods differed spatially and along the water column. This may have to do with the biotic processes (*e.g* Chla) and abiotic (*e.g* the distance from the coast to the open ocean). The stations 1



and 2, the most inshore were those that presented greater abundances. The highest variations were observed 0 to 100m depth. The vertical distribution was used to detect migration patterns like diel vertical migration (DVM), which was mostly detected in the large fraction. For this fraction, the “normal” DVM (up at night and down during the day) was visible at stations 2 and 3, where the large copepods aggregated at the 25 to 50, and the 0 to 50 m depth level, respectively during nighttime. At station 1, large copepods were found to be almost homogeneously distributed in the water column during daytime, whereas they also aggregated at the 25 to 50 m depth layer during nighttime. Further analysis of the data is ongoing and will resolve particulate and dissolved matter fluxes related to these migrations, but also can inform ecosystem modelling efforts.

Keywords : DVM, West Africa, ZooProcess, copepods, appendicularians, amphipods and decapods, eggs and molluscs.



Biological monitoring of *Polydactylus quadrifilis* in the Cacheu river

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Abstract

Given the important contribution of small-scale fishing, in food security and in improving the living conditions of coastal communities, a study was conducted on the species *Polydactylus quadrifilis* in the Cacheu River, to determine the state of sexual maturation, the time of reproduction and to propose the management plan for this species. The methodology of the work was covered by the spatial sampling plan and the reading of the hydrographic data. During the sampling surface and bottom nets were used mounted on board a pirogue. After fishing the sampling of the biology is done in a suitable place outside the sea and the gonads were observed macroscopically. The data were processed only in the Excel program, using the dynamic table, taking into account descriptive statistical tools. The results showed that the majority of the species of *Quadrifilis polydactylus* were found in the maturation state I and II (resting individuals and individuals in early sexual maturation) in the months of July to September, whereas Individuals undergoing maturation (Stage III) were more caught in the months of October to December. However, it was concluded that most catches are composed of individuals of small (immature) sizes that demonstrates that these individuals appear in the Cacheu River for growth during the month of July. But it should be noted that the study of this species is underway in the Cacheu river.



Principal results of the scientific fishing campaign in the Cacine river

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Abstract

The Cacine River presents a great biological diversity in the species of commercial values that contributes in a significant way to the improvement of the living conditions of the local communities. The purpose of this study is to assess the state of the existing fish and reproduction resources and to determine the area of geographical distribution biomass and state of sexual maturation to determine the sex ratio of the species and the actual occurrence of species. The work methodology was covered by the spatial sampling plan. During the sample was used surface and bottom nets mounted on board a pirogue. After fishing the sampling of the biology is done in a suitable place outside the sea and the gonads were observed macroscopically. The data were processed only in the Excel program, using the dynamic table, taking into account descriptive statistical tools. The results show that the biomass obtained during the last season was 36 1477 g, with a predominance of Estuarine species of Marine origin and Marine Estuarian especially *Ethmalosa fimbriata*, which adapts well to this environment. The other predominant species in the Cacine River is *Pseudotolythus elongatus*, but lately its catch has decreased significantly, this may be related to direct fishing for this species. Compared to its state of sexual maturation. In the last campaigns less individuals in postmature state were recorded, this led us to conclude that the Cacine River is a potential area of reproduction and growth.



Analyses of catches of cephalopods in the waters of Guinea-Bissau

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Abstract

In the present study, the catches of vessels of the Spanish industrial fleet targeting cephalopods in the Bissau-Guinean EEZ were analyzed at depths of less than or more than 150 meters. The evolution of catches in the European Union over the years (2000 to 2010) was also analyzed. Concerning the fishing effort the calculation was made in hours and days of fishing for the ships of the Spanish fleet, so as to have an idea of the orientation of trades of the trawl cefalópodier of the European Union, concretely the Spanish fleet. The fishing effort in depths below 150 for cephalopods is superior compared to depths greater than 150 meters. Two more important commercial cephalopods were analyzed, of which one cites; *Sepia ssp* and *O. vulgaris*. The percentage of the average accessory fishery for cephalopods is 66 %. The geographical distribution of cephalopods allows us to have an idea of the fishing grounds of these resources. These resources are distributed along the continental shelf, with a greater concentration more or less homogeneous from North to the South. Distribution to the North, Center and South is almost the same. These results are the same as found in the CIPA and IEO campaign studies.



Linking local fisheries observations to climate - a first analysis of historical data from Cabo Verde

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Abstract

Highest catch rates of yellowfin tuna (YFT) in the tropical Atlantic are linked to water temperatures of 24-25°C. We correlate the north tropical Atlantic SST index (NTA), a measure of SST anomalies in the north tropical Atlantic, with Japanese long-line catch-per-unit-effort from 1964 - 1973 (CPUE). The R package cross-correlation function is applied as first step to investigate whether historical catches around Cabo Verde were correlated with SST data in the area. NTA has increased during the last 50 years. The results reveal that at intra-annual scale catches increase during warm months, although this relationship was not significant. At inter-annual scale, catches are significantly correlated at lag0 and lag1 with NTA; the lag1 correlation was high (0.61). The lag0 correlation is consistent with the fact, that YFT generally have lower CPUE in waters influenced by the cold Canary Current system, whereas the lag1 relationship indicates that recruitment processes are also augmented by higher NTA in the area. Historical CPUE relationships will be further applied to analyse current CPUE patterns around Cabo Verde.



Vertical habitat use and diving behaviour of yellowfin tuna, *Thunnus albacares*, in CABO VERDE

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Abstract

Habitat quality changes with climate change, affecting water temperature and oxygen contents, and this change in habitat quality could trigger a shift in spatial distributions of the tuna species, *i.e.* yellowfin (YFT) and bigeye tuna (BET), in Cabo Verde with subsequent effects for the fisheries. The aim of PREFACE work package 12-2 is to investigate habitat use these species. Stramma et al. (2012) show expanding Oxygen Minimum Zones (OMZs) in the eastern tropical seas. Possible consequences of OMZ expansion to the marine ecosystem include loss of vertical habitat for high oxygen demand tropical big pelagic fishes like tunas and the associated increased risk of overfishing of these species by surface fishing gear. All fish were captured by means of hand line fishing and of rod fishing, applying circle hooks or Jhooks, depending on the fishermen's experience in using circle hooks. In April 2016, under-sized BET were caught besides two specimens of YFT all with around 1 m in length, which were tagged with External pop-up satellite tags (WildlifeComputers MiniPAT) (SF1, SF2). Whereas SF2 suffered from post-tagging mortality, SF1 ran successfully for 30 days. Swimming depth rarely was deeper than 80 m. No deep dives were undertaken. SF1 was deployed south of the island Maio, Cabo Verde. The specimen swam north along the east coast of Maio and then turned west between Maio and Boa Vista. In July/August 2016, two specimens of sufficient size were caught, but one specimen could not be retrieved with consequently unsuccessful tagging. SF3 was released on August 1 off Sao Vicente and ran successfully until September 4, 2016.



Typology of small-scale fishing gear impact on seabirds in the Senegalo-Mauritanian Upwelling

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Abstract

Situated in West Africa, Senegal has 700 km of coastline characterized by a large Eastern Boundary Upwelling Ecosystem providing significant biological productivity. Small-scale fishing plays an important role in the national economy of Senegal. The fishing gear used has a potentially direct or indirect impact on seabirds. To examine and evaluate this impact surveys were conducted on eight landing sites. Field surveys (2-3 days) took place in 2015 based on a standardized interview with questionnaire conducted with 225 small-scale fishermen. The results obtained indicate that longlines are the fishing gear that causes the highest rate of annual accidental seabird catch (63 % of seabird caught (n = 702)), followed by handlines (16%) and anchored gillnet (6 %). The Pomarine Skua (*Stercorarius pomarinus*) is the most captured bird annually (29 % of total captured birds), closely followed by the Cory's Shearwater (*Calonectris diomedea*) (28 % of captured birds) and the Northern Gannet (*Morus bassanus*) (13 % of captured birds). The village of Yoff is the landing site which has the highest rate of annual seabird catch with 39% of the total catch indicated, followed by Kayar with 19 % and Saint Louis with 14%, both situated on the Grande Côte. Further studies should be conducted in the entire Senegalese-Mauritanian coast in particular in the northern part of Senegal, to better evaluate the annual catch of seabirds. A great collaboration should also be established with longliners, handliners and anchored gillnet fishers to better quantify incidental catch of seabirds by the artisanal fishing gear and set up mitigation actions.

Keywords: small-scale fishing gear, seabirds, bycatch mitigation, Senegal.



The interest of smartphone use for field Fisheries and marine environmental sciences surveys in West Africa; a demonstration project AWAPhone

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Abstract

Data collection in fisheries and environmental sciences all over the world remain often difficult and expensive and particularly in low income countries as it is the case in West Africa. The national fisheries center have a regal mission to collect fisheries data and all other information relative to the marine environment. For such purpose all the fisheries center get numerous agents spread all along the coastline in the main national landing sites. The smartphone now get an impressive processing capacity and thus can do numerous tasks which were before limited to computer users, but also allow mobility in the field. The application developed for smartphone can now be easily developed and even delivered in open access. To take advantage of such technological progress well assimilated in West Africa (smartphone are now usual in West Africa) we have make some trials. The main interest of smartphone appear to be the data



acquisition, monitoring and transfer (*e.g.* ODK application) in near real time particularly for regular fisheries statistics in main landing sites and field interviews. Such method avoid errors during manual data acquisition and allow fast analysis. A side several of information have been collected during the trials as medusa and algal blooms, and stranding of fish or mammal as whales as well as turtle egg-laying but also extreme event as coastal erosion after a storm (*e.g.* ravage application; Cerema). These information/reports take advantage of spatial localization using GPS option. Obviously, fish species identification during data collection could be validated with remote expert and *e.g.* INRH have already developed an application (Guide des poissons du Maroc) for fish identification of main exploited fish species. Moreover, the fisheries center agents can inform on fishing interferences as well as illegal activities. We recommend the equipment of the fisheries agents with the development of regional ad hoc applications and procedures of data collection knowing that numerous others new applications of great interest for fisheries center in West Africa, will be found. Lastly, the smartphone can be associated to physic and chemical sensors to allow to upload and transfer data to the research center data center at low cost, quickly and foster collaborative action with civil society.

Keywords: Data collection, landing sites, monitoring near real time, fisheries statistics, field interviews, medusa and algal blooms, stranding, turtle egg-laying, extreme event, illegal activities, collaborative action.



Monitoring small scale fisheries (canoe) trajectories in West Africa: interest for management and research perspective

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Abstract

The West African small scale fisheries is often the main component vs industrial fisheries in biomass landing. More over the small scale fisheries is of major interest at socio economics level and is sometime a cultural activity. In Senegal the number of canoe operating in the sub region is around 16 000 to 22 000 canoes according to the source. Such huge fleet is particularly complex to manage and if industrial fishing fleet can be monitored with ad hoc system as VMS (Vessel Monitoring System) this is not the case (technical limitation) for fishermen canoe. In this work we present the results of a demonstration project showing the interest to monitor the canoe fishing trip using low cost portable autonomous global positioning system (GPS) developed by IRD. During one year some trial have been carry out in Hann a landing site of Dakar (Senegal). Preliminary results show that at a high temporal resolution the GPS allow to distinguish the fishing operation (e.g. line and seine) from the transit and exploration route. Such data allow to improve the estimation of the small scale fisheries fishing effort but also allow to know the maximum distance of operation to check potential interferences with the industrial fishing area (usually between around 6 to 10 nmi). We also report that fishermen based in a landing site can fish in another area and even land is catch in a third landing site, thus ecological and fisheries study made from data collected in landing site must be analyzed with care because au bias that such fishermen behavior can introduce in fisheries studies. The analysis of fishermen kinematics allow to improve the estimation of catchability coefficient, the estimation of economics costs, and



allow to set spatial Predator/prey model. Moreover the migration of fisherman from local to regional, which is sensitive in the sub region can be monitored. Conservation authorities can also use this information to check Marine Protected Area frequentation as well as local fishing committees the activities in the protected fishing area (ZPP). We want to underline the interest of such data in fisheries management which can also with little technical improvement play an important role for fishermen security at sea with the implementation of rescue system but also could allow participative data collection (physics and chemical parameters as well as fish sample) from small scale fisheries for manager and fisheries scientist. At the time of miniaturization of electronic component and big data analysis, we recommend the equiping of such system at large scale for small scale fisheries in West Africa.

Keywords: pirogue, fishing effort, fishing fleet, fishing trip, fishing operation, fishermen kinematics, of catchability coefficient, monitoring.



Robust estimation of acoustic abundance indices

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Abstract

In Northwest Africa, pelagic fisheries are a key economic sector. However, the scientific community is struggling to make satisfactory assessments of important pelagic species such as sardinella, due to the absence of relevant indices of abundance to adjust stock assessment models. The present work describes a new geostatistical method applied to acoustic data to estimate a new acoustic index based on the semi-quantitative modeling of acoustic densities. Acoustic energy is divided into binomial variables representing zero, low, medium, large and very large densities. A multidimensional geostatistical approach makes it possible to (i) map the spatial distribution of density classes and (ii) compute a new acoustic index of abundance for *Sardinella aurita*. The data used in this work are those of the Fridtjof Nansen research vessel surveys and the Mauritanian research vessel Al-Awam (2007-2010). The results obtained on the distribution of sardinella show a strong distribution of acoustic densities from one year to the next. The indices of abundance defined in this work were tested in the fit of an overall stock assessment model of round sardinella.



Semi-Markov model for the inference of the trajectories of fishing boats: application to the VMS data of the French and pelagic tuna fleet of the ZEEM

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Abstract

Analysis of VMS data could provide a reliable alternative for conducting pelagic stock assessments. For example, the fisheries community has been preparing GPS data for fishing vessels for some years. For the most part, the methods developed here are based on Markovian or semi-Markovian hierarchical models. This allowed us to show the informative potential of the VMS data. Once trajectories have been interpreted, these trajectories can be used to fine-tune fishing activities, as well as fish research activities when these phases are important for the trades concerned (large and small pelagics, for example). In this work, two semi-Markov models hidden to three and then five states were set up and validated using observational data to model the trajectories of tuna vessels in the Atlantic and Indian Oceans. These models yielded an estimate of the actual fishing effort deployed by the fleets concerned.



Horizontal distribution of dominant pelagic fish eggs in West African waters

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Abstract

Early life stages of dominant West African pelagic fishes, most of which are commercially important, are rarely studied especially in Senegalese and Mauritanian coastal waters. The aim of the present study is to examine the horizontal distribution of pelagic fish eggs of Atlantic sardine (*Sardina pilchardus*), anchovy (*Engraulis encrasicolus*), sardinella (*Sardinella aurita*) and horse mackerels (*Trachurus trachurus*.) in late winter and summer. The two seasons revealed two contrasting environmental conditions. While in late winter a permanent upwelling shaped the environmental conditions, in summer a warm tropical influx of surface water towards Mauritania was observed. We collected fish eggs in both seasons along the shelf coasts of Mauritania and Senegal. These data were then related to the sea surface temperature obtained at each sampling position from a conductivity-temperature-depth (CTD) instrument. This study showed that eggs of most species are concentrated in the coastal waters in front the Banc d'Arguin, in Saint-Louis and along the Petite-côte of Senegal. Moreover, it has been shown that spatial distribution of fish eggs is controlled by several factors such as temperature and also by the role of the continental shelf-break, as a mechanism of retention of fish eggs and larvae.



Effect of climate variability on decadal changes in small pelagic fisheries in the West African upwelling Ecosystem: the case of *Sardinella aurita* in Senegal

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Abstract

In Northwest African upwelling system, the populations of *Sardinella aurita* show evidence of important long-term natural fluctuations in their abundance, which have implications for medium and long-term forecasting of catches. These fluctuations seem to be related, among other factors, to large-scale climatic variability, raising important scientific and economic concerns. Understanding the processes affecting recruitment/abundance is a fundamental objective of fisheries biology. Thus, this study assesses the effect of climatic variability on the abundance of *S. aurita* in Northwest African upwelling system. Monthly data indicating the abundance of sardinella were first estimated from commercial statistics, using Generalized Linear Model techniques over the period 1966-2011. Abundance indices were then compared with environmental indices, at the local scale, a Coastal Upwelling Index (CUI) and a coastal Sea Surface Temperature (SST) index, and on a large scale, the North Atlantic Oscillation (NAO), the Atlantic Multidecadal Oscillation (AMO) and the Multivariate El Niño Southern Oscillation Index (MEI), using time series analyses, linear models and generalized additive models. The results showed that the abundance of sardinella is determined by a strong seasonal pattern and inter-annual fluctuations. The abundance of *S. aurita* peaked in spring and in autumn. The trend of the sardinella abundance was significantly correlated with the CUI, especially in autumn and spring. Interannual fluctuations of *S. aurita* abundance are respectively driven by the precocity and the duration of the upwelling season that is attributed to distinct migration patterns. *Sardinella* species also respond with a delay of around 4 years to the winter NAO index and the autumn CUI, and the AMO index respectively, either related to migration patterns. The wide variations in sardinella biomass are caused by variations in environmental



conditions, which should be considered in the implementation of an ecosystem-based approach in sardinella stocks management.

Keywords: climatic change, small-scale fisheries, North-West Africa, sardinella.



Dynamics of *Ethmalosa fimbriata* in Southern Senegal

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Abstract

The Bonga *Ethmalosa fimbriata* (Bowdich, 1825) is the most third small pelagic exploited in the Senegalese waters and is commonly consumed locally. Studies were conducted on the dynamics population of *E. fimbriata*. Monthly catches by landing sites of the Senegalese artisanal fisheries from 1996 to 2013 are provided by the CRODT. They are structured according to the fishing gear, per month and landing sites along the South Senegalese coast (between 14°36N to 13°36N and of 13°40N to 12°20 N). Growth parameters were determined using the length-frequency distribution per month over the period 2014-2015: the asymptotic length " L_{∞} "=38.2 cm total length, the asymptotic body weight W_{∞} = 956 g, the rate by which L_{∞} is approached $K=0.48$ and the theoretical age at zero length $t_0=-0.3$; which are used to estimate the optimum length (L_{opt}) of a cohort and its fecundity are maximum at 28.9 cm for an age $t_{opt}=2.8$ years. We estimate the total mortality, $Z=1.8$ per year, natural mortality, $M=0.4$ per year and fishing mortality, $F=1.4$. The current rate of exploitation (E) was found at 0.32 and the yield per recruit (Y/R) was estimated at 0.32, indicating that *E. fimbriata* stock is not fully exploited. We report a seasonal variability in the recruitment and biomass of the Senegalese part of the stock, with a clear trend downward in the analysis period. The seasonal signal shows three phases: between 1996 and 2001, recruitments are higher (50%) and took place from November to March. Over the period 2002 to 2008 (27%), the maximum values are observed May to September; and finally between 2009 and 2013 (23%), the recruitment of *E. fimbriata* peak is observed in the same time of the first phase (November to March). *E. fimbriata* is not fully exploited, that suggest a reallocation of the fishing effort on this species to decrease fishing effort on other species highly exploited as *Sardinella aurita* and so contribute to a better fisheries management of small scale activities in this area. Moreover that will



allow to fit to the theoretical maximum yield per recruit (Y_{pot}) for different species targeted by the same fishermen can prevent stock collapse.

Keywords: pelagic, optimum size at first capture, population dynamics, yield per recruit, virtual population analysis, West Africa.



Fishing effects on Senegalese Octopus stock in the context of climate variability

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Abstract

The common octopus *Octopus vulgaris*, a short-lived species undergo strong temporal variability of their abundance and recruitment closely depending to environment conditions. This study investigates the effects of fishing pressure and environmental variability on octopus stock in the Senegalese waters. First, monthly catches-at-age were estimated based on catch-at-weight data and a polymodal decomposition constrained by a given growth curve. Second, octopus recruitments and fishing mortalities were then estimated using a catch-at-age analysis performed on a monthly basis. Yield and biomass per recruit were simulated using a Thompson and Bell model which allows to generate a diagnostic of fishing impacts. Then, the abundance index estimated using a generalized linear model was inputted in Fox production model including environment effects. Finally, relationships between on a monthly step recruitment, abundance and environmental indices were finally assessed by a generalized additive model (GAM). The results showed that catches were performed 5 months after the recruitment. This latter was strong in spring and influenced the annual biomass. The octopus stock appeared to be consistently fully exploited both in the Thompson and Bell model and Fox model. The MSY strongly varied with weak or strong SST and CUI. Increasing fishing mortalities would decrease individual weight octopuses. The spawning stock biomass was linearly correlated to recruitment (83 %, $p < 0.05$). Moreover, the recruitment closely depended to the upwelling intensity. The best model including 'year', 'month' and 'MEI', 'CUI', 'AMO' explained 84.9 % of the overall variability. But nonlinear relationships between octopus abundance and MEI, AMO, and CUI were found, while SST and NAO were linearly correlated. The results were finally discussed with existing literature review and the groundwork of octopus management was set.



Keywords: Octopus, generalized linear model, generalized additive model, Fox model with environment effect, cohort analysis, yield per recruit, fisheries management, Senegal.



Climate-driven shift of *Sardinella aurita* stock in Northwest Africa ecosystem as evidenced by robust spatial indicators

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Abstract

In Northwest Africa, the small pelagic fish are in abundance and play a crucial role for the food safety of populations. The pelagic resources are exploited both by small-scale artisanal and industrial fleets. The landing structure of the countries in the region has been in perpetual change during the last years. The sardinella has been more and more landed by fishermen in Morocco, while the sardine has become a target by fishing vessels in Mauritania and Senegal. This indicates a modification in the distribution areas of pelagic resources. To verify this hypothesis, an outstanding database consisting in 14 acoustic surveys with a consistent and high sampling intensity (2263 trawl hauls) conducted by the RV Fridtjof Nansen from 1995 to 2015 was investigated in this study to identify trends in distribution shifts in pelagic fishes. A focus was made on sardinellas and the main species in the southern part of the region. Two strong spatial indicators are used in this study: the latitudinal extreme location and the barycentre of biomasses. Two clear trends can be observed from the data analysed. Firstly, in the southern and tropical part of this system the typical trend is that pelagic species show an increasing northward distribution. This applies to *S. aurita*, *Trachurus trecae*, *Chloroscombrus chrysurus*, *Sphyraena guachancho* and *Brachydeuterus auritu*. A second group is observed, those that do not show any clear trend in distributional shift, but where the distribution is stable over the period. The typical species observed here are *S. maderensis* and *Decapterus rhonchus*. Despite some variations in the upwelling intensity, we show that the sea surface temperature is by far the main parameter to explain this northern shift. We also discuss the likely – and largely unknown – influence of the under-estimation of the detections because of the absence of sampling in the shallow



coastal zone. The impact of such displacements is also discussed in term of regional management of these shared stocks.

Keywords: small pelagic fish, North West Africa, distribution changes, spatial indicators, sardinellas.

Estimation of the acoustic reflection indexes of the two main small pelagics in the northwest African region: sardine and sardinella

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Abstract

Reflection index equations (TS) are required for the conversion of backscatter energy of fish in abundance. These equations should ideally be applied by species or genus, but the standard equation $TS \text{ (dB)} = 20 \log L \text{ (total length)} + B20$ applied to all small pelagic species in Northwest Africa come from the Atlantic herring (*Clupea harengus*) with a B20 value equal to -71.9 dB. To examine the TS equations of the two main species in the region, European sardine (*Sardina philchardus*) and round sardinella (*Sardinella aurita*), the shape of the swim bladders was observed by X-rays and the Kirchoff-ray model (KRM) was used to estimate TS. The results show that the B20 values of the two species are higher than the value currently applied and that the sardine has a higher reflection index TS than that of the sardinella.

Keywords : target strenght, fisheris acoustics, stock assesement, small pelagic.



Study of the performance of the Nordmore grid in the gamba shrimp fishery in Senegal

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Abstract

Demersal shrimp fisheries, which are not very selective, generate large discards and / or bycatch, generally composed of crustaceans, fish and mollusks of different size classes. The fishing gear used in the capture of shrimp is one of the least selective; contributing to more than 27% of global bycatch. The ratio of by-catch biomass / target catch biomass is generally 5/1, and can reach 8/1 in the case of the farfantopenaeus (ex.: *Penaeus*) notialis coastal shrimp in Senegal and between 2.5 / 1 and 3 / 1 in the deep-shrimp fishery. As part of the implementation of the deep-water shrimp management plan *Parapenaeus longirostris* in Senegal, the fisheries administration, in collaboration with its technical and financial partners has committed to the introduction of the Nordmore selectivity device on the deep shrimp trawl, in order to ensure responsible fishing. The objective of the study is to test the performance of the Nordmore grid selectivity system under commercial deep-sea shrimp fishing conditions of *Parapenaeus longirostris* in Senegal. The offshore experiments took place from 3 to 13 October 2015, on board a commercial vessel (HISPASEN IV) of the HISPASEN armament. Three Nordmore grids characterized by different spacing between bars (24, 28 and 30 mm) were tested on the experimental trawl. The spacing between the bars of the three grids was determined on the basis of the biometric data of the shrimp *Parapenaeus longirostris*. The fishing grounds are the Center areas (Dakar to the northern border with the Gambia) and especially North (Dakar to Saint-Louis). After each trawl, the trawlers were emptied separately on the deck. The catches were processed according to the traditional methodology of CRODT: total sorting or, failing this, partial sorting and sampling if the catch is too large. The total length of the fish was measured to the nearest centimeter. After each grid change, 250 prawns were randomly selected from the 3 compartments (control trawl, experimental and pocket) for cephalothoracic length (LCT) and width



measurement, to the nearest mm. Control and experimental trawls, was timed and recorded. In both the trawl and the trawl, the number of shrimps broken and the amount of shrimps intact were determined in order to assess the quality of the shrimp. The results of this selectivity campaign Satisfactory than in the previous campaign. Whatever the spacing (24 mm, 28 mm or 30 mm), the Nordmore grid made it possible to exclude large individuals of several species of commercial interest (Saint-pierre and brotule) or not (rays, sharks, Etc.). The gamba shrimp loss analysis, i.e. the ratio of the weight of prawns in the pocket to the weight of the shrimp in the experimental trawl including the pocket, indicate a significant difference ($\alpha < 0.05$) between the three spacer grids 24, 28 and 30 mm. Indeed, the 24 mm grid rejected 18% of the shrimp on average, with minimum and maximum values of 10 and 43% respectively. The 28 mm grid showed average discharge of 16% and minimum and maximum values of 3 and 27%, respectively. The grid of 30 mm stands out with percentages of shrimp losses gamba oscillating between 3 and 20% with an average of 8%; And a by-catch / shrimp-gamba ratio of around 2.2 / 1, lower than the world average for this type of fishery (5/1).

Keywords: Nordmore grid, By-catch, Selectivity, *Parapenaeus longirostris*, Senegal.



Algae, an important lever for development: state of knowledge in Senegal

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Abstract

Senegal, with its 700 km of coastline and its freshwater and brackish water network, is characterized by rich and diverse algae flora but little known scientifically. Algae, however, offer very important ecological, economic and socio-cultural services in relation to their benefits and possible uses in fields as varied as food, health, agriculture, fisheries and aquaculture. It thus appears that the current diversity of macroalgae is over 260 species distributed in 105 genera on the Atlantic coast of Senegal. These genera belong to the families of Ulvophyceae (13), Phaeophyceae (19) and Rhodophytes (73). The study of microalgae made it possible to inventory 125 species of Cyanophyte divided into 30 genera and 4 families and 648 species of microalgae grouped in 166 genera and 26 families. In the marine environment, 145 species of microalgae distributed in 73 genera and 57 families were recently recorded in Senegal. In this marine microalgal flora, Bacillariophyta or diatoms dominate strongly with 60% of the total specific richness. They are followed by Cyanophyta with 33.10%. The other phyla are less representative with 3.45% for Chlorophyta, 2.76% for Dinophyta and 0.69% for Chromophyta. Most of these species have been collected and conserved. In terms of ecology and the environment, our studies have revealed the presence of certain species that are potentially toxic or characteristic of polluted environments belonging to genus *Lyngbia*, *Nitzschia*, *Cyclophora*, *Scenedesmus*, *Ulothrix*, *Oscillatoria*, *Phormidium*. In addition, some invasive algae have been identified. From the point of view of valorization and biotechnology, *in vitro* or *in situ* cultivation trials were conducted on species such as *Meristotheca senegalensis*, *Hydropuntia rangiferina*. Moreover, other possibilities for the development of algae are also studied (aquaculture, amendment). In terms of training, a Master's degree and doctoral training in Taxonomy, Biodiversity, Ethnobotany and Natural Resource Conservation have been set up with a specialization in the study of algae. These results thus constitute an important database for the scientific community, and tools for decision-making. They also offer real opportunities for algae valorization and



training of human resources. Finally, in the context of climate change, seaweed farming makes it possible to sequester the Carbon by creating biomass that can be developed into biomass (bioenergy), these algae also have the capacity to fix certain pollutants.

Keywords: Algae, biodiversity, impacts, valorization, training.



Thematic Session 3: “Physical-biogeochemical coupling: processes and control of small pelagic fish”. Afternoon 14th December 2016. Plenary room Dara

CHAIRMEN: Éric MACHU (IRD, France), and Vamara KONÉ (CRO, Ivory Coast)

The structure of the plankton communities and the interactions between its components has a decisive role in determining the dynamics and productivity of small pelagic fish in upwelling ecosystems. Observations and modelling activities conducted over recent years have helped developed novel and more realistic ecological principles on the structure and dynamics of upwelling food webs, and on the interactions of its components. 8 talks were presented during session 3, 4 related to Task 3.1 (Key biogeochemical processes: control of primary production and the oxygen minimum zone), 3 to Task 3.3 (Recruitment of *Sardinella aurita*) and one beyond the contours of WP3 about environmental pollution around the Cap vert peninsula. Within the 3 posters, one has presented an update of the work carried out on dust collection during previous surveys at sea. Y. Kande extended the work orally presented on pollution around Dakar by exhibiting a poster on the spatial analysis of this pollution (best poster award). The last poster presented the approach of phytoplankton biodiversity followed during AWA to relate it to environmental conditions.

Recommendations

- Promote the development and acquisition of low cost sensors (project proposal ?). NB: example of cheap ocean color sensor interfaced with Arduino
- Pollution issue: define standards adapted and meaningful for West African **countries (rather than using Canadian or European standards ...)**
- Define a strategy in terms of observation and modelling activities at the regional level
- Improve communication between scientific thematic communities in order to better transmit key knowledge-based messages at the interface of different disciplines
- In front of the great complexity of marine coastal ecosystems, promote sound realistic steps towards end-users aspiration
- Better organise the regional network for fund raising
- Make efforts for delivering meaningful indicators
- At the regional levels, position the community on the issue of fossil fuel exploitation, promote the idea of dedicating a percentage of the incomes of such exploitation in **scientific activities (reference points, monitoring, ...)**
- Lack of funding shouldn't prevent scientists to position themselves in societal issues since the expertise remains in their hands

Mister Khassoum Correa received the best presentation award for his oral communication and Miss Yoba Kande for her Poster presentation.



Oxygen variability over the southern Senegalese shelf

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Abstract

The shelf of the southern part of the Canary upwelling system along Senegal and Mauritania is bordered by an oxygen minimum zone whose center is located at about 400m depth above which is superimposed another minimum shallower than 200m. As a consequence, dynamic upwelling bring hypoxic waters (60 $\mu\text{mol/l}$ or 1.34 ml/l; 15°C) over the shelf during the upwelling season from December to May. An oceanographic survey was conducted in the heart of the upwelling season (7th-17th March 2012) over the southern Senegalese coast. Integrated physical and biogeochemical measurements were acquired and allowed us to measure for the first time to our knowledge an anoxic event in Senegalese waters with dissolved oxygen concentrations falling to zero. Very high concentrations of nitrite (11 mmol/m³) mirroring nitrate reduction and nitrate/nitrite deficit to phosphate highlight intense denitrification taking place in this oxygen-depleted water body. The record of this event by 30m depth occurs after a relaxation phase of the upwelling associated with a surface northward advection of warm waters from the south of the plateau. A subsurface north-westward advection of water consistent with wind relaxation was recorded near the anoxia event but inertial wave can not be dismissed for driving this northward flow. A diatom biomass was measured at 18 mgChl/m³ along the shore two days earlier. Apparent Oxygen Utilization and oxygen concentrations support the decay of phytoplankton biomass at the end of the survey. Whether the anoxia is due to the local decay of fast sinking dead diatoms or to a specific



3D history of the water body is difficult to establish. However, recently upwelled waters south of Cape Verde peninsula are advected southward and cover the entire shelf with undersaturated waters. Frequent occurrence of high phytoplankton biomass along the coast suggests that anoxia and denitrification could occur recurrently in this region during the degradation of organic matter. These observations take place in a long term monitoring of bottom oxygen concentrations in this very productive coastal region of the world.

Keywords: oxygen minimum zone, hypoxic waters, nitrate/nitrite, diatom, undersaturated waters Canary upwelling system, Senegal, Mauritania.



Distribution and Biomass of phytoplankton over the Senegalese shelf: A need for regional ocean colour algorithm

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Abstract

The acquisition and processing of 1179 images from the SeaWiFS (Sea-viewing Wide Field-of-view Sensor) sensor on board the Seastar satellite enabled us to monitor the chlorophyll a (Chl-a) between December 2003 and November 2007 over the Senegalese plateau. The level 1 data from this sensor were processed using an algorithm combining a neuronal classification and Self Organizing Maps before retrieving chlorophyll-a concentrations with a variational method (S-NV). The results obtained allowed us to distinguish a typical seasonality and a strong spatio-temporal variability of phytoplankton over the Senegalese plateau. The spatial distribution is marked by a maximum concentration along the coasts and especially south of the Cape Verde peninsula. Temporal variability is marked by a concentration that increases from winter to spring with a high spring concentration that exceeds 13 mg/m³ on average, a sharp decline in summer, and a new increase in autumn. The phytoplankton mean biomass estimated using the standard OC4V4 SeaWiFS algorithm was ~5 mg/m³ while the S-NV algorithm provided a mean concentration of ~4 mg/m³. Although estimates are comparable, S-NV allows to obtain a mean annual coverage over 50% while S-STD reached only 24%. Seasonal differences can be even stronger. Over the investigated period, years 2004 and 2007 show the highest concentrations in spring. S-STD give concentrations over 17mg/m³ whereas S-NV provide values of ~6mg/m³ for the same year/month. Results indicate that S-NV algorithm generates concentrations in better agreement with in situ observations than the standard algorithm.



Planktonic diversity in the Senegalese upwelling system: what can we learn now from the the spatial observation?

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Abstract

Remote sensing techniques based on the measurement of the “Ocean color” allow to estimate a proxy of the phytoplanktonic biomass through the estimation of “chlorophyll a” concentrations in surface waters with generic algorithms, now from almost two decades, in a near operational way. Although it incompletely describes the water column structure, this estimation is often used to estimate the marine primary production of a full ecosystem. Despite the fact that the precision of such measurements largely varies according to optical properties of the atmosphere and ocean (between 30% in oligotrophic clear water and much more in coastal waters), the optimal use of the “Ocean color” can be used in a more qualitative way, to estimate other significant patterns. The most promising is the statistical estimation of occurrences of Phytoplanktonic Functional Types (PFTs) from the analysis of differences in the reflectance spectra of the sea water. Other techniques, from the emergence of multi-spectral measurements, that allow a much more precise estimation of reflectance spectra from the sea surface, or the direct measurement of the natural fluorescence of the phytoplankton, related to the photosynthetic activity, are surprisingly extremely under-used. Moreover, most of these techniques are poorly related to in-situ measurements, a key point in their application to ecological studies. We investigate some reasons of such a situation and propose some ways to improve it.

Session 03

Study of the overall toxicity, water quality and microplastics of the peninsula of Cape Verde, Senegal

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Abstract

Currently only thirteen percent (13 %) of domestic wastewater produced daily in Dakar is being treated. Industrial and agricultural activities and domestic waste are the source of significant pollution of the marine and coastal environment in Senegal. Our work focuses on assessing the overall toxicity of sediments, the microbiological and chemical quality of water, and the quantification of microplastics around the Cape Verde Peninsula. Physicochemical measurements are carried out in situ and the sampling points correspond to effluent outlets, compared to two reference stations that are assumed to have little or no contamination. A total of 15 sites were collected: Cambéréne, Yoff Tonghor, Ngor, Almadies-Vivier, Ouakam, Magdalen Islands, Soumbédioune, Dakar Dantec, Hann1, Hann2, Port of Dakar, Lac rose, Guédiawaye, Mamelles and UCAD. High sediment toxicity [100% ADL (Larval Development Anomalies)] was demonstrated at sixty percent (60%) of the sites.



Twenty percent (20%) of sites have intermediate toxicity ranging from 30% to 60% ADL). Sites with the lowest toxicity (up to 30% ADL) accounted for only 20% and no ADL values were reported as nil. Mercury levels in sediments are very low, with a notable variation between sites in the north and those in the south of the peninsula. Coliforms (*Escherichia coli*) and enterococci are present in large quantities at most sites (64%). The presence of *Salmonella* is noted only in Cambéréne. The results of mass spectrometry analyzes also show overall high concentrations of heavy metals (Al, Cd, Cr, Co, Cu, Hg, Ni and Zn) with the exception of Fe and Mn, which are below the criteria for "Protection of acute and chronic aquatic life". Microplastic analysis revealed high mean values: 25,864 mpts / km² (42 g / km²) for microplastics (300 µm and 5 mm) and 37,441 MPTS / km² (97.33 g / km²) for macroplastics > 5 mm and < 200 mm). All the results obtained show, according to the pollutants, the importance of the sediment granulometry, the nature of the pollution, the size of the effluents, the anthropic contributions, the atmospheric falls like that of the behaviors of the populations. Our results are discussed with a view to environmental monitoring at the local, regional or national level. They will also allow this approach to be extended to other contaminants (hydrocarbons, metals, pesticides, megaplastics) as well as bio-trials in the various compartments of the marine and coastal environment (sediments, waters, fauna and flora). An in-depth statistical analysis will also allow optimization of ecotoxicological monitoring, sampling and analysis strategies.

Keywords: Global sediment toxicity, Microbiological parameters, Heavy metals, Microplastics, Dakar, Senegal, West Africa.



Study of the spatial variability of marine pollution around the peninsula of Cape Verde

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Abstract

Marine pollution, the scourge of modern times, is due to the runoff of domestic and industrial waters as well as to various anthropogenic activities, i.e. products and objects deliberately or accidentally discharged into the sea. The samples taken from 11 sites on the Cap-Vert peninsula in Senegal, indicate the presence of certain polluting substances in varying amounts. The objective of this work is to study the correlations between the physical, microbiological and chemical parameters in order to highlight the similarities between the sites and, if possible, to determine the most relevant parameter(s) to characterize the pollution. PCA results have shown that some sites appear to be less chemically polluted than others that are more polluted with eutrophication and chemicals (e.g., copper, mercury). From a physical point of view, for example, we observe that the characteristics of sediments (large silt, clays, fine silt) are related to certain chemical parameters. The AFC performed between the overall toxicity of the sediments and the microbiological quality of the water shows that the site of



Ouakam has a medium toxicity and a good microbiological quality while that of Cambérène and the Vivier are characterized respectively by bad and good quality but also by low toxicity at both sites. The two sites of Hann (Hann1 and Hann2), Soumbédioune, Ngor, Yoff Tonghor and Dakar Le Dantec are characterized by high toxicity and poor microbiological quality. Those in the Madeleine Islands and the Port of Dakar are characterized by high toxicity and bad microbiological quality. Moreover, as expected Soumbédioune appears as the most polluted sites in terms of microbiological load. The interest of the multivariate approach (ACP and AFC) is then discussed in this type of analysis.

Keywords: waste water, global sediment toxicity, trace metal, microbiology, Cap-Vert peninsula, Senegal.



Session 03

Influence of fine scale processes on fish larvae retention in the Senegalese Upwelling region

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Abstract

Mesoscale physical processes can affect the fate and distribution of fish eggs and larvae by aggregating and retaining them in favorable habitats or spreading them away to inappropriate areas. Here we examined the effect of fine scale processes on fish larval retention through a biophysical model of the early life stages of *Sardinella aurita* taken as an example within the Senegalese upwelling region. A set of 3 ROMS configurations is used from coarser (~9km, 7.5km) to finer (~2km) resolution. The ICHTHYOP individual based model is then forced by the different model experiments. To take into account more realistic physical forcing, the finer resolution configuration was used to test the effect of synoptic winds and tides. We first show that a finer resolution of physical processes provides a retention twice stronger. In addition that experiment shows 2 contrasted results in the region which differ from previous modelling work : 1) the northern domain considered so far as a low retention area displays high retention values and 2) a better resolution of the hydrodynamic of the Senegalese shelf modifies significantly the retention spatial patterns in the southern area although the seasonality remains similar. Simulation using synoptic winds and tidal forcing suggest a reduction of retention induced by a higher larval mortality due to enhanced export transport and stronger lethal temperature exposure.



Population traits in Small pelagic fish model: emergence from interactions between turbulent environment and individual behaviors in Upwelling Systems

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Abstract

Small pelagic fish (SPF) species are heavily exploited in the four main eastern boundary upwelling systems (EBUS), including both Atlantic African ones, as their transformation are increasingly used in the world food chain. Management rely on regular monitoring, but there is a lack of model for population traits emergence and evolution according to the variability of the environment. We attempt to extract some general rules based on the analysis of a life cycle biophysical individual based model applied to the round sardinella (*Sardinella aurita*, Clupeidae) population off North West Africa. Our analysis focused on the processes responsible for seasonal migrations, spatio-temporal body-length distribution, and inter-annual biomass fluctuations. These patterns were found at individual level in the dynamic change of preferred habitat, and variability in exploration capacities. The former resulted from complex interactions between natal homing behavior and environmental variability, while the last was determined by individual swimming capacities, the mesoscale structure of the



habitat and the horizontal currents. Observed spatio-temporal abundance variability emerged from a superposition of numerous distinct individual life histories. This work also suggested an alongshore pattern in size distributions confirmed by in situ surveys. New insights about population structure are provided, with a focal area in Mauritania and mainly two migrating sub-populations centered at 18°N and 21°N, respectively. Inter-annual biomass fluctuations were linked to variability in Sahara Bank's fish recruitment, itself depending on southward current intensity. The identified processes constitute an analytical frame that can be transposed to study Small pelagic fish in all eastern boundary upwelling systems and used to study potential effect of regional climate change.

Keywords : biophysical individual based model, *Sardinella aurita*, North West Africa, seasonal migrations, body-length distribution, biomass fluctuations, preferred habitat, homing behavior, swimming capacities, mesoscale structure.



Phytoplankton distribution and biodiversity on the shelf of southern Senegal

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Abstract

Two main reasons make phytoplankton communities' key components of upwelling ecosystems. First of all they are closely linked to small pelagic fish which are microphagous planktivores and dominate these oceanic provinces. They are also tightly coupled to physical and chemical conditions and hence very sensitive to climate change. During the last 5 years a significant effort of observation of these communities has been conducted in the Senegalese coastal waters. During five field trips conducted over the last 5 years (4 during the upwelling season and one at the end of the rainy season), we collected concentrations through underway fluorimetry (Scanfish undulating vehicle, ship fluorometer, fluoroprobe), ocean colour and pigment analyses (HPLC, cytometry). The phytoplankton biodiversity was studied through pigments, microscope taxonomy and metagenomics. We will present here an overview of the different analysis and the actual results obtained in the southern Senegal coastal region.



A case study of aerosol trace element deposition to Moroccan coastal waters: Lessons from the AWA Project

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Abstract

Aerosol deposition is an important source of trace elements (TEs) to the surface ocean. Due to the proximity to the Sahara and Sahel Deserts, the North Atlantic receives some of the highest inputs of mineral dust globally (~100-220 Tg yr⁻¹). In terms of biological production, this significant input of TEs contributes to the greater efficiency of the Canary Current Eastern Boundary Upwelling System (CC-EBUS) relative to its Pacific counterpart; both of which support socio-economically important fisheries. However, mineral dust is just one component of atmospheric aerosols. Human activities (e.g. fossil fuel combustion, agricultural practices) also contribute to the atmospheric load, resulting in changes in the elemental ratios with respect to crustal composition. In order to investigate the TE composition of aerosols to the CC-EBUS, aerosol samples were collected from three coastal locations in Morocco (Agadir, Laayoune and Dakhla) as part of the EPURE project, over an annual cycle (March 2015-2016). Here, we present TE composition data, with a focus on cadmium (Cd); an element of concern for human health, which is toxic to phytoplankton above a certain threshold, despite being essential for carbon uptake in some genera. A poor correlation between aerosol aluminium (Al; a tracer for mineral dust inputs) and Cd ($r^2 = 0.31$, $P = 0.091$) suggests that mineral dust was not the dominant source of Cd during this study. However, coincident peaks of Al and Cd did occur occasionally, suggesting that during dust events mineral dust could be an important source of Cd. In addition, despite the presence of phosphate mining activities south of Laayoune, we did not observe significantly different ratios of Cd/Al



relative to the other two stations. Using aerosol samples collected during the AWA campaigns off Senegal (2013, 2014) we have estimated the solubility of TEs from West African/European aerosols to provide an estimate of the flux of potentially bioavailable TEs for marine micro-organisms.



LMDz simulation of transport and deposition of mineral dust over the North Eastern Tropical Atlantic

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Abstract

Saharan dust represents more than 50% of total desertic aerosols emitted around the globe. The advection of desertic aerosols by air mass flux from West Africa to the Atlantic enriches the surface of the ocean in nutrients through atmospheric deposition. It has been shown that dust deposition is seasonal and in opposite phase between the eastern and the western Tropical Atlantic. This seasonality is driven by processes distributing the aerosol through the atmosphere over the continent and by other processes involved in the atmosphere-land-sea interactions. We used the LMD General Circulation Model in a West Africa regional configuration to investigate the processes at work in the fate of dusts. We quantify the atmospheric dust dry and wet deposition respectively in winter and boreal summer for the year 2006. In these estimates, we use simulations with aerosols scavenged by convection or convective features and large-scale precipitations. In the region between 35°W-18°W (longitude) and 0°N-25°N (latitude), we find that 2694 $\mu\text{g}\cdot\text{m}^{-2}\cdot\text{mth}^{-1}$ are deposited by dry process and 157 $\mu\text{g}\cdot\text{m}^{-2}\cdot\text{mth}^{-1}$ are washout in the atmosphere, representing respectively 95% and 5% of the total dust deposition in January. In July, the wet deposition increases up to 58% (1719 $\mu\text{g}\cdot\text{m}^{-2}\cdot\text{mth}^{-1}$) while dry deposition reaches only 42% (1261 $\mu\text{g}\cdot\text{m}^{-2}\cdot\text{mth}^{-1}$). These deposition are related to the physical processes dominated by the sedimentation near the emissions sources, the turbulence in the marine boundary layer in winter and the large-scale rainout in summer over the Atlantic Ocean.



A biophysical model of *Sardinella aurita* early life history in the northern Gulf of Guinea

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Abstract

Sardinella aurita is the most abundant small pelagic fish in the northern Gulf of Guinea. Its reproduction and recruitment depend crucially on environmental conditions. We developed a biophysical model of *S. aurita* early life history by coupling offline an individual-based model with the regional oceanic modeling system (ROMS). We used this model to investigate the main factors driving variability in eggs and larval dispersal and survival in the northern Gulf of Guinea. Precisely, individuals were released from different spawning areas along the coast and tracked for a period of 28 days corresponding to their planktonic phase. Individuals that remained in the coastal recruitment areas at an age more than 7 days, at which they can supposedly actively retain themselves in a favorable area, were considered as recruited. Simulation results show the importance of the spawning areas around Cape Palmas and Cape Three Point where cyclonic eddies trap eggs and larvae along the coast, preventing their advection offshore by the Guinea current. The spawning period also plays a key role in the recruitment success, with highest coastal retention obtained during the major upwelling period (July to September). We find that, a second retention peak can occur during the minor upwelling period (February to March) when larval mortality due to temperature is included in the model. These results are in general agreement with knowledge of *S. aurita* reproduction in the northern Gulf of Guinea. The spawning depth also influences the recruitment success of *S. aurita* in the northern Gulf of Guinea. The retention increasing with the spawning depth.



Keywords: hydrodynamic model, individual-based model, *S. aurita* early life stage, recruitment, connectivity, upwelling, northern Gulf of Guinea.



Thematic Session 4: «Economics integrated into the ecosystem approach to marine management». Afternoon 13rd December 2016, Signara 1 room

CHAIRMEN: Didier JOUFFRE (IRD, France), Joern SCHMIDT (University of Kiel 'CAU', Germany), and Moustapha DEME (ISRA/CRODT, Senegal)

Session 4 was an inter-disciplinary panel covering a broad range of thematic and methods. The session included presentations related to the economics and ecosystem approaches to marine management in the West Africa region. Along with economics and ecosystemic studies *sensu stricto*, the session 4 had presentations and discussions on transdisciplinary approaches, modelling and methodological studies related to the marine management of West-Africa waters

Price session: the price of the best **oral communication** was delivered to **Kane Elimane Abou et Ball Abou Ciré**; the price of the best **poster** was delivered to **Ely Beibou**.

Recommendations

To advance sustainable development in West-African coastal countries, the recommendations from session 4 are, to advance collaboration through scientific projects and research activities, including the organisation of topical workshops and expert groups, focussing on:

- Extending and intensifying the existing regional approaches on modelling, ecosystem indicators, regional information systems
- Evaluating the fiscal policy on national and regional level in relation to fishing capacity, economic performance of the fleets and marketing the catch (local food security vs. export)
- Continuing the scientific work of the consortia that have been formed through AWA also emphasizing on the development and exchange of research infrastructure (laboratories, research vessels, personnel)
- Focussing on shared resources, and on resources important for local food security and on resources of high economic value, specifically taking the value chain into account.
- Updating and further developing indicators reflecting environmental, economical and societal aspects of fisheries in West-Africa, including specifically fisheries performance indicators, employment, retirement provision
- Establishing operational modelling approaches to support decision making
- Working interdisciplinary and integrate the actors in the system, thus following a trans-disciplinary approach.
- Widening the collection of economic and social data.





Socio-economic importance of Ethmalose and the spatial and temporal distribution of its abundance in Guinea

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Abstract

In Guinea, among the small pelagics exploited, ethmalose is the subject of an intense maritime artisanal fishing and constitutes one of the most important species from an economic point of view. The present study aims to highlight the socio-economic importance of the fishing of ethmalose and to analyze the spatio-temporal distribution of its abundance. We exploited the database of the National Center for Fisheries Science in Boussoura to estimate: (i) the number of canoes targeting ethmalose, (ii) the evolution of landings over the period 1995-2013, (iii) the number of jobs generated by this fishery and (iv) breeding periods. The results indicate that the number of pirogues targeting ethmalose is constantly increasing. From 978 in 1992 to over 3,800 in 2016. At the same time, landings increased from 23,613 kg in 1995 to more than 74,900 kg in 2013. Over the period 1995-2013, catches of ethmalose constituted one third of artisanal landings. These landings are unevenly distributed in time and space. The period from October to January corresponds to good fishing. Low catches are recorded from February to September. The main fishing grounds are the Boké and Boffa prefectures on the northern coast, where seasonal upwelling is prevalent. Ethmalose reproduces throughout the year with a peak observed in September. The direct employment generated by this fishery is estimated at 17 000.

Keywords: Ethmalose, Guinea, abundance, distribution, jobs.



Session 04

Profitability and economic drivers of small pelagic fisheries in West Africa: a twenty year perspective

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Abstract

Small pelagics are the main fish resource in North West Africa. In Senegal, these are mainly sardinellas (*Sardinella aurita* and *S. maderensis*) and bonga shad (*Ethmalosa fimbriata*). The fisheries, mainly encircling gillnets and purse seines, are predominantly performed by artisanal fishers and are of great importance for the Senegalese economy and for food security in the region. However, in recent years, the main conditions for these fisheries have changed and recent observations have shown strong declines in profit. An analysis over the last twenty years (1993-2013) show that the fisheries lost profit between 65 and 100 % while operating costs increased by 25 and 90 %, for encircling gillnet and purse seine, respectively. While the fuel price dominates as determining factor during the survey period, important other drivers during the last five years were a decrease in fish biomass and an increase in fishing effort.

Keywords: Small pelagics, *Sardinella aurita*, *S. maderensis*, *Ethmalosa fimbriata*, encircling gillnets, purse seine, food security, operating costs, North West Africa.



Session 04

Fishing policies and changes in Senegalese artisanal fisheries in a context of overcapacity

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Abstract

Senegal has set up policies to reconcile the goal of rapid and sustainable growth, the fight against poverty and the sustainable management of natural resources. Significant changes were observed in the Senegalese artisanal fisheries. These dynamics are responses of artisanal fishermen on a one hand to established policies and on the other hand to medium and long-term fluctuations (abundance) and short-term variations (availability/accessibility) of resources. The dynamism of the artisanal fishing combined with different support policies is now resulting in overcapacity which threatens the sustainability of the fisheries. Indeed, for most Senegalese fisheries, overcapacity signs were reported by both empirical knowledge and scientific results. In this word we will discuss on the adequacy of policies with the constraints and current issues in the fisheries sector and produce knowledge that can integrate reported changes in the processes of decision making and implementation of policies.



Session 04

Significant ecological events in marine ecosystems in West Africa: an inventory duty

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Abstract

An inventory of significant ecological events in West African coastal marine ecosystems over the last decades has been conducted by combining three approaches: a document review, a survey of fishermen and an analysis of fishery statistics. This method allowed to identify an initial series of events that took place over the period 1970 to 2014, mainly in Senegal. This series refers to groups or species of fishery interest, of which fluctuations in abundance, either sporadically or in the longer term, have had an impact on the fisheries that exploit them. These species include Baltic carolinensis, Tassergal (*Pomatomus saltator*), octopus (*Octopus vulgaris*), Thai murex (*Stramonita haemastoma*), West African strombe (*Strombus latus*) and belt (*Trichiurus lepturus*). This paper describes and analyzes the events identified during this inventory, in terms of what is known and/or what is perceived. It highlights differences in perception between actors (scientists vs professionals in the fishing sector) and sources of information. These differences invite us to think about strategies to improve our ability to perceive and record the ecological changes occurring in marine ecosystems and to document them in real time. Such reflection is necessary in West Africa as elsewhere, since this knowledge is an essential prerequisite for a better understanding of the functioning of the ecosystems in question and to meet the needs of their management, exploitation and conservation.

Keywords: Ecological event, marine environment, West Africa, development, exploitation, conservation.



TAC and Experimental Pink Lobster Fishing Quotas, a New Opportunity for Economic Development in West Africa: What Values Added to the Mauritanian Economy?

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Abstract

Over the last thirty years, the dramatic state of some fish stocks in the Canary Current Marine Ecosystem has gradually highlighted the limits of fisheries management in West Africa. The Ecosystem Approach, advocated in Mauritania, calls for changes in the perception of fisheries management to incorporate considerations of participatory management of TACs and fishing quotas. At the heart of this approach is the experimentation, in a research program, of a Total Allowable Capture of 800 tonnes of pink lobster "*Palinurus mauritanicus*". This paper presents the methodological tools for analyzing / evaluating the economic performance of the exploratory lobster fishing. Survey results show that over the period February 2015 to January 2016, fishing was based on a total of 23 ships. 52% are owned by the Mauritians and the rest is chartered to European Union shipowners. The catch of the Mauritanian fishery is significantly higher than that of the European Union, respectively 393 tons and 390 tons. 98% of the total volume of production consists of live lobsters, mainly intended for the European market. This production generated sales of 4.26 billion MRO. Overall, the experimental lobster industry is an activity of macroeconomic importance. The turnover represents about 5% of the GMCC's export sales in 2015 (US \$ 268 million) and 13% of the GDP fishery in 2014 (MRO 33.47 billion, BCM 2015). More than two thirds of this amount (3.62 billion MRO) is generated by the Added Value, i.e. 85% of the turnover. The VA created by Mauritanian operators is 10% more than the VA created by European operators. The gross operating surplus represents 1.3 billion MRO or 32.31% of the turnover. More than half (896.6 million MRO) of EBITDA is generated by Mauritians. The experimental lobster industry creates 557 direct and indirect jobs. These jobs represent 10% of the jobs in the industrial fishing, which is estimated to be 3764 direct jobs in 2014. It is estimated that the Mauritanian segment creates 25% more jobs than the European segment. This assessment of the socio-economic performance of the lobster exploratory fishing



in Mauritania is a first step towards a more in-depth understanding of its cost structure and dynamics, which is necessary for the management of TACs and fishing quotas.

Keywords: *Palinurus mauritanicus*, TAC, Quotas, Mauritania, economic performance, European Union, CA, VA, EBE, West Africa.



Dilemma of Allowable Totals of Catches in Individual Quotas: A Bioeconomic Illustration in RIM-EU Fishing Agreements

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Abstract

Inspired by game theory "fish war game" of Levhari and Mirman (1980), this theoretical model is revisited to bring the bio-economic analysis of the process of determining RIM-EU fishing. The main originality of the basic model is the inclusion in the utility functions of financial compensation paid by the EU to Mauritania. The model assigns individual quota strategies to prevent the utility of each country in relation to a given financial compensation, catch trends and thus the optimal level of income by country for a maximum sustainable yield. The results and assumptions of the model are discussed in the Nash equilibrium, and then examine the impact of cooperation in the allocation of IQ for sustainable fisheries, the Ombudsman. Mauritanian political responsibility and level Net 'quota allocation.

Keywords: Bioeconomic Model, Total Allowable Catch, Fisheries Agreement, RIM, EU, Fish War Game, Nash Equilibrium, Game Theory, Cooperation.



Session 04

Use of SARIMA-type statistical models for the assessment of the billfish fishery in Côte d'Ivoire

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Abstract

In the fishing for billfish caught in Côte d'Ivoire, a country in the western part of the Gulf of Guinea, landings are carried out in the port area of Abidjan and San Pedro is about 400 km to the west. The collection of fishing data limited to Abidjan, knowledge of the state of fishing, its monitoring and control from the global models of stocks is impossible. In our study, we examine the capacity of statistical models from autoregressive to mobile means, integrated and seasonal (SARIMA) to adjust, predict and be used in the monitoring and control of landings of a so-called data-poor fishery. The method was applied to a regular series of 192 months over the period 2000-2015. A model rated $[[\text{SARIMA}(1,0,0) \times (0,1,1)]_{12}]$ was found to be acceptable among 508. Its estimated adjustment power of 23% is not bad considering that a single variable is involved in the analysis. However, the overall error of the forecast is estimated at 145% over a maximum horizon of 12 months. The observed landings did not exceed the limits predicted by the model and the fishery does not show any obvious signs of overexploitation.



Unexpected evolution of Thiof fisheries in Senegal: insight from mathematical and informatics bio-economic models

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Abstract

Fisheries constitute an economic sector that is much less regulated than terrestrial activities, because of the cost and difficulties of the control, especially in weak governance area. Thus self-regulation mechanisms of bio-economic equilibriums are the only rule. Understanding these mechanisms is crucial to detect how to influence the auto-organistaion of fisheries regulation. The thiof (*epinephelus aenus*) is a highly valuated commercial fish that have suffer intense exploitation in Senegal since several decades. However, in recent year some indicators suggest a slow recovery of the stock. Two bio-economic models accounting for artisanal fishers movement and variable price were implemented in mathematical and informatics formalism. The mathematical model was a set of differential equations with slow and rapid processes, solved analytically with the aggregation of variable method. The informatics was an individual based model explicitly representing each fishing boats. In both models, the international migration of fishermen in periods of low local abundance combined with variable price according to the market induced a shift from local over-exploitation to regional sustainable exploitation. We discuss the observed evolution of thiof landings and price in Senegal in the light of the bio-economic dynamic suggested by the models.

Session 04

Optimal fishing agreement between neighboring countries sharing a common migratory fish population

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Abstract

A mathematical model is developed to represent an idealized system of a shared fish stock associated with different exclusive economic zones. We apply such model on small pelagic fisheries shared between Southern Morocco, Mauritania and the Senegambia. The complete model is a set of six ordinary differential equations describing the time evolution of the fish biomass and the fishing effort in the three zones. The fish species targeted as small pelagics could be considered to perform quick displacement between the different zones, in comparison to their growth and harvesting. We take advantage of the two time scales to obtain a reduced model governing the total fish biomass of the system and fishing efforts in each zone. We study existence and stability of equilibrium points of the reduced model. The simulations show that as a result of competition between fisheries per zone there can only be one winner in the general case. Nevertheless there is also an arising case that allows an operational management of shared fisheries by acting on the cost of fishing unit effort, indeed we found that a large number of equilibrium exist. From this last case the initial distribution of fishing effort strongly impact the optimal equilibrium that can be reached. Lastly the model report that the country with the highest carrying capacity density may get less landings when collaborating with other countries than if it minimise its fishing costs. Such findings should allows regional fisheries organizations to get potential new ways for neighbouring fish stock management plan.



Session 04

Sub-Regional Information System: Towards a Collaborative Approach

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Abstract

The fisheries information systems existing in the sub region do not yet take into account the complexity of the management of the fishery resources majority shared at least between two countries; in addition to the multiplicity of actors involved and the sudden divergence of associated interests. To this must be added the complementarity of the data sources necessary for the proper understanding of the functioning of exploited marine ecosystems, which requires the federation of the different databases available or to be set up. In this work we propose a collaborative approach that will overcome these shortcomings and allow decision-makers and stakeholders to make informed decisions to ensure the sustainable management of shared resources in the sub-region.

Thematic Session 5 « Marine Protected Area (MPA) in West Africa ». Afternoon 13rd December 2016, Chapiteau room

CHAIRMEN: Dr Suzanne TRAORE (RAMPAO), Dr Modou THIAW (ISRA/CRODT, Senegal), and CI Abdoulaye DIOP (DAMCP, Senegal)



The aim of this session was to provide participants with scientific knowledge to strengthen the role of MPAs in fisheries management through oral communications, poster presentations and exchanges.

To this end, the participants addressed the following issues together:

1. scientific results allowing to characterize and assess the level of effectiveness of MPAs in stock rebuilding;
2. the socio-economic challenges and challenges to be met for the effective establishment of a coherent, representative and interconnected MPA network capable of meeting its assigned objectives.
3. and the prospects for fisheries policies in order to make MPAs an effective tool for sustainable fisheries management in West Africa.

The session began at 15:00, which was 50 minutes behind the start time of 14:20 for the organizers due to lack of adequate room. A round table was held for better knowledge and familiarization among the participants. Linguistic diversity (lusophones, anglophones and francophones) was not a prohibiting factor for good participation. This session 5 of the 3rd AWA conference, which provides a framework for the sharing of results, information and exchange of experience, recorded 11 papers including 8 oral presentations and 4 posters.

The papers dealt with the following (7) themes:

- (1) method of assessing specific wealth
- (2) conservation of biodiversity within MPAs;
- (2) benthic community structures within MPAs;
- (3) the effects of MPAs on structure of fish communities;
- (4) the effects of MPAs on coastal demersal fisheries;
- (5) life characteristics of the main demersal species living in MPAs;
- (6) economic impacts of MPAs on small pelagic fisheries
- (7) Discovery of oil and gas in Senegal: advocacy for risk prevention



Important points that should be capitalized upon are:

- **Biodiversity conservation**
 - A total of 223 fish species have been recorded in 7 Senegalese MPAs.
- **Assessment of benthic community structures within MPAs**
 - Two assessment methods were presented: (1) Underwater Visual Census of Fish (UVC) and (2) Benthos Photography
 - The results show that the low density of large piscivorous / carnivorous fish in the reserve is clearly identifiable as overfishing effects that require urgent attention in local management and conservation planning.
- **Economic Impacts of MPAs on Fisheries**
 - the implementation of MPAs can contribute to short-term fishing capacity reduction, to solve the problem of open access.
 - Objective 11 of Aichi 10% can be achieved but it will be necessary to close more area in the south or on the high seas;
 - Finally, given that resources are shared, it is necessary to have common management between the countries that share them.
- **AMP of Joal-Fadiouth**
 - 98 phytoplankton species were observed in the Joal-Fadiouth MPA, including 03 toxic species: *Pseudonitzschia* sp, *Dinophysis caudata* and *Lyngbia* sp. ;
 - The closure of the area does not improve for the moment a return of large fish with commercial benefit;
 - However, the effect is evident on sedentary or limited-moving species such as *Cymbium* spp. And *Murex* spp. Which experienced an increase in their size and number.
- **AMP of Cayar**
 - There are 97 species in 48 families, including 8 resident species. The most abundant species is the small captain *Galeoides decadactylus*
- **Bamboung AMP**
 - 101 phytoplankton species were observed including 02 toxic species *Pseudonitzschia* sp. And *Prorocentrum lima*
 - Closing the bolon improves the trophic structure of fish for fishing;
 - It resulted in a difference in abundance between species and an increase in biodiversity. However, a loss of abundance explained by the spill-over effect or predation is noted over the period 2008-2016.
 - AMP appears to be the preferred spawning area for catfish (*Arius latiscutatus*). The reproductive activity of this species would be more intense and fertility would be higher.
- **Expérience of Guinée Bissau AMP :**



- For better management of MPAs, it is important to have (1) effective community participation in biodiversity management and (2) integration of indigenous knowledge and traditional practices in natural resource management.
- **Advocating for collective prevention of risks linked to the discovery of oil and gas in Senegal**
 - To establish a baseline state of biological resources located at the continental slope (oil and gas discovery areas);
 - Map areas sensitive to oil spills around the slope to identify its use by sensitive species such as seabirds, fish (pelagic and demersal), cetaceans and turtles etc .;
 - Ask the oil company to share their exploration data in order to know what the seabed holds in Senegal, ie where vulnerable ecosystems are located.

Exchange between participants

At the end of the presentations, a round table was held to make recommendations to improve the efficiency of MPA management:

- ✓ Put more emphasis on the different themes presented in order to obtain the maximum results;
- ✓ Invest in other research areas or fish species (marine meadows, dolphins, sea turtles, etc.) that are present in MPAs;
- ✓ Extend research activities throughout the MPA network, in particular on the MPAs of The Gambia and Guinea Bissau;
- ✓ Strengthen tripartite collaboration, (1) research structure, (2) academic institutions and (3) MPA management structures (DAMCP, RAMP AO)
- ✓ Involve local communities and integrate their traditional endogenous knowledge and practices into the management of marine and coastal MPA resources;
Assess the ecosystem goods and services of MPAs to produce an advocacy document for their sustainable financing.

Two research programs are proposed:

- (1) Assessment of ecosystem goods and services of MPAs in West Africa
- (2) Effects of the development of oil and gas exploitation on marine biodiversity in West Africa

Nominees / winners for Session 5 on MPAs:

- (1) Mme Khady DIOP DIOUF doctoral student, for best oral communication.
- (2) M. Salla DIOUF, engineer, for the best poster.



Reef fish and benthic community structure of Santa Luzia Marine Reserve in Cabo Verde Islands, Eastern Atlantic

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Abstract

A first assessment was conducted to estimate reef fish abundance and substratum coverage in different sites and habitats of Santa Luzia Marine Reserve. Fish visual census and benthos photo-quadrats were utilized to describe fish trophic density and biomass in relation to benthos diversity and other habitat attributes. Underwater SCUBA sampling occurred between September and October of 2009 on 11 sites around the island. Fish and benthos assemblage attributes were plotted against descriptors as fishing intensity, water surge, complexity and substratum type by means of multivariate analysis. A total of 51.507 individuals of 67 species belonging to 32 families were recorded in 198 transects. Morays, damselfishes and wrasses dominated in richness, while *Chromis* spp. and small cryptic labrids were the dominant species both in density and biomass. Mean species richness per census (40 m²) was 12 spp. and mean number of individuals per census/transect without *Chromis* spp. (gregarious species) was around 80.32 fish (estimated biomass of 12.5 kg). Planktivores (4 sp.) accounted for 69% of all fish individuals recorded, 17.9% of mobile invertebrate feeders (13 sp.) and others groups also evaluated. The low density of large piscivorous/carnivorous fish in the reserve is clearly identifiable as overfishing effects which urgently needs attention in local management and conservation planning.



Overview of biodiversity in Senegal's MPA network in 2015

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Abstract

Aware that the police surveillance of marine protected area (MPA) is not sufficient to ensure proper management, the Department of Marine Protected Areas (DAMCP), accompanied by its technical partners, has set a participatory bioecological monitoring program. This program aims to monitor the variability of fish abundance, size and diversity within the network. This program aims to assess the dynamics of species living within these MPA. It is to conduct experimental fishing four times a year (cold season, cold-warm transition season, warm season and warm-cold transitional season). Abundance, size and diversity are the indicators that are essentially followed. Here, we present the results obtained after one year (2015) of seasonal monitoring from eight MPA (Saint-Louis, Cayar, Somone, Joal-Fadiouth, Palmarin, Gandoul, Bamboung and Abene). The highest species diversity is noted in the Joal MPA with over 100 species belonging to 48 families. The Community Nature Reserve of Palmarin with 35 species grouped in 21 families, is the area with the lowest species diversity. The dominant families are the Carangidae and the Mugilidae. Some species economically important were observed in several MPA.



Study of the ichthyofaunic population of the marine protected area (MPA) of Cayar in 2015

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Abstract

In order to characterize the current state of the ichthyofaunic population of the marine protected area of Cayar and its evolution, a follow-up protocol was set. It consists of a seasonal sampling over six stations (Sereup thieub, Bereup, Tank, Sereup Maissa Birame, Sereup Mor Mbaye and Kherou pass). The results obtained in 2015 are presented here. In total, 92 species regrouped in 49 families were recorded. The most abundant species were *Galeoides decadactylus*, *Pagellus bellotti*, *Sarda sarda*, *Caranx senegallus*, *caranx crysos*, *Sphyrna guachancho* and *Cynoglossus senegalensis*. The most represented families were the Carangidae (11 species), followed by the Sparidae and Serranidae with 11 and 5 species, respectively. According to their temporal variability, the greatest number of species and families were observed in upwelling season, while the lowest appears in warm season. The species diversity showed a very heterogeneous spatial distribution. As for the nature of the population, five ecological categories were identified in the MPA, marine species (Mo), marine-estuarine (ME), strict estuarine (Es), marine accessory (Ma) and marine estuarine (Em). The Mo and Ma accounting for more than 50%, were the most important. Regarding the structure of the populations, the top predators were the most abundant.

Session 05

Effects of the Bamboung Marine Protected Area (Saloum, Senegal) on fish communities: an approach based on the bio-ecological indicators analysis

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Abstract

Marine Protected Areas (MPAs), initially set up to protect critical habitats and improve biodiversity, are increasingly seen as a tool for the spatial management of fisheries. However, MPA managers rarely have a scientific assessment of the effectiveness MPAs from a fishery perspective. Thus this study analyzes the bio-ecological effects of Bamboung MPA by comparing two nearby tropical estuaries: Bolong de Bamboung (closed to fishing) and Bolong de Sangako (fished). For this purpose, usual ecological indicators have been estimated: abundance, biomass, specific richness and Shannon index. These indicators were calculated from experimental fishery data (2008-2016) in both bolongs using the same purse seine sampling protocol. The preliminary results showed the presence of 69 species in the MPA, compared to 61 species in the Sangako bolong. For Bamboung MPA, the mean abundance is 25 individuals for a biomass of 72 kg/ha, while for the Sangako bolong, the average abundance is 36 individuals for a biomass of 39 kg/ha. The Shannon index is equal to 1.8 in the AMP and 1.7 in the bolong of Sangako. These indices are close to their maximum values, indicating a more or less equal distribution of individuals between different species. However, the higher biomass in the MPA compared to the exploited site indicates the presence of large individuals in the Bamboung MPA.

Keywords: Bamboung; MPA Effect; Bioecological indicators; Sangako; Senegal.

Effects of Marine Protected Areas on Demersal Coastal Fisheries: The Case of the Joal-Fadiouth MPA (Senegal)

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Abstract

In West Africa, Marine Protected Areas (MPAs) have become an instrument for managing fisheries since the 2000s. Thus, this study aims to assess the effects of the Joal-Fadiouth MPA on the main coastal demersal fisheries. To lead this study, two types of data are used: i) surveys data on the landings and small-scale fishing activities carried out by the CRODT on Petite Côte between over the 1974-2011 period and, (ii) experimental fishery data (2015-2016) carried out inside and outside the MPA by the Fisheries Ecology Laboratory - West Africa. The evolution of the catches and CPUE of the main demersal species captured by lines and bottom gillnets is analyzed. In addition, the usual bioecological indicators are estimated from experimental fishery data for a spatial comparison. The results obtained from the experimental fishery data showed that the most abundant species in the MPA are the estuarine species and marine affinity species at low trophic level such as *Sardinella maderensis*, *Mugil bananensis*, *Eucinostomus melanopterus*, *Liza dumeri*, *Tilapia Guineensis* and *Sarotherodon melanotheron*. And in the outside MPA, biomasses of all the species encountered are weak. On the other hand, the CRODT data analysis shows that the most important demersal species in landings are *Argyrosomus regius*, *Arius spp.*, *Brachydeuterius auritus*, *Cymbium spp.*, *Epinephelus spp.*, *Murex spp.*, *Octopus vulgaris* and *Pomadasys jubelini*. However, the catches of these species decreased over the period 1990-2011. Moreover, their average size and biomass are relatively low. So the effect of the MPA is not visible either on the composition neither of vulnerable species nor on the size and abundance of exploited species. However, an exploitation gradient of *Cymbium spp.* and *Murex spp.* indicates that the number and size of these species are higher inside



the MPA than outside for similar habitats. Thus the Joal-Fadiouth MPA would favor the development of sedentary or limited-moving species.

Keywords: Protected Marines Areas, AMP effects, demersal fisheries, Senegal.



Reproductive parameters of a catfish (*Arius latiscutatus* Günther, 1864) inside and outside the Bamboung Marine Protected Area (Saloum Delta), Senegal

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Abstract

The reproduction of *Arius latiscutatus* (Günther, 1864) was studied both inside and outside of the Bamboung marine protected area (MPA) (Saloum Delta) in Senegal, from individuals collected monthly from April 2015 to March 2016. The reproductive parameters were quantified from the macroscopic examination of the gonads and from the counting and measurement of the oocytes. The monthly variation of the condition factor was similar at both sites. The strongest condition coefficients were observed during the two major seasons (cold and warm) and the lowest during the transition period (warm - cold). *A. latiscutatus* had only one breeding season from March to July. Size at first sexual maturity varied by gender and site: 400 mm for females and 448 mm for males inside the MPA, and 419 mm for females and 375 mm for males outside. Absolute fecundity was 29 ± 14 oocytes and relative fecundity 0.024 ± 0.007 oocytes per gram within the MPA. Outside, absolute fecundity was 22 ± 10 oocytes and relative fecundity 0.027 ± 0.005 oocytes per gram. The MPA appeared to be the privileged spawning area of the species, an area where reproductive activity would be more intense and fertility higher. Additional analyzes based on a larger sample and integrating other parameters such as age estimation, growth and diet, will allow to complement these initial results and to specify the impact of the reserve on the biological parameters of the species but also to have a global knowledge of its life traits.

Keywords: *Arius latiscutatus*, reproduction, marine protected area, Bamboung.



Session 05

Changes in the fish assemblage structures of marine protected areas in West Africa: the case of a tropical estuarine MPA (Bamboung) and a coastal and marine MPA (Joal-Fadiouth)

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Abstract

In the West African region, the marine protected areas 'MPAs' were primarily created with conservation objectives, to protect emblematic species and critical habitats. In the last ten years, their use as fishery management tools has also been advocated, particularly in Senegal. This study aims to assess the observed changes in the fish populations' structures in the years following fishing bans. The study is conducted in the MPAs of Bamboung and Joal-Fadiouth, in Senegal. We described and analysed the fish assemblage structures using the data from two years' experimental survey (2015-2016). In the Bamboung MPA, an increase of total fish biomass and of maximal fish length has been registered after the fishing ban. But over the 2004-2016 period, these indicators globally fluctuated. The contribution of marine affinity species has increased in depends of the estuarine part of the assemblage. In addition, the trophic structure has been modified with an overall increase of the mean trophic level, resulting from an increase of the percentage of generalist or piscivorous predators and a sharp decrease of herbivorous and detritivorous species feeding in the low trophic levels. Marine predators which abundance and size were reduced by fisheries were again important components in the Bamboung MPA. For the Joal-Fadiouth MPA, the fish biomass increased within the reserve with a dominance of small size fishes. This MPA led the conservation of certain species, but does not allow the proliferation of large size and high trophic level species. The results of the multivariate analysis showed an increase of abundance of the estuarine affinity species to the detriment of marine species. In addition, the low-trophic level species as herbivorous are more important in the reserve due to the high habitats diversity (mangroves, sandy and muddy bottom, algae) and the



fishing ban effects. In summary, we argue that the total ban on fishing in the estuarine area can significantly improve the fish assemblage for the fishing, and this is not evident for a coastal and marine area like Joal-Fadiouth MPA.

Keywords: Fish assemblage structures, MPAs impacts, Senegal.

Effet Spillover d'une Aire marine Protégée estuarienne en Afrique de l'Ouest : le cas de l'AMP de Bamboung (Saloum, Sénégal)

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Abstract

The efforts to conserve biodiversity has been stimulated by the creation of large marine protected areas at sea, in addition to small sites in the coastal waters of many countries. The objectives of creating MPAs are diverse and may appear to be conflicting. Scientists and managers are interest in their effectiveness as tools for restoring biodiversity and tools for fish stock management. Many AMP were evaluated worldwide and the results are in the main part positive. Then, MPAs are predicted to benefit adjacent fisheries through net emigration of adults and juveniles across borders, termed "spillover". This phenomenon is favored by high density in MPAs, species mobility and habitat connectivity. MPAs can contribute to an increase of abundance and biomass due to the Spillover effect, especially near a reserve. The objective of this work is to verify whether an MPA can contribute to the improvement of fisheries yields near its borders. The question is whether fishing parameters such as abundance, biomass, average size and maximum size decrease with distance to Bamboung MPA. It means to examine spatial patterns of these fishing parameters across the boundary of Bamboung MPA. The present study is conducted in a part of Diomboss area, located in the estuary of Saloum, near the border of Bamboung AMP where fishing activities are banned. The data were collected during 3 fishing surveys in 2012, carried out during the three main hydro-climatic seasons of the region in March (end of the cool dry season), June (end of the h t dry season) and October (end of the wet season). Samples were fished with a baited longline. The results show in the cool season, an increases of abundance away from the MPA border, whereas in the dry season, it decreases away from the MPA. The biomass did not evolve with the distance to the MPA. The average size of fish decreases when moving away from the MPA in both the cool and wet seasons. The maximum size decreases away from the MPA in the wet season. The spillover effect in Bamboung MPA is not clearly demonstrated according to our results. A downward trend of biological indicators according to the distance to the MPA has been observed especially in hot season and wet season. These results would



reveal the possibility of an improving artisanal fishery yields near the boundaries of the Bambang MPA in dry and wet seasons.

Seasonal variability of phytoplankton composition inside and outside the Marine Protected Areas of Joal-Fadiouth and Bamboung in Senegal (West Africa)

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Abstract

Marine Protected Areas (MPAs) are considered tools for biodiversity and resource restoration and resilience. However, their role in improving the flow of matter through better productivity remains to be demonstrated. The present study aims to analyze the phytoplankton composition inside and outside two contrasted MPAs; Joal-Fadiouth (coastal) and Bamboung (estuary) at dry cold and wet hot seasons. Data were collected with plankton net of 20 µm net mesh in April and September 2016. In the laboratory, by optical microscopy, the phytoplankton species were identified at the lowest possible taxonomic level by comparison of our data with those of taxonomy works. A total of 101 species belonging to 30 families were identified in the Bamboung MPA, compared with 98 species of 28 families in the Joal-Fadiouth MPA. In the latter MPA, the number of species was higher (40 species of 19 families) inside than outside (30 species of 18 families) the MPA in April *i.e.* the cold season. In September, *i.e.* the hot season, the number of species was higher (62 species of 16 families) outside than inside (50 species of 14 families). As for the Bamboung MPA, whatever the season (cold and hot), the number of species was respectively higher inside (58 species of 28 families and 61 species of 20 families) than outside (30 species of 18 families and 58 species of 20 families). However, even if both MPAs present similitude for the taxonomical composition, characteristic species of each environment have been encountered: *Eucampia* sp and *Stephanopyxis pelagica* in estuarine Bamboung MPA and *Plagiogramma* sp, *Podocystis* sp, *Melosira* sp and *Rhabdonemma* sp only encountered in Joal-Fadiouth (marine environment). Three species and / or groups of harmful algae blooms (HABs), *Pseudonitzschia serieta* in Joal-Fadiouth, *Prorocentrum lima* in Bamboung and *Pseudonitzschia* sp in both MPAs, were also encountered.

Keywords: Phytoplankton, Specific composition, HAB, West Africa.

Session 05

"Discovery of oil and gas in Senegal: marine environment, protected fishing areas and marine protected areas"; Advocacy for collective prevention of ecological risks

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Abstract

Senegal has a network of protected marine areas (MPAs) but also protected fishing areas (SPAs) with a view to conserving marine biodiversity, protecting and restoring habitats and managing fishing. Recent discoveries of hydrocarbons (oil and gas) were successively discovered in 2014 (Sangomar offshore deep 473 million barrels in the deposit) and in 2015 straddling Senegal and Mauritania in the deep offshore Kayar block and that of St. Louis offshore deep (450 billion m³). This type of exploitation refers to original issues because the economic resources coming from the sea are essential for the State (e.g. artisanal fishing and fishing agreements, tourism, coastal urbanization), but also because Senegal is involved in major international conservation agreements. The country is currently at a key moment in its oil history, whose production of the first barrels of oil is expected from 2021-2023. The technical and security arrangements necessary for the environmental management of petroleum exploitation refer to a major concern, linked first to ecological problems in the exploration phase. Impacts on marine biodiversity can be observed with the phenomenon related to the discharge of waste (spoil, sludge, waste etc.) or accidental spills (crude oil). In addition, mapping of sensitive areas on the high seas (surface and seabed) is not clearly defined by scientific research centers (CRODT, CSE, DGEFM, etc.). Thus, faced with insufficient knowledge and information on the Senegalese continental slope and the risks linked to the exploration and future production of fossil fuels at sea, the State must take measures to better control the whole



process of the oil and gas activities taking place at sea but above all to be able to reconcile them with maritime fishing and the conservation of marine biodiversity in order to manage all its maritime resources on a sustainable basis. The data, in particular bio-ecological, fishing, physical and anthropological, acquired during the implementation of MPAs and ZPPs are all useful data for the establishment of benchmarks but must also be considered before the start-up phase. Recent exercises to monitor and model the hydrodynamics of the Senegalese continental shelf under the AWA project are also valuable pieces of information that could be used to manage potential impacts (eg Polmar; 07022 of 16/07/2009, on the organization and operation of the national plan to combat marine pollution). The project piloted by AWATOX also made it possible to carry out measurements of the ecotoxicological state of the peninsula of Cape Verde. This project can provide input and support with relevant scientific information. In view of this prospect of development of the Senegalese oil and gas sector, we emphasize that all actors, in particular those of the littoral, are encouraged to a participatory and inclusive management of fossil fuels located in the edge of the continental shelf.



Side event 1. « Scientific research and ICT (information and communication technologies) in the fisheries Monitoring Control and Surveillance ». All day 14th December 2016, Room Signara 1

CHAIRMEN: C^{dt} Babacar BA (SRFC-CSR, The Gambia), Arnaud COMOLET (UNDP, United Nations) and Demba GUISSÉ (CNSP, Guinea)





Synthèse et recommandations

Par Babacar BA (CSRP)

En marge de la conférence ICAWA 2016, un « Side Event » sur la pêche illicite, non déclarée et non réglementée (pêche INN) sur le thème « **La recherche scientifique et les technologies de l'information et de la communication, outils de renforcement de la lutte contre la pêche INN** », s'est tenu, le mercredi 14 décembre 2016.

Le « Side Event » a été présidé par Monsieur Arnaud COMOLET Coordonnateur du projet «Gouvernance, politiques de gestion des ressources marines et réduction de la pauvreté dans **l'Ecorégion WAMER** (Mauritanie, Sénégal, Gambie, Guinée-Bissau, Guinée, Sierra Leone et Cabo Verde) projet GoWAMER» financé par le Programme des Nations Unies pour le **Développement (PNUD) et l'Union européenne (UE)**. Il était assisté dans sa tâche par Monsieur Demba GUISSÉ, Directeur Général du Centre National de Surveillance des Pêches de la République de la Guinée.

Au cours de la rencontre, les représentants des centres de recherche des Etats membres **ont tour à tour fait le point sur l'implication de leurs structures dans la** planification des activités opérationnelles de surveillance des pêches. Cette implication se fait à travers la cartographie des zones de pêche et la détermination du taux de chlorophylle. La recherche **est également fortement engagée dans l'élaboration des plans d'aménagement des** pêcheries que seul un bon système SCS peut garantir la réussite. La présentation de Monsieur Idrissa BAMY, Directeur Général du centre de recherches halieutiques de la Guinée (CNSHB) **au travers du cas d'étude portant sur la mise en place d'un** repos biologique dans son pays **est la preuve de l'importance de la recherche dans le dispositif de Suivi, Contrôle et** Surveillance (SCS) des Etats membres de la CSRP.

Au menu de cette rencontre, figurait également une présentation sur l'importance de **l'imagerie satellitaire dans la surveillance des pêches**. Ce sujet a été abordé par Monsieur Henri FOUCAULT expert SCS international qui a présenté l'exemple de la **Marine et des** Affaires maritimes de la France. La présentation a permis de faire une description détaillée **de ce dispositif innovant qui permet l'exploration de grands espaces maritimes à des coûts** largement en deçà des frais de mise en œuvre de moyens navals et aériens conventionnelles.

Après de riches débats, les participants au « Side Event 1» **d'ICAWA** ont formulé les recommandations suivantes :

- la redynamisation du « Groupe de Travail Recherche » composé des directeurs des centres de recherche des Etats membres (**lien avec le « side event 5 » d'ICAWA 3rd** voire plus bas), pour une meilleure implication de la recherche dans la planification et la conduite des opérations sous régionales de surveillance des pêches ;
- **la promotion de l'imagerie satellitaire dans les Etats membres ; à cet effet, les** participants avaient invité la CSRP et le PNUD à étudier les modalités de financement, **par le projet GoWAMER, d'une phase pilote d'acquisition d'images satellitaires.**

Session content under embargo, please contact the chairmen from CSRP or/and PNUD.



Side-event 2: “What technical and economic model(s) to foster the development of aquaculture in sub-Saharan countries: the case of West Africa”. Morning 14th December Signara 2 and Afternoon 15th December 2016, Chapiteau

CHAIRMEN: Dr Hamet Diaw DIADHIOU (ISRA/CRODT, Senegal), and Dr Melecony Célestin BLE (CRO, Ivory Coast)

Recommandations

Au cours de cette session thématique les discussions ont principalement porté sur **l’expression de la volonté politique des Etats mais faible application dans la mise en œuvre des programmes de développement de l’aquaculture. Des projets et expériences aquacoles sont conduits depuis plusieurs années dans de nombreux pays de l’Afrique de l’Ouest mais le constat reste le même pour la plupart, le taux élevé d’échec. Cette situation s’explique par l’improvisation des projets, les approches mises en oeuvre, la mauvaise gouvernance des projets ceci malgré les potentiels réels notés (disponibilité de l’eau, les besoins non satisfaits en protéines animales, la main d’oeuvre, les acquis de la recherche et des projets de développement mis en oeuvre).** Fort de ces éléments, la session portant sur l’aquaculture de l’ICAWA 2016, propose la vulgarisation des résultats de recherche intéressants en aquaculture qui **méritent d’être adoptés, diffusés dans le cadre d’une démarche participative avec un personnel d’encadrement qualifié. Au niveau de la Recherche, elle a proposé de tester le modèle technique et économique pour le développement de l’aquaculture de la FAO.** Au niveau sous régionale, les membres de cette session thématique ont inscrit quatre points importants autour desquels des actions devraient porter dans les années pour développer l’AQuaculture en Afrique de l’Ouest :

- Adapter les modèles techniques et économiques à l’environnement et au contexte sociaux-économique des communautés locales ;
- Promouvoir des programmes de recherche en aquaculture en lien avec le développement durable (intensification écologique des systèmes aquacoles) ;
- **Promouvoir l’aquaculture** intégrée dans les systèmes de production ;
- Appuyer et accompagner les initiatives en faveur du développement des systèmes piscicoles familiaux innovants.

*Side Event 2*

Technical and Economic Models to Promote the Development of Aquaculture in Mauritania

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Abstract

Mauritania presents environmental, technical and socio-economic peculiarities but with immense potential for the development of aquaculture. An Atlantic facade with many sheltered sites where mariculture is possible at low risk. In addition to the Senegal River, there are numerous permanent water bodies in the interior of the country: Synthiane pond, Wompou pond, Ould Yenge pond, Leibher pond, Kankossa Lake, Tichilitt pond, Mâal lake, Site of Bakhaw (near Boghe), site of Maghama, depression (bed) between the pond of Mathmata and Guebou, and lake of Foum Gleita. However, numerous pilot projects have been put in place to identify potential sites for the development of fish farming and shellfish farming in Mauritania. We will present in this communication the various fish farming projects and technical models used, identifying the strengths, weaknesses, opportunities, and possible threats. We will describe the financial, material and human resources to encourage the development of aquaculture in Mauritania. In order to encourage the implementation of the fundamental principles and strategic axes to be promoted in the field of aquaculture development, it will be based on the operational strategic framework for the development of aquaculture in Mauritania.

*Side Event 2*

The use of the phytase in aquaculture, its zootechnical interests and the possibilities of incorporation in the feed

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Abstract

The study turns on the use of the phytase in aquaculture, its zootechnical interests and the possibilities of incorporation in the feed. The goal is to reduce the waste in phosphorus linked to the feeding of fishes, without any loss of zootechnical performances and with a decrease of feed costs. We have studied the bibliography data, in order to enhance the value of the raw materials (total phosphorus, phytate and available phosphorus) used Guoussant for the manufacturing of rainbow trout of feed ; to determine the needs of phosphorus for aquaculture species; to determine the needs of phosphorus for aquaculture species, to determine the signs of lack of phosphorus for fishes; to study the antagonism between the phosphorus and the calcium and to study also the different forms of waste for the rainbow trout. The results found in the bibliography enable us test several Hypothesis of feed formulation for rainbow trout with different raw materials. This simulation and the calculation for wastes allowed to validate two formulation of feed: a control feed (0.5% of monocalcique phosphate) and a trial feed (supplementation with 0.002% of phytase Ronozyme PL and without inorganic phosphate). The feeds have been produced and sent to an experimental structure (agricultural college of Brehoulou).The result of the formulation give a decrease of the phosphorus waste of 28% for the trial feed compared to the feed. The supplementation enables a gain of 2.3 euro per ton. The partial results of the current test show no significant difference yet for the zootechnical parameters (growth rate, mortality, weight gain and obvious conversion rate) between control feed and the trial one. The waste measures do not show either significant difference between the control feed and the trial one, but however, the average difference would to decrease the wastes of 35.6% thanks to the use of phytase.

Keywords: phosphorus, phytic acid, phytase, digestibility, formulation, food, waste, rainbow trout.



Side Event 2

Effects of different protein regimes on the growth, survival and biochemical composition of the flesh of tilapia *Oreochromis niloticus*, Linnaeus (1758)

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Abstract

Tilapia Oreochromis niloticus is a fish whose breeding is of interest because of its biological and nutritional characteristics. However, data on the protein content of the food are missing at the population level of this species in Senegal. The study was undertaken to determine the adequate level of protein in the food to help improve the quality of fish food. In this study, tilapia fingerlings (*Oreochromis niloticus*) were fed with five diets differing only in dietary protein content (21.88%, 25.57%, 32.38%, 37.63%, and 45.5%) to assess their effects on growth performance, flesh composition and fish survival. The experiment was carried out in a closed system maintained at 30 ± 1 ° C. After the acclimation phase, fish with an average weight of 1.25 ± 0.25 g were selected. Thus, five treatments were studied for 42 days, duplicating 100 individuals distributed in 10 aquariums (50 x 25 x 40 cm) containing (50 l), with a density of 10 fish per aquarium. The results revealed significant effects of the protein content of the food on growth performance and survival of fingerlings. For average weight gain and specific growth rate, the best results were obtained with diets containing 32.34% and 37.63% protein. The best dietary conversion rate was obtained with the diet containing 37.63% protein, while the worst was obtained with the diet containing 45.50% protein. The best survival rates (100%) were observed in fish fed diets containing 32.38 and 37.63% protein. There were no significant differences in the protein content of the flesh of tilapia fed with the five diets compared to the initial fish. The lipid content of fish flesh increased significantly with the increase in dietary protein levels from 21.88% to 45.50%. The highest crude lipid (9.4%) content of flesh was recorded with the diet containing 45.50% protein followed by that 21.88% protein. In conclusion the study showed that the food containing 37% of protein is the most appropriate and the most economical for the success of the rearing of the fry of tilapia in recycled system.

Keywords: Protein; MeSH Terms: Tilapia; *Oreochromis niloticus*.



Aquaculture Research In Center of Research for Oceanology in Cote d'ivoire : achievements and prospects

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Abstract

The fisheries sector occupies a predominantly socio-economic and nutritional place in Côte d'Ivoire. Approximately 37% of animal protein consumption comes from fish with an annual demand of about 350 000 tonnes of which about 70% is supplied by frozen fish imported by the Ivorian State. The increase in imports is explained by the decline in national production linked to the depletion of fish stocks. Overexploitation of fish resources to meet high demand is exacerbated by rapid population growth. Since 1950, the supply of fish through the promotion of aquaculture has been a major concern of the Ivorian government, which has initiated several development projects. The intensification of this activity therefore seems to be predictable. However, aquaculture remains a relatively vulnerable activity whose development in fresh and brackish waters requires a better knowledge of the environment, the biology of species and the development of breeding technics that adapted to the local conditions of developing countries. In view of the natural potential of the Côte d'Ivoire in aquaculture (vast hydrographic system and many untapped shoals) and on the basis of knowledge about the lagoon environments and particularly their fish fauna, the Aquaculture Department of the Center of Research for Oceanology (CRO) identified different indigenous species of potential interest for aquaculture. Species such as catfish *Chysichthys nigrodigitatus* and *Heterobranchus longifilis* cichlids *Sarotherodon melanotheron* and *Tilapia guineensis*, have been studied in order to control their livestock production. These studies made it possible to control and optimize the breeding process of the *Chysichthys nigrodigitatus*, and the *Heterobranchus longifilis* catfish. These studies allowed the control of rearing catfish *Chysichthys nigrodigitatus* *Heterobranchus longifilis*. With a view to diversifying livestock species, guaranteeing sustainable development and preserving aquaculture biodiversity, new species with aquacultural potential such as *Mugil cephalus*, *Liza falcipinus*, *Polydactylus quadrifilis* and shrimp *Macrobrachium vollehovenii* and *M. Macrobrachion* are studied. These efforts of research have allowed the



emergence of lagoon aquaculture and brackish water. Prospects for the development of continental environment have also been analyzed.



Side Event 2

Potential Impacts of Biofloc and Aquapony in Improving the Productivity of Aquaculture Systems in Senegal

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Abstract

Fish food is one of the budget items that affect the economic and financial profitability of many so-called modern fish farms in Senegal. In fact, the proposed sale price for quality granulated food (imported product) does not allow it to be used in the current context of Aquaculture development in Senegal and to obtain added value. The potential impacts of the substitution of granulated feedstuffs by Biofloc and Aquapony elements on modern fish farms of the country are discussed to propose their uses by the actors of the pisciculture.



Side Event 2

Improved Management and Technological Innovation in African tilapia farms and hatcheries (ITACA Project) : Outcome and Results.

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Abstract

The ITACA Grant project was build in a consortium based thru the cooperation North-South in terms of technology transfert and capacity building. The project was funded by African union and European Union for three years. The main objectives was to : to identify and follow sutainable indicators thru selected farms and hatcheries ;to settle appropriate farm mangement plans ; to introduce of innovation's technologies ; to edit tutorials for capacity building. After three years activities, the main out put of the project are as follow : establishment of economic, social, environmental and technical sustainability for tilapia farms and hatcheries development ; settle farm management plans for broodstocks, fingerlings production and growing ; introduction of automatic monitoring control system in hatcheries in order to follow several parameters on a real time basis by computer with warning system and ; production of 5 tutorials online (www.itaca-project.com) and News letter for End-Users with the settlment of a network of more the 1,500 contacts.



Which technical and economic model of aquaculture is adapted to the Senegalese context?

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Abstract

Worldwide, most wild capture fisheries are above the maximum sustainable yield expected to predict the collapse of current rates in a few decades. This situation positions Aquaculture as a credible alternative to meet the world population's estimated fish needs of about 8.5 billion people in 2020, of which 1.1 billion in Africa, for needs of the order of 40 Millions of tons by 2030. In Senegal, the fisheries sub-sector has always been an essential component of the country's economic and social development. It is a sector of employment and a provider of food security. It contributes on average to 2% of GDP and brings 70% of the proteins of animal origin. However, over the past few years, fisheries have experienced unprecedented crises, the main consequence of which is the reduction in the catch and the reduction in the catch potential of certain fish stocks, including those of coastal demersals in Senegal. Depending on the global and regional trend, Senegal considered Aquaculture as an alternative to maintain at least the supply of fish products, or even increase it in response to growing national demand and ensure the food and nutritional security of animal proteins of aquatic origin in the medium and long term. This orientation is clearly displayed in the Emergent Senegal Plan (PSE), a unique repository for economic and social development policy. Indeed, the PSE has identified Aquaculture as one of the 27 flagship projects leading to the structural transformation of the Senegalese economy. Within this framework, the ambition is to produce 50 000 tons of fish by 2023. This ambition to develop Aquaculture in the PSE has always been clearly defined in the development policies of the country, causing the creation of the National Agency for Aquaculture (ANA) which is in charge of the promotion and development of Aquaculture. In carrying out the mission, several technical and technological models have been developed across the



country; in view of the enormous biophysical potential of the country. The advantages and disadvantages of these different models will be presented at this symposium. In addition, the business model or economic model used in Senegal as part of the accompaniment of aquaculture developers to assess the profitability of the activity will be presented. This model will be compared with the different economic models applicable to this subsector. Emphasis will also be placed on the advantages and limitations of these models drawn from practical experiences in the country. Recommendations on the different economic and technical models will be formulated in order to improve the existing models for the harmonious development of Aquaculture in Senegal.

Keywords : Aquaculture, GDP, animal proteins, food security, Emergent Senegal Plan (PSE), economic and technical models, West Africa.



Side Event 2

Effectiveness of biological filters made of coconut chips and pumice stones on the quality of water used in fish farming

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Abstract

The aquatic environment is susceptible to contamination of feces, unconsumed food and other excreta products. Some of these residues (organic) decompose naturally through chemical and biological reactions in water. These enrich the environment with chemical (N, P) and biological elements (viruses, bacteria and fungi) that are often pathogenic to these aquatic animals. These pathogens are often fatal or lead to decreased zootechnical performance (growth, reproduction and nutrition). It is therefore necessary to systematically filter this aquaculture water. Therefore, in all aquaculture farms in closed circuits, mechanical, chemical and biological filters must be compulsory. In the present study, the effectiveness of biological filters based on coconut chips and pumice stones on water quality was studied. The results show that from the second week of immersion we have a progressive and remarkable decrease of all chemical elements: nitrate (0.45 to 0.1 mg / l), nitrite (0.3 to 0.1 ° mg / l) and PH (9 to 7). From the third week nitrates and nitrites disappear completely (0 mg / l).

Keywords: biological filter, coconut shavings, pumice stones, nitrogen, phosphorus.



Side Event 2

Study of the fertility of *Tilapia Oreochromis niloticus*, source of the Senegal river valley as a function of weight

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Abstract

The importance of fertility control in aquaculture is clear. We all know that fertility (the number of eggs laid by a female) depends on the weight of the individual. To optimize fry production yield, it is necessary to know the weight of the broodstock used to obtain the maximum number of eggs. It is this observation that motivated the study of the fertility of the different spawners of *Oreochromis niloticus* that we use in the Bel-Air greenhouse. The results show that with 19 assessed eggs (a total of 14,527 eggs were obtained). The weight curve as a function of the number of eggs shows that below 390 g (spawners) the number of eggs produced on average is 850; over 390 g we have a considerable increase up to 1600 eggs per spawn. We can also see that the age of sexual maturity of these individuals (*Oreochromis niloticus*) is 44g, but with very weak spawning (150-200 eggs).

Keywords: *Oreochromis niloticus*, fertility, spawning, sexual maturity.

*Side Event 2*

Potential use of bioremediation methods for aquaculture wastes in coastal areas

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Abstract

Currently, aquaculture is considered as one of the fastest growing food-production industries in the world due to practically stagnant and declining fisheries, higher global demand for fish due to increased human population, change in diet preferences from red meat to healthier among others. In the effort to meet this increasing demand, production systems have been progressively intensified. Despite their high output, the intensive culture practices have adverse and negative impact on the environment. They are associated with both uncontrolled use of feed and massive production of waste which if released into the environment untreated, it deteriorates the water quality, leads to eutrophication, causes and spreads parasite and diseases and causes metals and antibiotics pollution. Other impacts include destruction and alteration of natural habitats, depletion of wild stocks, salinization of adjacent soils and change of biodiversity. These risks and impacts from aquaculture has often being criticized by environmental organisations, politicians and has generated great scientific interests and great advocacy for undertaking mitigation measures. Bioremediation techniques which are widely known to be environment friendly, healthy, efficient and cost-effective methods for improving the quality of aquaculture waste have been proven to reduce environmental damage. In addition, bioremediation techniques in aquaculture are easy to implement and maintain, can be performed on-site and/or off-site, and reduce the amount of waste to be landfilled. In the present work, we describe the bioremediation strategies that could be applied for ameliorating negative impacts of the aquaculture effluents in coastal areas towards sustainable aquaculture. This was achieved by reviewing various bioremediation concepts and strategies used in various parts of the world. Then, describing aquaculture facilities within the coastal areas and their associated environmental impacts. Finally the study carries out comparative reviews of potential bioremediation strategies which can be applied in the aquaculture waste treatment in the coastal areas.



Contribution to the study on the use of natural binders in the diet of tilapia (*Oreochromis niloticus*)

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Abstract

This study carried out at the hatchery laboratory of the Department of Animal Biology of the Faculty of Science and Technology of UCAD is a contribution to the development of foods based on natural binders for aquaculture activities. A performance test was carried out on four isoprotein diets of $30 \pm 0.50\%$ differentiated from each other by a binding agent: A: 20 g *Adansonia digitata* leaf meal B: 20 g flour leaves of *Corchorus tridens*, C: 20 g of powdered gum arabic and diet control D: 20 g carboxy-methyl-cellulose were tested on *Oreochromis niloticus* fry for 45 days, in duplicate or 104 medium-weight individuals Initial value equal to 5.74 ± 0.01 g distributed in an isolated system consisting of 8 plastic bins of 50 liters with a density of 13 fish per bins. The results of this study show that the best survival rates were obtained by diets B and C and the lowest survival rates by those of A and D. In terms of growth performance, the results obtained are favorable to diet B ($1, 90 \pm 0.1$) and unfavorable to others (A (1.47 ± 0.1), C (1.46 ± 0.1) and D (1.41 ± 0.1)). For food efficiency, the best TCA (2.43 ± 0.01) is obtained by the diet B and the diets A (3.21 ± 0.02), C (3.56 ± 0.01) and D (3.75 ± 0.01) gave the lowest results. The same is true for the CEP and the IV where the best results are observed with the B diet (1.34 ± 0.05), (1.10 ± 0.01) successively and the lowest with the other diets. We have the same trends in the results of the economic analysis where the B regime is much cheaper compared to the others. Encouraging, although preliminary, results were obtained at the end of this study. Therefore, these results suggest that *Corchorus tridens* flour may now supplement Carboxy-methyl cellulose in food formulations for fish species.

Keywords: *Oreochromis niloticus*, CMC, high performance, growth, natural binders, *Corchorus tridens*, *Adansonia digitata*, *Acacia senegal*.



Side Event 2

Study of the growth of fry of different strains of *Tilapia Oreochromis niloticus* in aquarium

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Abstract

The growth of fish in pisciculture is one of the most widely used zoo technical parameters for the development of livestock. Good growth performance is synonymous with good production efficiency. This study examines the growth performance of our different strains (all from the Senegal River Valley) candidates (A, B, and C) from *Tilapia Oreochromis niloticus* of the Bel-Air greenhouse, in order to see the best performing strain. After a 36-day experiment, the results show similar growth of the three strains A, B and C up to the 22nd day (0.2 g / day) after this period, we note that strain B (0.4 g / day) has the best growth performance. The study also revealed a poor growth performance of these individuals, due to the quality of the food distributed and the lack of space (confinement) in the glass bins, because with these fish under the same growth conditions but placed in glass bins with capacity of 1000 liters, we obtained an average growth rate of 0.8g / day.

Keywords: *Oreochromis niloticus*, growth, strain, growth performance.



Side Event 2

Contribution of innovative family farming systems to the promotion of fish farming in West and Central Africa

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Abstract

World Bank estimates for 2030 tend to show that demand for fish will increase by 30% in sub-Saharan Africa due to continued population growth (2.8%). Faced with the stagnation of fishing, the only alternative on a global scale is the development of fish farming. In most countries in sub-Saharan Africa, conventional fish farming, introduced for several decades, struggles to develop despite the concerted efforts of the continent's technical and financial partners. However, innovative commercial fish farming systems adopted by producers have strong potential and have shown great adaptation to the socio-economic and environmental changes of recent decades. These farms are characterized by facilities in ponds and dam ponds, with the use of an essentially family labor force. Polyculture based on *Tilapia Oreochromis niloticus* is the most common practice. Fish farmers are mostly farmers (92% in Côte d'Ivoire, 61% in Cameroon). An analysis of the productivity of these small commercial fish farms integrated in family farms and their contribution to the value chain realized within the framework of the regional project SyPiEx has shown that these contribute to the bulk of the fish production of the fish farming in Benin, Cameroon and Côte d'Ivoire. This article proposes an advocacy to take these innovative family farming systems into account in public policies in West and Central Africa.



Traditional fish farming in Lower Casamance in a context of climate change

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Abstract

Traditional fish farming, once widely practiced in Lower Casamance, declined significantly during the great decade of drought in the Sahel during the 1970s and 1980's. During this period, the region experienced a decrease of more than 30 % of managed fish ponds, not of mangrove for desalination of rice fields upstream of the mangrove, affected by the rise of salt. This situation had ultimately affected the productivity of fish ponds and prompted a large number of actors to abandon fish farming for other economic activities. With the return of rain recorded in recent years and the support of the economic partners and the National Agency for Aquaculture, new farms and new actors are working towards the development of traditional fish farming Lower Casamance. This oral presentation takes stock of the ongoing dynamics of the environment, actors, production systems and production.



Side Event 2

Improving the sustainability of Tilapia fish farms in Africa

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Abstract

This paper provides the main results of research obtained on 5 of the 13 farms studied in the African Union-funded research project (AURG / 2/139/2012 - EDF / 2012 / 305-980) in the period from 2012 to 2015 in Senegal and Egypt with the support of Spanish partners (INKOA and IRTA). Apart from these farms, the ANIDA pilot farm in Diama Maraye was also selected to study the possibilities for improving the productivity of tilapia fish farms in Senegal. This work made it possible to highlight the low level of technology developed in tilapia fish farms and to identify the socio-economic and environmental aspects that characterize these areas.

*Side Event 2*

Sustainable conservation of aquatic genetic resources: Application of biological, biotechnological and molecular methods

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Abstract

The free-living and farmed breed populations have high importance as genetic resources. Many of these breeds, are among the world's most seriously threatened biodiversity. Most private sector breed producers and farmers keep only the most profitable farmed breeds, leaving others under threat of extinction. These trends indicate an urgent need for better management – meaning fully integrated use and conservation – of animal genetic resources: *in situ /in vivo*, as free-living, wild and feral populations; *in situ /in vivo*, as captive populations on-farm; *ex situ/in vitro*, as collections of cryopreserved sperm, embryos. This will require increased investment in the management of aquatic genetic resources (AqGR), commensurate with their high and growing contributions to world food security. Keeping representative, farmed animal genetic resources undisturbed in their habitats to contact with other farmed breeds, has operational and opportunity costs. Therefore, unless there is equitable sharing of costs and benefits among the stewards and potential users of such genetic resources for aquatic production, the conservation element in their management will not be achieved. Establishing and maintaining *ex situ*, *in vivo* and/or *in vitro*, animal gene banks is also expensive and will require public and private sector investment and partnerships. *Ex situ* conservation is a technique of conservation of biological diversity outside its natural habitats, targeting all levels of biodiversity such as genetic, species, and ecosystems. Its concept was developed earlier before its official adoption under the Convention on Biological Diversity signed in 1992 in Rio de Janeiro. In general, *ex situ* conservation is applied as an additional measure to supplement *in situ* conservation, which refers to conservation of biological diversity in its natural habitats. In some cases, *ex situ* management will be central to a conservation strategy and in others it will be of secondary importance. Broadly, *ex situ* conservation includes a variety of activities, from managing captive populations, education and raising awareness, supporting research initiatives and collaborating with *in situ* efforts. It is used as valuable tools in studying and conserving biological resources for different purposes through different techniques such as zoos, captive breeding, aquarium, botanical gardens, and gene banks.

Side Event 2

Methanogenic potential of waste in aquaculture: case of Tilapia faeces *Oreochromis niloticus*

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Abstract

L'aquaculture est de nos jours en pleine expansion car répond au défi alimentaire notamment dans les pays en développement. Cependant, elle est, à la fois consommatrice d'énergie lors des premiers stades de développement des larves et productrice de beaucoup de déchet de types organiques (MO) issus des aliments apportés. Ce travail propose donc de valoriser les déchets issus des activités en pisciculture par le procédé de méthanisation. Pour cela, des fèces de Tilapia *Oreochromis niloticus* ont échantillonné périodiquement à partir de bassins et leur potentiel méthanogène (test BMP) déterminé et comparé à un substrat de référence (fientes de volaille); avec ou sans inoculum. L'analyse au μ CG a permis de déterminer les proportions relatives du méthane (CH_4) dans le biogaz en fonction de la durée de production. Les tests BMP (biochemical methane potential) ont montré une cinétique de production rapide de biogaz des fèces poisson en présence d'inoculum (+inoculum) comparé à la production de biogaz dans les fèces seules. Cette cinétique de production de biogaz s'inverse entre la troisième et quatrième semaine. Dans les deux cas, la proportion de méthane est généralement supérieure à 60% à partir de la deuxième semaine d'incubation ce qui témoigne de la qualité du biogaz produit. La composition en CH_4 et CO_2 ne change pas avec ou sans inoculum. Cependant, il existe une différence notable sur le volume total de CH_4 qui est deux fois plus importante avec les fèces de poissons inoculées que celles non inoculées et les fientes de volaille. Ainsi, pour une masse de MO de 50g utilisé, le volume de biogaz obtenu est respectivement de 14,4 ; 12,4 et 10,1 ml de biogaz g^{-1} de fèces. Nos résultats montrent que les fientes de poissons est bon substrats méthanogène et l'utilisation de l'inoculum permet un démarrage rapide de la production de biogaz et évite les pertes de MO.

Mots clés : méthanisation, biogaz, fèces de poisson, MO (matière organique).

Side-event 3: “Understand coastal processes to better manage the West Africa coast”. Morning 15th December 2016, Chapiteau Room

CHAIRMEN: Rafael ALMAR (IRD, France), Moussa SALL (MOLOA, Senegal), and Abou BAMBA (CA, Ivory Coast)

Guest of Honor Pr. Dr. Ir. J.A. ROELVINK (UNESCO, The Netherland)



Saint-Louis breach observed during the Costavar experimenet the week before ICAWA (Rafael Almar © IRD 2017).

Coastal zones are essential for social and economic developments. In West Africa, coastal zones represent 80% of the regional economic activity (UEMOA). The entire coast experiences a large erosion rate that reaches 10 m year⁻¹ at Cotonou (Benin). Because most countries in West Africa are facing the same vulnerability to erosion, it has become a major regional issue. Located at the interface between ocean and continent, the coasts are vulnerable to environmental hazard and are currently facing an intensification of risk associated with increasing human pressure and the context of global climate change. West Africa countries are currently facing a rapidly growing demographic pressure and uncontrolled exploitation of resources associated with rapid economic development. The natural environmental vulnerability of the coastal zones (*i.e.* extreme events of tropical storms, erosion, flooding) conjugated with demographic pressure increases hazard for human activities and represents a limitation for coastal development (maritime transport, tourism, urban development).

One of the principal limitations to our knowledge of coastal dynamics is a lack of appropriate integrated observations (multi-scale, structured in a network, maintained over long term) and numerical tools (regional to coastal areas, hydro-morphological nearshore dynamics). There is a strong need for a greater understanding and estimation of present dynamics and future evolution (ALOC-GG 2011 report, global warming impact, Stive, 2004).

This session aimed at providing our current knowledge on the understanding of the processes responsible for the observed large coastal variability and erosion, quantifying their impact; by reviewing current projects, actions undertaken so far, monitoring and modeling tools employed. This session also reviewed solutions in

anticipating coastal evolution and improve coastal zone management techniques and politics toward an integrated strategy for risk mitigation.

A special discussion animated by Patrice Brehmer and Rafael Almar have taken place between AWA WP2, and our side event, focusing on the use of stereoscopic camera to follow the fishermen activity on a particular landing site by counting the number of canoe in activities per day and even at high temporal frequency, in order to improve the estimation of the fishing effort of small scale fisheries. Moreover the interest to follow algal beaching or cetacean stranding as turtle frequentation appear of relevant interest for the sub region and without technical lock. Lastly the implementation of the stereoscopic camera can also allow to check potential illegal activities on the landing site or any interference us.

Communiqué de presse « campagne Costvar »

La campagne de recherche COASTVAR vient de se terminer sur la langue de barbarie à Saint-Louis, la veille de la troisième édition de ICAWA à Dakar. Les objectifs de **l'équipe internationale (Senegal, France, Togo, Benin) de plus de 17 scientifiques** visaient à comprendre les causes de la forte érosion côtière observée dans la zone **qui concentre des enjeux majeurs sociétaux (patrimoine mondial de l'UNESCO) et environnementaux** (parc national, aire marine protégée). Cette campagne, financée par l'Agence Nationale Française de la Recherche (ANR) est le fruit d'une collaboration entre l'Institut de Recherche pour le Développement, L'Université Cheikh Anta Diop de Dakar et le Centre de Suivi Ecologique et le Département des Aires Marines Protégées. **L'équipe a installé un système vidéo de suivi du trait de côte pérenne au niveau de l'hotel Dior et, avec l'aide des sapeurs pompiers de Saint-Louis, déployé des instruments de pointe sur la plage et au large pour la mesure des vagues, marée, courant et évolution sédimentaire.** La mesure complète topographique de la langue de barbarie permettra pour la première fois de quantifier **les taux d'érosion, qualifier les zones les plus vulnérables faces aux aléas océaniques et identifier les points d'ouverture future de la brèche.** Les retombées pour les populations exposées et la gestion de l'aire marine protégée de la langue de barbarie sont espérées nombreuses.



A gauche : Sur le bateau en partance pour le déploiement de courantomètres au large. A droite : Structure avec LIDAR (laser), cameras et base GPS.

Plus d'information : Moussa Sall (CSE, Dakar) : sall@cse.sn ; Rafael Almar (IRD, Toulouse) : rafael.almar@ird.fr ; Paul Moise Diedhiou (DAMCP, Saint-Louis) : paulmomodiedhiou@gmail.com



Side Event 3

Understand coastal processes to better manage the West African coast

Overview of the Keynote speech: Prof. dr. ir. J.A. Dano Roelvink

UNESCO-IHE, Coastal Systems & Engineering and Port Development, p.o. box 3015, 2601 DA Delft, The Netherlands

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AWA © MS WP2_S2_20

Abstract

Not communicated by the author. The presentation will provide an overview of processes such as longshore transport, swell vs wind waves, infragravity waves; causes of coastal erosion, such as longshore transport gradients, overwashing, sand mining, port construction; effect of mitigating measures, such as groynes, revetments and (unfortunately rare) sand nourishment; sand bypassing and nourishment as structural solution vs groynes and revetments as combating symptoms. Importance of healthy beaches for coastal ecosystem.



Side Event 3

MOLOA 2013-2016: Elements of the West African Coastal Assessment

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AWA © MS SE3_17

Abstract

Launched in 2013 as part of the West African Economic and Monetary Union's (UEMOA) regional program to combat coastal erosion, MOLOA (Mission d'Observation du Littoral Ouest Africain) developed a coastal assessment in 2016 which constitutes an updating of the master plan executed in 2011 by IUCN. According to the demographic prospective, 50% of the urban population is concentrated in this area (Mauritania to Benin) which will welcome 80 million inhabitants in 2050 in a trend scenario. In addition, extreme marine weather events are recurrent and the works of extension and protection of the infrastructures are practically generalized thus justifying the modification of the issues in certain sectors identified within the framework of the master plan.

Keywords: Erosion, coastline, impact, climate change, West Africa.



Side Event 3

COASTVAR: understanding the processes responsible for the observed large coastal variability and quantifying their impact

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AWA © MS SE3_19

Abstract

This project is an important step to not only improving our understanding of coastal dynamics in vulnerable and non-documented tropical environments, but more generally providing fundamental insight in the functioning of coastal zones. It enable to validate 3D wave-current models and 2D morphological models in challenging conditions. COASTVAR has three key scientific objectives: 1) Bridging the knowledge gap in event-scale beach evolution and more specifically on hydro-sedimentary mechanisms linking the upper beach and surf-zone dynamics. This includes the study of extreme events and crucial but mostly unknown beach recovery. 2) Identifying the hydrodynamic processes involved in cross-shore exchanges between nearshore and shelf zones and the role of transient currents. There is still no consensus on the origin and effect of these currents, on their 2D or 3D dynamics and their relation to the stratification of shelf waters. 3) Understanding the sources of coastal variability at various scales, in particular the link between short-term (event scale) and long-term evolution. This includes determining the long-term impact of individual events (*i.e.*, resilience?) and the coastal response to oceanic forcing with seasonal modulation of wave conditions or regional climatic modes.



Side Event 3

Dynamics of the coastal arrow of the Langue de Barbarie from 1954 to 2016

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AWA © MS SE3_10

Abstract

Dynamics of the coastal arrow of the Barbary Language from 1954 to 2016
Situating on the West African Atlantic coast, at the mouth of the Senegal river delta, the sandy coastal arrow of Langue de Barbarie plays a fundamental role in the stabilization of the north coast of Senegal, and constitutes a natural rampart for the historic island city of Saint-Louis that it defends against the swells and storms of the Atlantic. However, the dynamics of the Langue de Barbarie are still complex and little known, as regards in particular the impact of the swell on the shore and the dynamic response of the latter, the contributions of sand and their redistribution by the swell through coastal drift, longshore sediment transport and its interaction with anthropogenic actions (defense works, breach ...), sedimentary bypass and sedimentary exchanges between the delta of the stream and the delta of the adjacent mouth ... which does not facilitate the forecast of scenarios of geomorphological evolution of this coastal arrow whose socio-economic and environmental stakes are unquestionably strong. The lagoon water level behind the Langue de Barbarie tended to rise considerably during a period of high flooding of the Senegal River, particularly during the rainy season, causing repeated flooding in the town of Saint-Louis and its surroundings. It was during one of these flood cycles that, on the decision of the local authorities, a breach 4 meters wide was opened on the coastal spit in October 2003, with the aim of sparing the historic island of a risk of flooding. The opening of this breach certainly made it possible to lower the water level in Saint-Louis, but reveals in consequence serious problems of management and coastal management. The dramatic enlargement of the breach resulted in the dismantling of the coastal arrow, causing the destruction of houses, infrastructure and settlements that it supports, justifying a dynamic analysis of the Langue de Barbarie.

Keywords: dynamics, coastal arrow, breccia.



Strong event analysis measured by "ALIZE" bouys in Cotonou area

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Abstract

Benin, like most African countries, is exposed to disasters due to climate risks. This includes strong winds, late and intense rains, floods and episodic ocean events including extreme swells. The latter accentuate the phenomenon of erosion and result in material damage along the coast. In order to limit damage and destruction caused by climatic variations and extreme events, the Climate Information Strengthening Project and the Early Warning System in Africa (SAP Benin) were set up in 2013. It is in the framework of this project that in December 2015, the IRHOB (Institute of Fisheries and Oceanic Research of Benin) received an oceanographic buoy (buoy Alizée) and installed it about 6km offshore of the port of Cotonou. The data of the buoy are sent by radio waves to the premises of the IRHOB and are analyzed in order to characterize the temporal variability of the wave, wind and current parameters. The analysis of the wave parameters allowed us to give a statistical assessment of the state of the sea in the region and to identify the strong events during the period from December 2015 to October 2016. These combined with the high tides have led to marine flooding.

Keywords: wave, tidal current, statistics, early warning system.



Side Event 3

Monitoring of hydrodynamic and morphological parameters by imagery video at Grand Popo beach in *Benin*

Frédéric BONOU^{1,*}, Grégoire ABESSOLO ONDOA², SERGE TOMETY¹, Yves DU PENHOAT³, Perret CLÉMENT¹, Rafael ALMAR³, Elodie KESTENARE³, and Armand BAHINI¹

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AWA © MS SE3_61

Abstract

Several studies have been carried out in the Gulf of Guinea to understand the complex dynamics that control the evolution of tropical coastal environments. The results, based on altimetric and re-analyzes data, revealed the variability of hydrodynamic and morphological processes. These results were validated in the short term with field measurement campaigns. In this paper, we propose a validation of the seasonal and inter-seasonal variability from data collected with a video system installed at Grand Popo, Benin since February 2013 – September 2016. Its potential is assessing event and seasonal coastline behaviour have been demonstrated in a previous study. The video system was used to track the evolution of hydrodynamic parameters and beach's state at high frequency and continuously. A comparison of video estimates is carried out with ERAInterim re-analysis data. The results show a strong correlation between seasonal cycles of hydrodynamic parameters and shoreline's position. However, the qualitative variation of the beach (beach slope) is still strongly linked to other parameters (tide and cross-shore transport processes). During the study period, the Grand Popo beach experienced a gradual decline of its shoreline, reflecting the presence of a strong trend or an inter-seasonal (inter-annual) cycle.

Keywords: video system; seasonal cycle; shoreline; waves; beach slope; alongshore sediment transport; Bight of Benin; Inter-seasonal variability.



Side Event 3

Nearshore Sedimentary transfer: On Flash Rip Activity Quantification

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AWA © MS SE3_02

Abstract

The coastal zone of the Gulf of Guinea is exposed to high-energy ocean swell generated in the South Atlantic. This zone is under both increasing societal pressure and the threat of coastal erosion. In order to understand the primary hydrodynamic and sediment processes along this stretch of coast, an intensive field campaign was conducted at Grand-Popo beach in Benin (12 to 19/03/2014). Flash rips current has been shown to occur repeatedly in this environment. This process is transient in both time and space, field data on it is scarce, with video monitoring appearing as a relevant approach to capture their dynamics on large temporal and spatial scales. In this study, we implemented a method based on image processing in order to detect the presence of rips, to extract their characteristics and to further link them to the forcing conditions. 434 events recorded in 7 days: the method is relevant for flash rip study. The preliminary results show more occurrence for low incidence in comparison to available conditions but not representative enough to conclude and we report an increasing littoral drift (as the incidence angle) makes the flash rip dissipate faster. Lastly, directional spreading increases the lifetime of flash rip but not the crossshore extension. The perspective are to improve in situ measurement method to detect suspended matter in rip and turbulence and generation mechanisms, to deploy two coupled ADCP of different frequencies and a colocated turbidimeter located in the flash rip neck will allow us to retrieve Reynold turbulent stresses components and to address the sediment grain size and concentration and lastly to make a proper statistical study on the available data.



Side Event 3

Impacts of protection structures on sandy shores: the example of the seaside resort of Saly (Petite Côte, Senegal)

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Abstract

The annual morpho-sedimentary study of the Saly coastline between December 2013 and December 2014, carried out with a series of beach profiles, showed that coastal erosion severely affected its morphological evolution, thus jeopardizing the main socio-economic activity of the area, tourism. The spikes and breakwaters built in Saly, with little structure, were not very effective. The erosion processes continue and worsen even in several areas of the coastline, causing a considerable sedimentary imbalance between a northwest and a southeast sector separated by a spur extended by a breakwater built at the Safary Hotel by the government of Senegal. This structure has a very decisive influence on the current dynamics of this coastline. The coastline has an eroding zone located to the south-east downstream of the "épi-breakwater" of the Safary Hotel. The effects of isolated spikes are much more evident than those of the "épi-breakwater". The beaches downstream of it are not protected and are subject to erosion due to the effects of the return currents.

Keywords: Saly, beach profile, coastal erosion epi breakwaters, evolution.



Side Event 3

Drones photographes pour le suivi du littoral

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AWA © MS SE3_06

Abstract

Fruits de la collaboration entre le Laboratoire Domaines Océaniques de l'IUEM et l'Université Claude Bernard de Lyon, les drones DRELIO survolent depuis 2006 plusieurs plages aux alentours de Brest en acquérant des photographies aériennes à très haute résolution. Ces clichés permettent de générer des Modèles Numériques de Terrain (MNT) pour l'étude de la topographie et de l'évolution morpho-sédimentaire de la frange littorale.

Keywords : Drone, Aerial, picture, coastline, high resolution.



Drone HyperSpectral

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AWA © MS SE3_07

Abstract

L'objectif de ce projet est la mise au point d'un drone équipé d'un capteur d'imagerie hyperspectrale sensible dans le visible et le proche infra-rouge. Ce type de plateformes offre un grand potentiel pour l'étude des paramètres physico-chimiques, biologiques et géologiques de la « Zone Critique ». L'intégration du capteur hyperspectral sur le drone a nécessité la mise au point de solutions innovantes pour assurer une bonne autonomie et une excellente stabilité de la plateforme. Des développements technologiques et méthodologiques sont toutefois encore nécessaires afin d'avoir un système totalement opérationnel depuis l'acquisition de la donnée jusqu'à la création d'un cube hyperspectral corrigé géométriquement et radiométriquement.



Side-event 4: « Environmental marine law in West Africa ». Morning 13rd December 2016, Room Chapiteau

CHAIRMEN: Pr. Ibrahima LY (UCAD, Senegal), Mme Dienaba Beye TRAORÉ (SRFC-CSRP, Senegal) and Dr. Marie BONNIN (IRD, France)



Restitution of Side event 4 in plenary session with Pr. Ibrahima LY, Mme Dienaba Beye TRAORÉ and ICWA chairmen.

Recommandations

La première présentation sur la « pêche durable et adaptation au changement climatique : **les nécessaires réformes du droit des pêches dans l'espace CEDEAO** » a fait essentiellement les recommandations suivantes : développer en Afrique de **l'Ouest la coopération dans l'adaptation à la lumière du changement climatique** ; et développer et assurer le suivi des mesures pour une pêche durable, en prenant en compte par exemple : **la hiérarchisation des mesures d'adaptation** ; **l'implication des pouvoirs publics qui jouent un rôle moteur dans l'encouragement à la mise en place des mesures d'adaptation aussi bien par le secteur public que le privé** ; **l'adaptation des solutions de financement au cas par cas** ; la promotion de la gestion intégrée des zones côtières ; **l'intégration des changements climatiques dans les politiques et stratégies liées à la pêche** ; la prise en compte des communautés vulnérables, par exemple les acteurs de la pêche artisanale ; le renforcement des mesures visant à **réduire la surpêche et l'excédent de capacité de pêche** ; **la promotion l'approche écosystémique** ; **le renforcement des mesures portant sur l'établissement d'aires marines protégées** ; **la promotion de la mise en place d'un cadre institutionnel communautaire, avec la mise en place de moyens financiers et techniques, ainsi que de prérogatives permettant d'assurer le suivi de ces mesures.**

La deuxième présentation portant sur « **quelles mesures juridiques et institutionnelles nécessaires pour mieux protéger l'environnement marin sénégalais face à l'exploitation du pétrole et du gaz** » a permis de retenir les recommandations suivantes en rapport avec l'approche de précaution : **l'amélioration de la Norme NS 05-061 qui met l'accent sur le rejet des eaux usées et la formulation des normes minimales spécifiquement liées au secteur pétrolier en prenant en compte toutes les considérations du processus de l'activité pétrolière** ; **l'évaluation environnementale**



stratégique (EES) avant une éventuelle production pour mieux prévoir les impacts directs et cumulatifs du côté des pays voisins ; **la nécessité d'une étude d'impact environnemental** avant-projet de chaque phase ; la signature par le Sénégal de toutes **les conventions pertinentes de l'OMI (surtout pour les conventions FIPOL portant création d'un fond pour l'indemnisation en cas de marée noire causée par le trafic maritime ou l'obturation des puits) ; l'interdiction des rejets des déblais, boues et ciments même après traitement dans les profondeurs allant de 200 à 1500 mètres ; l'interdiction des campagnes sismiques dans les zones sensibles pendant la période de la remontée des eaux profondes entre novembre et mai ; l'interdiction de la proposition de forage des puits verticaux devant une biodiversité riche et sensible ; l'obligation pour les compagnies de réaliser parallèlement des puits de secours, dispositifs rendus obligatoire par la Norvège, le Canada et le Brésil.** La formulation de normes minimales pour les boues, déblais, système du torchage et **eaux de production pour une meilleure gestion des impacts négatifs de l'exploitation pétrolière et gazière offshore au large de la sous-région ouest africaine.**

La troisième présentation sur « **l'encadrement juridique des câbles sous-marins et les activités de pêche** » a abouti aux **recommandations suivantes : l'intégration, dans le Code des télécommunications sénégalais, des dispositions juridiques sur les conditions et modalités de pose, d'entretien et de déclassement des câbles sous-marins tenant compte des activités économiques menées sur l'écosystème marin et côtier.** Et **l'intégration, dans le Code de la pêche maritime sénégalais, des dispositions préventives et sécuritaires pour éviter l'accrochage des câbles sous-marins par les navires de pêche.**

La quatrième présentation relative à **l'élaboration, dans le cadre de la Convention des nations unies sur le droit de la mer (CNUDM), des normes relatives à la conservation et à l'utilisation de la biodiversité marine au-delà des zones sous juridiction nationales (ZAJN) et le rôle potentiel de la CSRP** » a abouti aux recommandations suivante : les ZAJN devraient avoir le statut juridique de **patrimoine commun de l'humanité faisant l'objet de protection particulière** en raison de leur importance aux plans écologiques, socio-économiques et scientifiques dans les ZEE/CSRP. Et **Mise en place d'un mécanisme sous régional de coordination de la position des EM/CSRP par rapport au statut juridique des ZAJN pour avoir une approche commune à l'instar de l'approche utilisée pour la demande conjointe de délimitation des limites extérieures des frontières maritimes devant les NU.**

Le Professeur Ibrahima LY a informé de la parution de l'ouvrage collectif « Droit de l'environnement marin et côtier au Sénégal » (IRD/PRCM) sous la direction des Professeurs Marie BONNIN (IRD), Ibrahima LY (UCAD), Betty QUEFFELEC (IRD) et Moustapha NGAIDO (UCAD). A la fin de la session thématique, le manuel a été retenu comme devant être primé par ICAWA 3.



Side Event 4

Droit de l'environnement marin et côtier au Sénégal

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Abstract

L'ouvrage traite du droit de l'environnement marin et côtier au Sénégal. Il met à la disposition des chercheurs et décideurs ainsi que de tous les acteurs de l'environnement ainsi que du public, les connaissances essentielles sur l'application des règles et politiques environnementales sur le milieu marin et côtier au Sénégal. Il comprend au total 532 pages, avec une préface signée par Mr Ahmed Senhoury, Directeur de l'Unité de coordination et de mobilisation du PRCM. Il comporte six parties avec des cartes et des illustrations. Les parties traitent des points suivants : Les frontières de l'environnement marin sénégalais ; Les institutions compétentes en matière de protection du milieu marin ; La protection du milieu marin par le droit relatif à la conservation de l'environnement et à son aménagement ; L'intégration de l'environnement marin dans la réglementation des activités humaines ; La protection du milieu marin par le droit des pollutions et nuisances ; Les sanctions du non-respect du droit relatif à l'environnement marin. La présentation de ces différents aspects juridiques et institutionnels est étayée par des cartes et illustrations (11 cartes au total) pour permettre aux lecteurs de bien situer sur le milieu marin et côtier les règles de protection juridique à respecter par tous. Cet ouvrage constitue la parfaite illustration de la collaboration entre chercheurs et décideurs dans le combat inlassable pour protéger les littoraux et milieux marins en Afrique.



Side Event 4

Sustainable fisheries and adapting to climate change: the necessary reforms of fisheries law in ECOWAS

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Abstract

Fishing is a source of employment, currency and especially food for thousands of people. However, this sector is deeply affected by climate change. Climate effects include rising sea levels, acidification of the oceans, droughts and floods. The accumulation of carbon dioxide and other greenhouse gases in our atmosphere is changing many of the characteristics of the world's climate, oceans, coasts and freshwater ecosystems, affecting fisheries. The right of fisheries in the ECOWAS area must dwell on benefits on adaptation to climate change in order to ensure the sustainability of the fishery. Indeed, fishing for the countries of West Africa is fundamental.



Side Event 4

L'encadrement juridique des câbles sous-marins et les activités de pêche

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Abstract

Au Sénégal, plusieurs câbles sous-marins de télécommunications sont actuellement en service et assurent de nos jours l'essentiel des communications avec l'étranger. Des câbles sous-marins assurent également le transport et la distribution d'électricité à l'instar de la ligne qui relie Dakar à l'île de Gorée. Enfin les fonds marins au large de Dakar sont le cimetière de câbles télégraphiques ou à transmission analogique hors service. L'essentiel des dommages sur les câbles sous-marins sont causés par la pêche et les ancres. Quand un navire accroche un câble, les conséquences peuvent mettre en danger le navire et l'équipage, provoquer la perte de matériel, la perte de la cargaison et une perte de temps de pêche. La rupture des câbles provoque également des impacts majeurs sur les communications internationales et la distribution d'énergie électrique. En raison des enjeux économiques et stratégiques, la protection des câbles sous-marins et l'encadrement des risques qu'elles peuvent occasionner pour la pêche intéressent le droit. En droit international, cet intérêt se manifeste à travers des dispositions de la Convention de Paris du 14 mars 1884 pour la protection des câbles sous-marins et de la Convention des Nations Unies sur le Droit de la Mer (CNUDM). En droit interne, la cohabitation des câbles sous-marins et des activités de pêche est aménagée par le Code des télécommunications et le Code de la pêche maritime. Le défi est d'assurer une gestion intégrée des fonds marins pour les besoins des télécommunications, de l'électricité et de la pêche.

*Side Event 4*

Analysis of the environmental risk reduction mechanism of the offshore petroleum industry on the Petite Côte du Sénégal

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Abstract

Legal and institutional measures to better protect the Senegalese marine environment confronted with the exploitation of oil and gas. Although a legislative production process in the environmental field has been under way for some years now, provisions for environmental regulation of oil and gas operations are incomplete and remain difficult to implement. Until now, the situation is unclear in many areas, these provisions are often ambiguous and above all incomplete and still pose problems regarding the protection of the marine environment. Faced with this recent discovery of oil and gas, Senegal has not yet ratified the protocol of MARPOL 73/78. This instrument regroups two treaties adopted in 1973 and 1978. The 1978 IMO conference adopted a protocol to the MARPOL Convention of 1973 which absorbed the parent convention and developed the requirements applicable to oil tankers so that they were less likely to pollute the marine environment. In addition, the Convention on Fishing and Conservation of the Living Resources of the High Seas has not yet been ratified by Senegal. For the time being, the main activities related to seismic surveys and exploration drilling are carried out at the level of the rim of the continental shelf by multinational companies in search of hydrocarbon. As a part of the national regulations, the country is strengthening its policy, strategic, program and legislative framework for environmental protection and improvement, but the deficit of national environmental standards is particularly felt in the marine environment and more particularly with concerns related to offshore oil activities. In the field of the petroleum industry, the realities become more complex and in order to better manage the impacts on marine biodiversity and fisheries resources, other relevant measures concerning the disposal of cuttings, cement, drilling mud, production waters, ballast water and anti-fouling paints must be taken into account in national regulations so as not to compromise the components of the natural resource of the receiving environment. Environmental bonds specifically related to the petroleum industry can be summarized as follows: Environmental and Social Impact Studies (ESIA); Environmental Management Plan (EMP); Emergency Response Plan (ERP); Monitoring and Surveillance Plan (MSP).



Elaboration, dans le cadre de la Convention des Nations Unies sur le droit de la mer, des normes relatives à la conservation et à **l'utilisation de la biodiversité marine au-delà des zones sous juridiction nationales (ZAJN)** et le rôle potentiel de la Commission Sous Régionale des Pêches (CSRP)

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Abstract

L'importance de la biodiversité marine au-delà des zones situées sous les zones sous juridiction nationales préoccupe la communauté internationale qui a entamé des discussions au sein de plusieurs forums (Conférence des NU sur le développement durable (DD) en 1992 et mieux en 2012 sur "L'avenir que nous voulons » ; Le programme de DD à l'horizon 2030 des NU avec les Objectifs de DD 14 qui visent à conserver et à exploiter de manière durable les océans, les mers et les ressources marines aux fins du DD et enfin Le Plan d'action d'Addis-Abeba (PAAA) qui constitue aujourd'hui le cadre global de financement du programme de DD à l'horizon 2030 (PDD-H2030).

Avant ces échanges de la communauté Internationale, des instruments juridiques internationaux existaient pour régir les responsabilités en haute mer (Accord de conformité, FAO1993), les stocks de poissons (NU, 1995) et le Code de conduite pour une pêche responsable CCPR/FAO 1995. Tous ces instruments ont fortement favorisé l'examen en toute urgence de la question de la conservation et de l'exploitation durable dans les ZAJN. Ce qui a conduit les NU a enclenché le processus d'élaboration du projet de convention, dans le cadre de la CNUDM relative a la conservation et l'utilisation de la biodiversité marine au delà des ZAJN. Des avancées dans la connaissance et le statut des ZAJN sont notées dans différentes régions du monde. La région de la CSRP qui est comprise dans la zone de compétence de la Convention de 1985 d'Abidjan « relative à la coopération en matière de protection et de mise en valeur du milieu marin et des zones côtières dans la région de l'Afrique de l'Ouest et du Centre ». Cette dernière a mis en place un groupe de travail régional sur les ZAJN. Quelle contribution/position quant au statut des ZAJN et des intérêts à tirer pour les Etats membres de la CSRP?



Side-event 5: “Toward the establishment of a scientific council for SFRC member’s states”. Morning 15th December, Plenary room

CHAIRMEN: Cdt Babacar BA (SRFC-CSRP, Senegal), Dr Patrice BREHMER (IRD, Senegal), Dr Joern SCHIMDT (University of Kiel ‘CAU’, Germany)

Guest of Honor **Mohamed M’Barek O. SOUEILIM (IMROP, Mauritania)**

Terme de reference (TdR) / Term of reference (ToR)

La CSRP est un organisme intergouvernemental créé par voie de convention le 29 mars 1985 qui regroupe sept (07) Etats membres (Cabo Verde, Gambie, Guinée, Guinée Bissau, Mauritanie, Sénégal et Sierra Leone) dont le siège est à Dakar au Sénégal ; ses Organes sont:

- La Conférence des Ministres (Ministres en charge des pêches) qui se réunit en session ordinaire tous les deux (02) ans et en session extraordinaire à chaque fois que de besoin.
- Le Comité de Coordination, composé par les Directeurs des pêches des Etats membres. Il est un organe technique consultatif de la Conférence des Ministres. Il se réunit également en session ordinaire tous les deux (02) ans pour préparer la Conférence des Ministres et en session extraordinaire à chaque fois que de besoin.
- **Le Secrétariat Permanent, est l’organe d’exécution, chargé de la mise en œuvre des décisions de la Conférence des Ministres.** Il est dirigé par un Secrétaire Permanent et dispose de trois (03) départements et divers Services.

En dehors de ces organes statutaires, le Secrétariat Permanent bénéficiait du soutien technique de trois (03) Groupes de travail : le groupe de travail des juristes, le groupe de travail Suivi, Contrôle et Surveillance, et le groupe de travail Recherche.

Ces groupes de travail ont été très actifs de par le passé en alimentant la réflexion sur des thématiques majeures adressées par la CSRP comme la gestion durable des petits pélagiques. **Cette réflexion sur les petits pélagiques a d’ailleurs fortement influencé le dossier de requête du projet CCLME. Aujourd’hui, force est de constater que ces groupes de travail ont connu, ces dernières années, une léthargie préjudiciable à la réflexion au niveau de la CSRP.** Toutefois, depuis 2013, il est noté un certain regain des activités des groupes de travail des juristes et du SCS sur des dossiers importants comme la saisine du TIDM et **l’élaboration de la Convention SCS ; démontrant ainsi la pertinence de ces entités de réflexion et de conseil.**

A ce propos, la Convention SCS établit la Commission Technique SCS comme un organe consultatif ayant pour mission de renforcer la collaboration et la coopération sur les activités sous régionales SCS. Cette commission est composée des directeurs des structures SCS des Etats membres. La CSRP souhaite ainsi étendre la démarche au domaine de la recherche qui **constitue un pan important de l’aménagement des pêcheries.**

L’objectif principal est d’initier la réflexion sur la mise sur pied de la Commission Technique Recherche.

Introducing speech

Patrice BREHMER (IRD, FRANCE), CDT BABACAR BA (SRFC/SCS-DRSipi), THE GAMBIA) EXCUSED

*Side Event 5***Is the structure and organization of ICES/CIEM an example for a scientific council on “Marine Fisheries and Ocean” for West Africa?****JOERN SCHMIDT****GERMAN REPRESENTATIVE IN THE SCIENCE COMMITTEE (SCICOM) OF THE INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA ‘ICES’**

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Abstract

The International Council for the Exploration of the Sea (ICES) is an Intergovernmental Organization that develops science and advice to support the sustainable use of the oceans. ICES currently has 20 member states and supports a network of more than 4000 scientists from these member countries and beyond. It provides advice to the European Union through the European Commission, Regional Fisheries Management Organisations (RFMOS) like the North East Atlantic Fisheries Commission (NEAFC) and the North Atlantic Salmon Conservation Organization (NASCO), Regional Conventions like the Oslo Paris Convention (OSPAR) and the Helsinki Commission (HELCOM) and member countries.

ICES structure is serving the purpose to provide a scientific network and a mechanism to translate the science into salient, credible and legitimate advice. The main structure that is funded through membership contributions is the secretariat, which supports all secretarial, administrative, scientific, and data handling support activities and ensures communication and dissemination. The scientific network is governed by the Science Committee (SCICOM) and topical Steering Groups and consists of currently over 130 expert groups and 20 – 30 yearly workshops. The presentation gives an overview and description of the structure and opens the discussion, if ICES can serve as a structural example for a scientific council for West Africa.



Side Event 5

CS4AWA, A research proposal on Climate Service for the AWA region

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Abstract

CS4AWA's main objective is to develop better tools, methods, and standards on how to produce, transfer, communicate, and use reliable climate and related information for the African Atlantic coastal region. It will, thus, contribute to the development of climate services (CS) for this region; where to our best knowledge, no consistent CS exist for Ocean sectors, despite their great societal and economic significance, and despite an urgent demand (see e.g., Ocean climate declaration of Dakar, 2015), particularly since CoP21. CS4AWA has three specific objectives that contribute to integration and application of climate science for decision-making, and research for co-development of advanced CS: 1. To integrate improved climate predictions with coastal erosion (and associated risks, 1), marine ecosystems, and fisheries bio-economic impact models to provide relevant user demanded information for the three African Atlantic large marine ecosystems (LME): Canary Current (CCLME), Guinea Current (GCLME), and Benguela Current (BCLME). 2. To support science based decision-making at local, national, regional and international level by analysing how climate change (CC) impacts will affect the socio-economic development of the coastal zone, with focus on small-scale fishing communities and coastal populations. 3. To co-develop advanced tools, methods and instruments to produce, transfer, communicate and use scientific information and model outputs in order to enhance the capacity of decision-makers to deal with climate uncertainties knowledge. In the first, knowledge of user requirements gained from the AWA and PREFACE projects will be refined with respect to climate impact prediction capabilities and according to the UG. The second will assess whether user requirements are being met, and revisit user and researcher expectations. The final workshop will provide products and summary information to the UG, evaluate whether expectations were met, and design the next step in CS based on CS4AWA's results. We will develop CS using seasonal and long-term climate predictions. Climate predictions from PREFACE using innovatively corrected models will drive regional marine ecosystem, fisheries, and coastal impact models for the three LMEs. Output from AWA and



PREFACE bio-economic models that integrate survey derived user behaviour with climate predictions will be used to assess the vulnerability of small scale fishing communities and identify appropriate adaptation strategies. Uncertainty measures will be provided by multi-model data. CS4AWA will develop an interactive web-platform as a key instrument to disseminate CS products to the UG: general public, academia, and decision makers. This project and its AWA and PREFACE precursors actively contribute in capacity building in African countries on the Atlantic coast both in natural and social sciences, through active involvement and training (including summer schools and graduate level courses) of CC impacts researchers from the region. CS4AWA will engage these African countries in using CS and increase market opportunities locally and for Europe. CS4AWA will thus improve the communication of prediction uncertainties to the stakeholder community. We will communicate climate knowledge in a way that is both scientifically sound and easily understood, facilitating decision making, and integrating into the broader context of societal, economic, and environmental changes.



Side Event 5

Sustainable management and influences of/adaptation to climate change in W-Africa

MECKI KRONEN^{1,*} AND MARK PREIN

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AWA © MS SE5_S1_3

Abstract

This theme will allow to discuss the various issues, including climate change (and L&D) but also regional approaches to sustainable artisanal fisheries. Global Programme on Risk Assessment and Management for Adaptation to Climate Change (Loss and Damage) funded by German government and implemented by GIZ (global programme managed by Dr. Michael SIEBERT).



Side Event 5

Regional consequences of climate changes on the West African coastal environment: identifying knowledge gaps

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Abstract

Climate change will impact the coastal socio-ecosystems in various ways. This will be particularly true along the West African shores where no specific regional projection exercise has been carried out so far. We propose to present 1) the type of approaches that have been implemented for other coastal regions, *e.g.* in other upwelling systems to gain insight into the regional/local consequences of climate change; 2) the needs of regional stakeholders; 3) the scientific programs that could address these needs.



Side Event 5

Conservation genetics of fish in Western Africa to improve regional fisheries management

**PATRICE BREHMER¹, THIERRY HORAREAU², BLOOMER PAULETTE³, FAMBAYE NGOM SOW⁴, BRAHAM BAYE⁵,
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Abstract

In western Africa, multiple species of marine fish are exploited by a large fishing community. The exploitation of this resource calls for the establishment of appropriate management and conservation strategies at national and regional levels, which must start with the correct species identification of catches at fish landing sites. To improve fisheries management in West Africa, research actions have recently been developed, but surveys for the correct identification of species and delimitation of stocks are still in need as *e.g* the famous sardinella shared stock between Morocco, Mauritania, Senegal, Gambia, Guinea Bissau. Research of the past two decades established that molecular approaches are the best to fill the need especially in poor data area. To address these challenges, we propose a research programme for improving the identification of catches following two objectives. The first objective is to implement a biodiversity collaborative survey on landing sites, with small scale fishermen, using a barcoding approach which will provide a reference barcode library for future studies. This objective may also help discovering new species, establish data base, follow inventory of genetic resources and identify taxonomic ambiguities as well as traceability of fishing product for *e.g.* exportation. The second is the development of appropriate molecular tools for the delimitation of potential genetic stocks in West Africa for selected fish of high economic importance. The project involves a network of collaborators which will facilitate different aspects of the study including collection/sampling and laboratory procedures. The outcomes of the project include the development of a molecular resource for West African fish, improvement of fisheries management particularly for transboundary species and a better understanding of their biodiversity along the East Atlantic. The project will also contribute to building human capacity in fish identification as well as strengthening a collaboration network between Mauritania to Guinea and South Africa. Scientific outputs will include identification tools, reports for national and regional fisheries organizations, conference communications, and scientific articles in international peer-reviewed journals. The new knowledge gathered by the project will be crucial for better management of commercial and threatened fish in West Africa as well as establish a precedent for future studies on other commercially important taxa.

*Side Event 5*

Socio economics in West Africa vs Climate change: potential extension of AWA-Preface field surveys

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Abstract

Global Climate Change and related environmental change are undoubtedly major impacts on world societies. The primary sector with agriculture and fisheries is specifically sensitive as temperature and precipitation changes directly influence plants and animals. Thus it is necessary to gain empirical knowledge of the actual effects of environmental change on these sectors. In addition, climate change is not the only driver and for the development of meaningful management strategies, knowledge about other major impacts and their effects on society and economies is necessary.

In the framework of the AWA and PREFACE projects, we had developed questionnaires, targeting fishing communities (fisher, processor, retailer) to collect empirical data on environmental change, the economic situation of the sector and current regulations. The surveys have been carried out in Senegal and Cape Verde and currently (2017) in Nigeria. Survey data will be used to perform cross-community and cross-country climate vulnerability assessments, to inform local communities and local and national governments. The surveys are programmed to be conducted using tablet PCs. Therefore they can be easily adapted and carried out in other countries as well to allow for comparison. In this presentation, we present the core parts of the survey and the main questions addressing climate change to discuss, if this could be of potential interest to other countries and the potential to extend the surveys, given appropriate funding.



The « Blue belt initiative » in the context of CoP22

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AWA © MS SE5_S1_7

Abstract

Une plateforme collaborative pour agir ensemble et mettre en pratique des solutions innovantes pour l'adaptation du secteur de la pêche et de l'aquaculture au changement climatique et pour la résilience des océans et du climat. Les zones côtières et les Zones Economiques Exclusives des Etats côtiers concentrent l'essentiel des activités de la pêche et de l'aquaculture. Elles sont à l'origine de plus de 85 % des captures de la pêche mondiale. Figurant parmi les régions des océans les plus sensibles aux effets du changement climatique, elles exigent un renforcement des observations, ainsi qu'une attention particulière dans nos stratégies d'adaptations en matière de pêche et d'aquaculture, ainsi que des actions contribuant aux efforts d'atténuation dans le contexte du changement climatique. L'initiative de la ceinture bleue propose un plan d'action global comprenant une feuille de route de «solutions» à mettre en oeuvre. Basées sur les best-practices, ces «solutions» sont les actions identifiées comme prioritaires qui devront être enrichies par la recherche, l'innovation, l'échange d'expertise et les retours d'expérience issus de toutes les régions du Monde. Mises bout à bout, ces solutions offrent, dans une vision intégrée du secteur de la pêche et de l'aquaculture, qui prend en compte les étroites interactions et les différentes composantes de l'Ecosystème et de la Pêche, la possibilité de transformer le secteur halieutique en un domaine d'activité durable et créateur de richesse. Pour soutenir la réalisation des «solutions», l'initiative prévoit également une «plateforme collaborative» d'appui à leur mise en oeuvre. L'initiative se propose d'instituer cette plateforme pour créer un réseau d'experts orienté vers les projets d'adaptation du secteur halieutique dans le contexte du changement climatique, appuyer les acteurs qui le souhaitent dans le montage de projets, dans la recherche de leur financement et éventuellement dans le suivi de la mise en oeuvre. La plateforme collaborative aura également pour mission d'enrichir le package des solutions à travers un forum collaboratif d'échange d'expertise, de retour d'expérience et de mise en commun de solutions innovantes.

Plus information: <http://www.laceinturebleue.org/>



*Side-event 6: “Contribution of human and social sciences research for ecosystemic approach of fisheries management in West Africa”
Morning 14th, room Chapiteau and morning 15th December plenary
Room Dara*

CHAIRMEN: Dr Adama MBAYE (ISRA/CRODT, Senegal) and Dr Assane FALL (IMROP, Mauritania)



The Chairman of the IACWA 3rd Side vent 6 in sub-commission room Adama MBAYE and Dr Assane FALL

Les facteurs socioculturels, économiques et institutionnels, plus que les facteurs biologiques ou physiques, influencent le développement, la gestion et les performances des mesures de gestion des ressources marines renouvelables et des écosystèmes. Les écosystèmes marins ont un impact sur les hommes et réciproquement. En conséquence, les objectifs et orientations des mesures de gestion doivent intégrer les dimensions sociales, économiques et institutionnelles. Ce "Side Events" a permis de questionner la dimension humaine de la pêche en **Afrique de l'Ouest dans le cadre de son adaptation et de sa gouvernance d'une part et d'autre de d'essayer de mettre en réseau** les chercheurs en sciences humaines et sociales dans la pêche. Recommandations (1) Etudier les interactions entre les usages **et l'écosystème du PNBA (mine d'or, transport maritime, ville, routes, pêche)**, (2) Analyser les **motivations des implantions d'industries de farine de poisson et les impacts** sur les ressources halieutiques et sur les populations (problématique actuelle dans sous-région, (3) Analyser le rôle des savoirs locaux dans la cogestion et leur transmission dans le contexte du développement des nouvelles techniques de **navigation et de pêche et de l'arrivée de nouvelles générations de pêcheurs**, (4) Analyser les motivations et les impacts réels des initiatives locales de gestions sur les ressources et les écosystèmes (rapports entre migrants et autochtones), (5) Développement de projets structurants impliquant les chercheurs en sciences sociales et sciences halieutiques (par exemple sur la problématique pêche et migration, changement climatique).



Side Event 6

Senegalese fishermen come to the rescue of the fish flour and fish oil industry in Mauritania

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Abstract

Since the early 2000's, several fish processing and packaging industries have been established in Mauritania. The annual harvest of small pelagics (eg sardinella, horse mackerel, sardines, anchovies) occupies an important place in catches with almost one million tonnes in 2010 (IMROP, 2010). The establishment of this industry is also favored by a migratory dynamism essentially linked to the fishermen of Senegal from "Guet Ndar" to Mauritania; mainly fishermen specialized in the sector of small coastal pelagics. The proportions of the volume of products processed by the industry are mainly distributed between Ethmalose (*Ethmalosa fimbriata* or "Obo"), which contributes 80% and sardinella (round sardinella, *Sardinella aurita* and flat sardinella, *Sardinella maderensis*) with 15% of the volume. In this work, we try to show the contribution of Senegalese fishery targeting small pelagics in the flour and fish oil industry. It is an industry that has many challenges in terms of the supply of fish products. Despite enormous difficulties encountered by Senegalese fishermen during their stay in Mauritania, these fishermen constitute the base of this industry because of their know-how and their availability. We present and discuss the contributions of these non-native fishermen in the development and survival of the Mauritanian milling industry, but also the social conditions of this form of economic migration with its advantages and disadvantages for both parties, increasingly linked in recent decades. We rely mainly on the IMROP data but also on the data collected during field surveys carried out between 2014 and 2015 in Nouadhibou where the main part of the flour and fish oil industry is concentrated.

Keywords: pelagic fishery; Flour and fish oil industry; Senegalese fishermen.

*Side Event 6*

Sustainable Development: The contribution of fishing communities to the sustainable management of fisheries resources

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Abstract

Artisanal fishing is of great economic, social and environmental importance for the more than 80 fishing communities of the Cape Verde islands. In addition to its relevance to the sustainability of the population, it constitutes a source of income, food security and plays a fundamental role in reducing unemployment and in securing populations. In this communication, we aim to discuss and reflect on the contributions of fishing communities to the sustainable management of such fishery industries. It is based on the experience of fishing communities on the islands of São Vicente, Sal and Santiago in the Cape Verde archipelago which have their main economic resource for local development in fisheries. Data and information to perform this work were extracted from formal and informal interviews with residents of the communities and technicians who work in the area, and from the analysis of an applied questionnaire. The results show evidence of sustainable fishing given the type of fishing practiced, the skills used and the diversity of species caught, as well as the level of organization and participation of fishermen and various players in fisheries management and also aspects of community life which influence the sustainability of this activity. However, these communities face problems related to socio-environmental vulnerability, resulting from pressure on resources (causing the State to implement protection measures in fishing areas for certain target species captured), on the occupation of coastal areas, on the introduction of new coastal exploration activities (tourism, port infrastructures, etc.)

Keywords: sustainability development, artisanal fisheries, fishing community.



Impact of the seasonality of small pelagics on their value chain in Senegal

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Abstract

The factors influencing prices at arrival/unloading and products (large-scale and processed fish) according to the different categories of actors are mainly-landed quantities and the quality of the products. These are in turn influenced by the seasonality of the sardinella. It is generally during periods of Coroon (April to June) that landings of sardinella are more important and it is also during this period that the prices of fresh fish and processed products are the lowest. On the other hand, sardinella is rare in Lolli (October to December) and it is also during this period that prices are generally higher. Nevertheless, depending on whether one is on the Little Coast or on the Great Coast, the appreciation of the fishermen about the periods of abundance of sardinella differ. However, based on the analysis of the knowledge of fishermen on the migration of sardinella and bio-ecological models, it appears that sardinella are present on the coast of Senegal during periods of low temperature. Thus, due to the fact that the periods of cold water are later and shorter, sardinella will be more and more rare on the coasts of Senegal, its price higher, its accessibility more difficult and consequently the protein deficiency of populations more stressed.

Keywords: Sardinella, Seasonality, Empirical knowledge, value chain, Senegal.



Side Event 5

Climate change: What kind of knowledge, what type of adaptation for what type of West African artisanal fisher folk

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Abstract

Senegalese artisanal fishermen have always been able to deal with variable weather and changing climate by adapting their knowledge, which is passed on from one generation to the next. The analysis of their perceived and realized threats on climate change and their associated adaptation strategies, revealed that they are based on a mixture of magic-religious (animism and Islamism) considerations and empirical knowledge. Such considerations and knowledge lead to (1) divination sessions to address *e.g.* the lack of rain and too high winds, (2) taboos and prohibitions to preserve *e.g.* the resource, but also and especially (3) appraisal modes of climatic parameters including swell, winds, and the moon cycles. The observation of these parameters allows fishermen to know the sea state and to adapt their behavior to it. However, an analysis per age group shows that most of the young fishermen tend to ignore or disbelieve the magic-religious considerations and move towards empirical considerations gained through the use of electronic marine equipment (*e.g.* sounder, GPS) and national weather forecast. However, the limited traditional knowledge of young fisher folk on atmospheric and marine climate parameters compared to older fishermen might be an important gap in developing adaptation strategies. This is also true for neglecting new scientific findings by part of older fisher folk. We underline the importance to consider the three main types of knowledge for developing adaptation strategies for the artisanal fisheries sector in West Africa.

Keywords: Local knowledge, typology knowledge, adaptation, small scale fisheries, Senegal.



Side Event 5

La cogestion locale des pêcheries comme dynamique émergente de gestion durable des ressources halieutiques au Sénégal

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Abstract

La gestion des ressources halieutiques sénégalaises a été pendant des décennies l'affaire exclusive des seules administrations publiques. Ce manque de procédures participatives et la non appropriation par les communautés de pêcheurs du processus font que ces dernières ne sont pas disposées à faire face à toute perte de revenus découlant de mesures de gestion prohibitives (e.g. instauration de zone de pêche protégée (ZPP/AMP) ; repos biologique sur différentes espèces ; contrôle de l'accès à la ressource). Jusqu'à la fin des années 1990, seuls les enjeux écologiques sont considérés dans la gestion des ressources halieutiques. Les aspects socioculturels et organisationnels ont été mis de coté. Conscients que la pêche doit être considérée comme un tout cohérent dont les éléments sont interdépendants, les autorités publiques à travers des institutions locales de cogestion tentent depuis 20 ans (particulièrement ces 10 dernières années) d'afficher un objectif social et organisationnel au secteur. Les institutions locales de gestion sont perçues par les autorités publiques en charge de la pêche comme des cadres propices à une gouvernance locale de la pêche artisanale pour une approche de type « bottom up ». Conçues comme une délégation de pouvoir aux acteurs de base, elles sont censées instaurer la concertation et la promotion d'initiatives locales en matière de gestion durable des ressources. Notre travail, basé sur des études de cas, analyse le niveau de fonctionnalité de telles institutions et leur capacité à accompagner le processus de mise en place de systèmes durables de gestion des pêcheries côtières sénégalaises.

Mots-clés : Cogestion, institutions locales, pêche, ressources.



Side Event 5

The "Feugue diaye" technique or identity positioning of Ndiago fishermen in small pelagic fisheries in Mauritania

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Abstract

The indigenous fishermen of the village of N'diago is in the extreme south of Mauritania, 15 km from Saint-Louis. The traditional life was always varying between the practice of subsistence fishing alternated with activities of breeding and market gardening. Through the periodic or seasonal migration waves, thanks to the creation of Nouakchott in the 1960s and Nouadhibou in the 1970s, this fishing community will contribute greatly to the development of Mauritania fishing along the coast by training and mentoring new fishermen from other ethnic communities bringing with them their know-how and fishing techniques using the Rotating Net, Hand Line, Fixed Gillnet, Ground Net, Longline etc. These fishermen will contribute greatly to the development of fishing. With the advent of the flour and fish oil industry, Ndiago fishermen will try to differentiate themselves from the Senegalese fishing technique, which requires a lot of financial and human resources by adapting their fishing gear to target the small pelagic. Thus, they will create the fishing technique "Feugue diaye" which marks the imprint of the Ndiagolaise in the practice and exploitation of the pelagic fishery at the level of ZEEM Mauritanian. This ethnological work tries to describe this fishing technique which can be considered as an innovation and a positioning of a fishing community in search of legitimacy.

Keywords: feugue diaye; Community of fishermen; Pelagic fisheries; Flour and fish oil industry.



Book launch and associate





Statistique et recherches interdisciplinaires; Implication d'une discipline sans objet

Auteur(s) : Francis Laloë
Editeur(s) : Quae
Collection : Indisciplines
Nombre de pages : 168 pages
Date de parution : 03/10/2016

Ce livre décrit une expérience de recherche au sein d'un programme sur l'étude de la pêche artisanale au Sénégal ; dans ce cadre, une démarche de statistique impliquée s'est très concrètement imposée. Dans le contexte de programmes de recherche finalisés, les questions posées peuvent être identifiées à partir de points de vue disciplinaires éloignés tels que ceux de sciences humaines et sociales, et de sciences de la nature et de la vie portant sur un objet complexe commun. La statistique n'a pas en général de point de vue propre sur cet objet : son rôle est de concevoir des protocoles d'observation et des outils de synthèse de ces observations permettant de restituer "au mieux" l'information qu'elles contiennent. Cette restitution doit aussi être interprétable sans ambiguïté sous forme de réponses aux questions non statistiques qui ont justifié la mise en place de l'observation.

Lorsque les observations découlent d'une confrontation avec la réalité, ce résultat n'est pas nécessairement accessible. Une synthèse présentant une qualité statistique acceptable peut ne plus être en relation claire avec la ou les questions initiales. De nouvelles questions peuvent alors se poser, légitimes si elles peuvent être liées à la finalité du programme.

S'appuyant sur des concepts clés tels que l'exhaustivité, la vraisemblance, l'estimation, il est montré que le rôle de la statistique ne peut plus être confiné à celui de la seule application. Il s'agit d'implication dans l'évolution de la problématique générale du programme de recherche.





Droit de l'environnement marin et côtier au Sénégal

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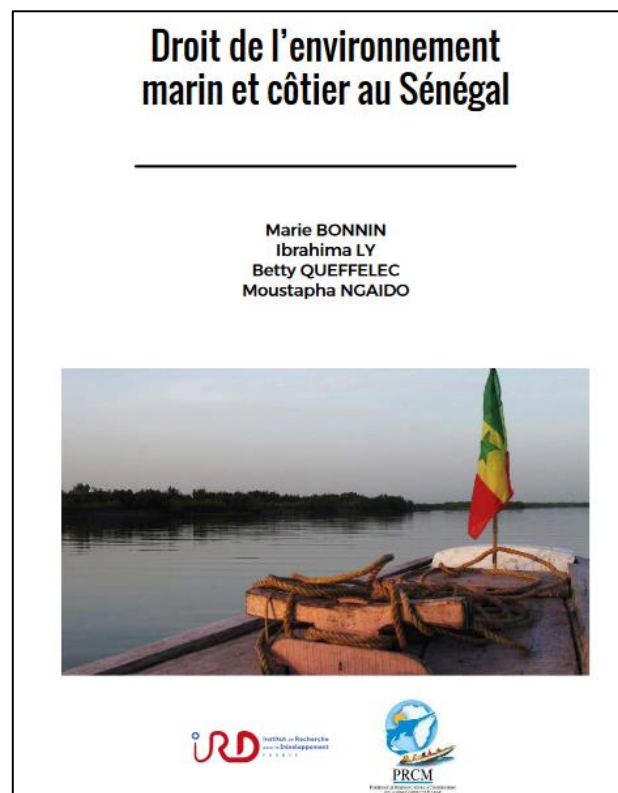
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Conservation Awards Ceremony Go-Wamer/Prcm



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Appel à candidatures pour le «Prix de la conservation» Go-WAMER/PRCM, édition 2016

Dans la continuité et le renforcement du Partenariat régional pour la conservation de la zone côtière et marine en Afrique de l'Ouest (PRCM), il a été institué depuis 2009 un « Prix de la conservation » qui a pour objectif de créer une émulation des efforts des acteurs en Afrique de l'ouest. Le programme Go-WAMER -co-financé par l'Union Européenne et le PNUD, coordonné par le PNUD Bureau de Dakar et mis en œuvre dans les pays de l'espace de la CSRP- a développé avec le PRCM un partenariat pour assurer la continuité de cette pratique depuis 2013 en finançant cette opération. L'édition 2016 sera organisée dans les mêmes conditions afin de récompenser les meilleures initiatives de la sous-région en matière de conservation des ressources marines et côtières, de sécurité alimentaire et/ou de réduction de la pauvreté. Le prix dénommé « Prix de la conservation, » sera décerné en marge de la conférence ICWA, prévue du 13 au 15 décembre 2016 à Dakar, Sénégal.

Espace géographique et thématique, Mise en œuvre du prix & Critères et Procédures de sélection

Les initiatives candidates au prix devront porter principalement sur la conservation, la valorisation des ressources marines et côtières ou sur une activité innovante en matière de **création d'activités génératrices de revenus susceptibles de générer des retombées socio-économiques** pour les communautés Ouest Africaines membres du PRCM et/ou bénéficiaires du projet Go-WAMER.

Le « Prix de la conservation », édition 2016 est doté de deux distinctions :

- Une distinction pour les initiatives de conservation et de gestion durable des ressources marines et côtières ;
- Une distinction pour les activités génératrices de revenus visant à améliorer la sécurité alimentaire et à lutter contre la pauvreté.

Les critères indicatifs pour la pré-sélection et la sélection définitive des lauréats sont :

- A. Pour les initiatives de conservation des ressources marines et côtières :
1. **Pertinence de l'initiative par rapport à une problématique liée à la conservation des ressources marines et côtières ;**
 2. Reproductibilité (locale) et /ou répliquabilité (échelle nationale et sous régionale) ;
 3. **Durabilité (respectueux de l'environnement et de la biodiversité).**
 4. **Mise en œuvre impliquant outre les initiateurs les autres acteurs locaux.**
- B. Pour les activités génératrices de revenus innovatrices en matière de sécurité alimentaire et/ou de réduction de la pauvreté :
1. **Pertinence de l'initiative par rapport à une problématique liée à la conservation des ressources marines et côtières ;**
 2. Innovation (valorisation de connaissances traditionnelles, introduction de nouvelles technologies, etc.) ;



3. Reproductibilité (locale) et /ou répliquabilité (échelle nationale et sous régionale) ;
4. **Promotion d'un partenariat créatif et gagnant-gagnant ;**
5. Durabilité (respectueux de l'environnement et de la biodiversité) ;
6. Susceptible de générer de retombées socio-économiques et équitables pour les communautés locales ;
7. **Mise en œuvre impliquant outre les initiateurs les autres acteurs locaux.**

La sélection des meilleurs candidats se fera en deux étapes :

- Une première étape implique un jury de pré-sélection qui sera mis en place au niveau sous-régional composé d'experts de la CSRP, du PRCM, du projet AWA, de la coordination du Go-WAMER et de tout autre expertise qualifié à la discrétion des organisateurs ;
- Une deuxième étape de sélection finale, tenue en marge de la Conférence internationale ICAWA qui se tiendra du 13 au 15 décembre 2016.

Les dossiers de candidature seront déposés exclusivement via l'adresse email suivante prixdelaconservation@gowamer.org et adresse mail PNUD au plus tard le 28 octobre 2016, délai de rigueur.

PRIX GoWAMER 2016: La conservation à l'honneur

L'édition 2016 du « Prix de la conservation/GoWAMER » a vécu. En marge de la 3ème Conférence internationale ICAWA, du 13 au 15 décembre 2016 à Dakar, le **Programme GoWAMER financé par l'Union Européenne et le PNUD, a récompensé les** meilleures initiatives de la sous-région en matière de conservation des ressources marines et côtières et de lutte contre la pauvreté.

Les initiatives candidates au prix pour l'édition 2016 déposées exclusivement via une adresse électronique sont constituées de 16 dossiers analysés par un jury composé d'experts de la CSRP, du PRCM, du projet ICAWA, d'ADEPA et de la coordination régionale du Go-WAMER. Ce jury a analysé l'ensemble des dossiers sur la base de critères liés, entre autres à la Pertinence de l'initiative ; à sa Reproductibilité et /ou répliquabilité (échelle locale, nationale et sous régionale) ; à sa Durabilité (respectueux de l'environnement et de la biodiversité) ; à sa Capacité de valorisation de connaissances traditionnelles ; Capacité d'innovation par introduction de nouvelles technologies ; Promotion d'un partenariat créatif et gagnant-gagnant et enfin à sa capacité de générer des retombées socio-économiques et équitables pour les communautés locales.

Sur 16 dossiers de candidature, 04 ont été jugés non éligibles parce que portant sur des initiatives mises en œuvre hors de la zone d'intervention du projet, espace de l'éco région WAMER. Ainsi, sur les 12 éligibles, 07 dossiers ont porté principalement sur la conservation, la valorisation des ressources marines et côtières ; et 05 sur des activités génératrices de revenus susceptibles d'avoir des retombées socio-économiques pour les communautés Ouest Africaines membres du PRCM. Sur les 12 dossiers retenus, 07 sont proposées par des sénégalais, 03 du Cap Vert et 02 de la Guinée, donc trois des 06 pays couverts par le projet GoWAMER.

Pour ce qui concerne les initiatives de conservations, trois distinctions ont été retenues avec un premier prix et deux prix d'encouragement. Le premier prix a été décerné à l'initiative de la Réserve Ornithologique de Kalissaye à Kafountine, Casamance au Sénégal, pour son action dans l'Amélioration du succès de la



reproduction de sternes royales (*Sterna maxima*) et sternes caspiennes (*Sterna caspia*) dans le site de la pointe de sankoye au niveau de la réserve ornithologique de Kalissaye au Sénégal. Les prix d'encouragement sont allés aux deux initiatives du Sénégal et du Cap Vert, respectivement GREEN Sénégal / Réseau des Acteurs du Littoral (REAL) et la Renaissance Africaine - Association des femmes de l'Afrique de l'Ouest - Cellule du Cabo Verde.

Pour les activités génératrices de revenus, un prix d'encouragement a été attribué à l'initiative portée par le GIE Mantoulaye Guene de Cayar au Sénégal. Le prix GoWAMER pour la Conservation est doté d'une enveloppe de un million cinq cent mille (1 500 000) francs CFA et d'un certificat de reconnaissance, le prix d'encouragement est doté d'une enveloppe de un million (1000 000) de francs CFA et d'un certificat de reconnaissance. Les initiatives candidates au prix GoWAMER, édition 2016 ne proviennent que dans trois pays bénéficiaires que sont le Sénégal, le Cap Vert et la Guinée bien que l'appel ait été largement diffusé dans tous les pays couverts par le projet via le site du PRCM. En outre dans les pays candidats, la participation semble se limiter à un groupe restreint d'institutions. Ainsi, il est donc recommandé qu'une large communication soit faite pour améliorer le taux de participation dans l'espace de la commission sous régionale des pêches notamment par une plus grande implication des Equipes nationales de mise en œuvre (ENMO) dans la diffusion de l'information et l'appui à la rédaction des dossiers de candidature qui, dans une large mesure, devrait être améliorée.

Source : <http://www.nouvelhorizonsn.com/spip.php?article775>





ICAWA 2016 Agenda and Program





ICAWA: 13rd, 14th & 15th December 2016, Hotel Almadies VACAP, Dakar, Senegal



Agenda and Program

The AWA project is funded by:



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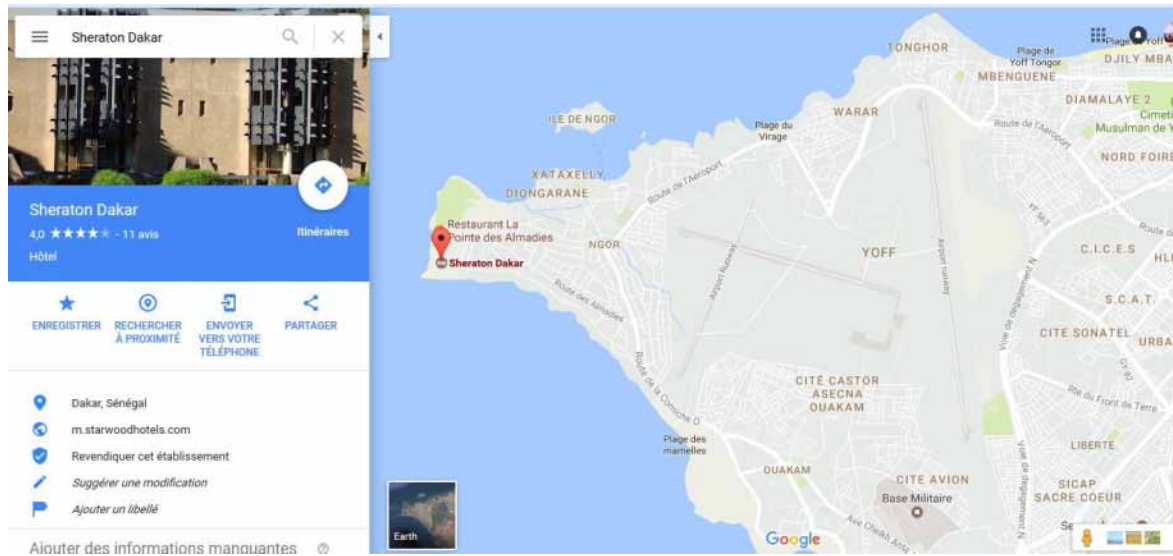
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- Patrice BREHMER (chair), IRD
- Amadou TOURE, CSRP
- Ndague DIOGOUL, Prestataire
- Toussainte BOISSY, CSRP
- Marie Madeleine GOMEZ, CSRP
- Traduction
- Déborah HARRIS, Prestataire
- Sheguella SARR, CSRP
- Finance
- Mouhamadou Makhtar SECK, SRFC
- Cheick Tidiane DIA, SRFC
- Website
- Charles BEYE, CSRP
- Couly Laba DIOGOUL, Prestataire

Conference location



HÔTEL DES ALMADIES La Pointe des Almadies, BP 3236 Dakar / Sénégal ;
Téléphone (221) 33 869 54 54 ;
Télécopie (221) 33 820 43 79 ;
Web : www.hoteldesalmadies.com

Term of Reference ICAWA 2016

It must be noted that coastal states of West Africa face host of problems, notably, overexploitation of fisheries resources together with climate change. The consequences of the two phenomena on the fisheries resources are at the heart of debates between managers to which researchers of the subregion take part. Within the framework of AWA, financed by IRD (France) and BMBF (Germany), the SRFC is to support the member states and associated West African partners with concrete actions and enhanced advisory capacities on the new fisheries management approaches. The multidisciplinary approach adopted in AWA allows the interaction of ecologists, biogeochemists, oceanographers, sociologists, economists and climatologists. The long term objective of this conference is to promote the development of an Observatory to monitor, simulate and predict key parameters of the ecosystem of North West Africa. Aside the regular sessions, this year, the organizers will provide feedback from the CoP22 held in Morocco and encourage the participation of Moroccan partners. As last year, we will emphasize fight against Illegal, unreported and unregulated fishing (IUU), marine protected area as well as aquaculture in West Africa, and moreover a special event will focus on Coastal erosion. Greenpeace and Birdlife will also actively take part on ICAWA 2016.

The primary objective of the conference is to permit member states of the SRFC and partners from West Africa and northern countries to put in place a sustainable fisheries and marine environment management systems based on biological, ecological, laws, economic and social state of the art knowledge. In this way the conference organizer would like: (i) to enhance fisheries management mechanisms in West Africa and particularly of the member states of the SRFC; (ii) Improve knowledge on the effects of climate change on living marine resources relative to the functioning of their habitats; (iii) and enhance and train students including researchers of institutions and universities of West Africa in view of propagating AWA in the region.

The conference enhance the observation and modeling of ocean physics supporting the ecosystem approach to marine management as well as a better understanding of the variability of pelagic productivity in West-African waters. The Physical-biogeochemical modeling and observations on processes and control of small pelagic fish or other species are very welcome. Economics integrated into the ecosystem approach to marine **management and reports on “human dimension” in West African fisheries in a framework of adaptation and governance** will be relevant. A working groups will also take advantage of the conference venue. **The International Workshop IndiAWA: “Indicators for an Ecosystem Approach to the Management of Fisheries and the Marine Environment in West African Waters”**. **The ICAWA** (which have obtained the COP22) label institutions participants and delegates taking advantage of the common declaration **“Ocean Climate of Dakar”** (done last year at the 2nd ICAWA conference, to underline the importance of West African marine ecosystems and coastlines in the context of climate change, have this year at COP22 presented the AWA **works with our Moroccan colleagues who will present this year the “Blue Belt initiative”**. Lastly during ICAWA we will work on the establishment of a scientific council at the SRFC for the upcoming years which could be related to the ministry council of the SFRC.

Conference Agenda

Program Overview

ICAWA Session / Event	13 rd Morning	13 rd Afternoon	14 th Morning	14 th Afternoon	15 th Morning	15 th Afternoon
Conference Opening Conference Closing	Plenary Room					Plenary Room
Session 1. Observation and modelling of ocean physics supporting the ecosystem approach to marine management		Signara 2 room				Plenary Room
Session 2. Variability of pelagic productivity in West-African waters		Plenary Room (Dara)				Plenary Room
Session 3. Physical-biogeochemical coupling: processes and control of small pelagic fish				Plenary Room (Dara)		Plenary Room
Session 4. Economics integrated into the ecosystem approach to marine management		Signara 1 Room				Plenary Room
Session 5. The marine Protected Area in West Africa		Chapiteau				Plenary Room
Side event 1. Scientific research and ICT (information and communication technologies) in the fisheries Monitoring Control and Surveillance			Signara 1 SE 1			Plenary Room
Side event 2. What technical and economic model(s) to foster the development of aquaculture in sub-Saharan countries: the case of West Africa			Signara 2 SE 2	Chapiteau SE 2		Plenary Room
Side event 3. Understand coastal processes to better manage the West African coast					Chapiteau SE3	Plenary Room
Side event 4. Environmental Marine Law in West Africa	Chapiteau SE4					Plenary Room
Side event 5. Toward the establishment of a scientific council for SFRC member's states					Plenary room SE 5	Plenary Room
Side event 6. Contribution of human and social sciences research for ecosystemic approach of fisheries management in West Africa			Chapiteau SE6	Louanda SE6		Plenary Room
International Working Group IndiAWA: Indicators for an Ecosystem Approach to the Management of Fisheries and the Marine Environment in West African Waters".				Signara 2 Room Working Group IndiAWA		Plenary Room
Stand: Marine Important Bird Areas in West Africa: important tools to marine spatial planning towards the conservation of seabirds and marine life		Plenary room				Plenary Room
Press conference	Plenary Room					Signara 1

Plenary Room = Salle Dara (Opening/Closing). Morning all day start at 08^h30.

Exhibition / Exposition

- Exposition AWA « face au changement global une approche communautaire pour atténuer les impacts socio-économiques ; **la fermeture de l'accès récif artificiel est bénéfique pour l'ensemble de la communauté (le cas de Yenne Todd)**

Réalisé par IRD, DAMCP, DPM, CRODT, Mairie de Yenn Todd

- Océan et Climat. Des échanges pour la vie (IRD)

Cette exposition réalisée par l'IRD vise à faire connaître, le rôle que joue l'océan dans le climat planétaire et l'actuel changement climatique, un rôle essentiel mais encore méconnu du grand public.

Social event

Visit of the « Mamelle » lighthouse at the extreme West coast of Africa and diner in an original West African restaurant (Art & Afrique). See Mme Marie-Madeleine GOMEZ.

Awards

«Prix de la conservation » Go-WAMER/PRCM, édition 2016

Dans la continuité et le renforcement du Partenariat régional pour la conservation de la **zone côtière et marine en Afrique de l'Ouest (PRCM)**, il a été institué depuis 2009 un « Prix de la conservation » qui a pour objectif de créer une émulation des efforts des acteurs en **Afrique de l'ouest. Le programme Go-WAMER co-financé par l'Union Européenne et le PNUD, coordonné par le PNUD Bureau de Dakar et mis en œuvre dans les pays de l'espace de la CSRP- a développé avec le PRCM un partenariat pour assurer la continuité de cette pratique depuis 2013 en finançant cette opération. L'édition 2016 sera organisée dans les mêmes conditions** afin de récompenser les meilleures initiatives de la sous-région en matière de conservation des ressources marines et côtières, de sécurité alimentaire et/ou de réduction de la pauvreté. Le prix dénommé « Prix de la conservation, » sera décerné en marge de la conférence ICAWA, prévue du 13 au 15 décembre 2016 à Dakar, Sénégal.

ESPACE GEOGRAPHIQUE ET THEMATIQUE

Les initiatives candidates au prix devront porter principalement sur la conservation, la valorisation des ressources marines et côtières ou sur une activité innovante en matière de **création d'activités génératrices de revenus susceptibles de générer des retombées socio-économiques** pour les communautés Ouest Africaines membres du PRCM et/ou bénéficiaires du projet Go-WAMER.

MISE EN ŒUVRE DU PRIX

Le « Prix de la conservation », édition 2016 est doté de deux distinctions :

- Une distinction pour les initiatives de conservation et de gestion durable des ressources marines et côtières ;
- Une distinction pour les activités génératrices de revenus visant à améliorer la sécurité alimentaire et à lutter contre la pauvreté.

ICAWA Award edition 2016

This ICAWA Award is delivered by the Sub-Regional Fisheries Commission this year with the AWA and CoP22 labels, distinguish the best scientific contribution, oral and poster, during the theme sessions and some side events of the conference. This honorific price (no price money), is an expression of acknowledgement of the conference chairmen and organizers for scientist advance and innovation in West African waters.

Event related to AWA before, during and after the ICWA conference

BEFORE

- **CoP22**, one month ago

Au cours de la 22^{ème} session de la Conférence des Parties de la Convention-Cadre des Nations Unies sur les changements climatiques (COP22) à Marrakech du 7 au 18 novembre 2016 s'est tenu un side event majeur « Fisheries and aquaculture in the context of climate change : challenges and opportunities », vendredi 11 novembre durant la journée Ocean, en zone verte, Salle Oum Errabia. Organisé par l'Institut national de recherche halieutique du Maroc, en partenariat avec la FAO et l'IRD, cet événement donnera un aperçu global des défis et opportunités liés aux impacts des changements climatiques sur la pêche et l'aquaculture. Il permettra également de présenter des exemples d'adaptation efficace et abordera les perspectives pour le secteur industriel. Intervenants: Dr. Abdelmalek Faraj, Director INRH, Dr. Manuel Barange, FAO, Kumbi Kilongo, Benguela Current Commission/ Ecosystem Coordinator, Patrice Brehmer, AWA-IRD.



- **South African Science Forum**, one week ago

Science Forum South Africa (Pretoria), side event Workshop on trilateral cooperation in science and innovation between South Africa, France and other French-speaking African countries (e.g. Madagascar, Senegal).



- **Costvar Survey in Saint-Louis**, one day ago

Multi-scale and multi-method study of COASTal VARIability in West Africa and Vietnam. The SAINT-LOUIS 2016 experiment (contact Rafael Almar and Luis Pedro Almeida); COASTVAR aims to advance our understanding of tropical nearshore hydro-morphodynamic processes, from event to inter-annual scales. Emphasis is given to extreme events and to the fundamental processes underlying the swash-surf-shelf exchanges and their long-term effect on the equilibrium of the nearshore morphology. Saint-Louis mission (SL) aims to address the interactions between barred beach surf and swash hydrodynamics and morphological evolution, from tide to wave-by-wave timescales. A combination of remote sensing instrumentation (e.g., video cameras, laser-scanner) and in-situ instruments (e.g., ADCP, pressure transducers, ADV, etc.) and drones will be used in addition to more conventional instruments (DGPS, total station, echo-sounder) to achieve the mission objectives. The site of COASTVAR project in Senegal is Saint Louis beach (SL), that is currently facing an intensification of coastal risks such erosion, and submersion of the old city, and breaching of the sandspit. SL offers good conditions to study the link between tide, surf zone processes and swash hydro and morphodynamics on a double bar beach. SL is exposed to energetic swells coming with an oblique incidence from NW that drives a strong alongshore drift (~600 000 m³/yr) that peaks over the bars and in the swash.

DURING THE CONFERENCE

- **AWATOX**, 5 survey will took place from pink lake (Senegal) to Rufisque (Senegal),

The goal is to monitor marine pollution: microbiological contamination, trace metal, sediment, chemistry and micro plastics adding Seabird diversity and sociological studies with a team from ISRA, IRD, UCAD, and IPD.

AFTER

- **Training Ocean acidification**, the day after

Future Earth Coasts in partnership with a large range of local, regional, and international organisations, are organising The Ocean Acidification-Senegal Conference (OA-Senegal) training and networking workshop in Dakar, Senegal. OA-Senegal will build upon existing ocean acidification research across Africa. To achieve this, two pathways have been identified to help build local, national, and regional capacity to measure and study ocean acidification as well as advance discussions

around the operationalisation of **the Africa Network for Ocean Acidification Science (“OA-AFRICA”)**. OA-AFRICA was launched by the IAEA Ocean Acidification International Coordination Centre (OA-ICC) in Cape Town in November 2015. OA-Senegal is specifically designed to promote (1) capacity building, (2) regional and inter-regional networking, and (3) collaboration and data sharing and will contribute towards effective monitoring of ocean acidification.



See more online at <http://www.futureearthcoasts.org/ocean-acidification-workshop-senegal/>

- **Restitution GoWamer INN**, the days after (Friday)

The Department SCS of the SRFC will organize a sub-regional “Workshop for the restitution **of the feasibility study of mechanisms for sustainable financing of SCS activities**”.

Contact: Cdt Babacar Ba (SRFC, The Gambia)

Tuesday 13rd December: Official Opening, Plenary room

08^h30-09^h30: Registration of all participants

- 09^h30-09^h35: Marieme Diagne Talla, Permanent secretary of the Sub-Regional Fisheries Commission
- 09^h35-09^h45: Dr Laurent VIDAL, IRD Representative for Senegal, Mauritania, Cabo Verde, The Gambia, Guinea Bissau
- 09^h45-09^h55: S.E. Christophe BIGOT, French Ambassador in Senegal
- 09^h55-10^h00: S.E. Bernhard KAMPMANN, German Ambassador in Senegal
- 10^h00-10^h15: S.E. Omar GUEYE, Opening by the Minister of Fisheries and marine economy.

Press: Interview authorities

10^h15-10^h45: Coffee break

- 10^h45-11^h00:

Babacar BA (SRFC), Patrice BREHMER (IRD), and Henio FOCK (TI)

«General ICWA conference overview and objectives»

- 11^h10-11^h30:

Keynote speaker: Prof. dr. ir. J.A. Dano ROELVINK (UNESCO-IHE)

"Understand coastal processes to better manage the West African coast"

- 11^h30-11^h35

Mme Njeri KABEBERI (Executive Director of Greenpeace Africa)

“Green peace engagement for ocean in West Africa”

- 11^h35-12^h00

Patrice BREHMER

“AWA Preliminary outcome and what will be the next step?”

12^h00-14^h00: Lunch Break

Thematic Session 1: «Observation and modelling of ocean physics supporting the ecosystem approach to marine management». Afternoon 13rd December 2016: room Signara 2

CHAIRMEN: Dr Bamol Ali Sow (UASZ, Senegal), Heino Fock (TI, Germany) and Dr Alban LAZAR (UPMC, France)

12^h00-14^h00: Lunch Break

Oral communications

- 14^h00-14^h20:

Alban LAZAR, Dennie DAUSSE, M. DIAKHATÉ, M. MARTIN DEL REY, Eric MACHU, Dominique DAGORNE, Saliou FAYE and Amadou T. GAYE.

« First year of an ocean-atmosphere mooring in the Senegalese coastal upwelling. »

- 14^h20-14^h40:

Xavier CAPET Siny NDOYE, Philippe ESTRADÉ, Bamol SOW, Eric MACHU, Timothée BROCHIER, Julian DÖRING, and Patrice BREHMER.

« The southern Senegal coastal ocean: a low enrichment-high retention upwelling center. »

- 14^h40-15^h00:

Lala KOUNTA, Xavier CAPET, Julien JOUANNO, Nicolas KOŁODZIEJCZYK, Siny NDOYE, Julie DESHAYES.

« West African upwelling waters and the circulation in the North-east tropical Atlantic. »

- 15^h00-15^h20:

Florian SCHÜTTE, Peter BRANDT, Johannes KARSTENSEN, and Gerd KRAHMANN.

« Observations of mesoscale eddies in the eastern tropical North Atlantic. »

15^h40-16^h00: Coffee break

Poster teaser

- 16^h00-16^h10:

Christian Kenfack SADEM, K. F. MKANKAM, and Gael ALORY.

« Atlantic Niño and Atlantic dipole Analysis through nonlinear principal component analysis. »

- 16^h10-16^h20:

Moustapha SOW, Cristèle CHEVALIER, and Bamol Ali SOW.

« Impact of the tide and the swell on the hydrodynamic circulation in the Tulear lagoon: modelling, description and analysis. »

Round table

« Observation and modelling of ocean physics supporting the ecosystem approach to marine management ».

Thematic Session 2: «Variability of pelagic productivity in West-African waters». All day 13rd and morning 14th December 2016, Plenary room (Dara)

CHAIRMEN: Dr Aka Marcel KOUASSI (CRO, Ivory Coast) Dr Idrissa Lamine BAMY (CNSHB, Guinea) and Dr Osvaldina SILVA (INDP, Cabo Verde)

Term of reference

Pelagic productivity in the West African upwelling sustains one of the **world's** largest small pelagic fisheries. However, key ecosystems processes and stock dimensions are still not clearly understood. This session will link process data and operational observational data (e.g. satellite data, physical oceanography) in order to establish long-term modeling and forecasting capabilities of pelagic productivity and exchange processes in the West African upwelling and estuarine interface. Indicators of productivity of oceanic small pelagic in nurseries, shelf and deep water/oceanic habitats as pelagic key components at the interface between subtropical gyre and coastal upwelling are of relevant interest. Exchange processes and pelagic productivity at the estuarine interface are also considered.

12^h00-14^h00: Lunch Break

Oral communications (13rd December afternoon)

- 14^h00-14^h15:

Corine R. T ALMEIDA, FERNANDEZ, G. L., HENRIQUEZ, N. G.

« Seasonal change of oceanographic condition in murdeira bay, Cabo Verde, northeast Atlantic: bottom-up effect on productivity. »

- 14^h15-14^h30:

Ousmane Diankha, Hervé DEMARCO, Massal FALL, Djiga THIAO, Modou THIAW, Bamol Ali SOW, Amadou Thierno GAYE, Patrice BREHMER.

« The contribution of small scale fishing constraints on Sardinella landings in Senegalese waters. »

- 14^h30-14^h45:

Justin KANTOUSSAN, Raymond LAE, Mbaye TINE.

« Use of multi-metric indices for monitoring fisheries exploitation and fishing effects on aquatic ecosystems. »

- 14^h45-15^h00:

Ndague DIOGOUL, Patrice BREHMER, Yannick PERROT, Abou THIAM, Oumar SADIO, and Abdoulaye SARRE.

« Acoustic study of water masses over Senegalese continental shelf: effect of environmental variable on the structure of zooplankton layers. »

- 15^h00-15^h15:

Ismâïla NDOUR, Ibrahima NDIAYE, Assiatou BALDE, Patrice BREHMER, and Modou THIAW.

« Seasonal variation of copepod communities in the Senegal-Gambia waters. »

- 15^h15-15^h30:

Emmanuel Calèbe MIDNOUDEWA, and Zacharie SOHOU.

« Paramètres démographiques du requin soyeux, *Carcharhinus falciformis* (Bibron, 1839) dans les eaux marines du Bénin. »

- 15^h30-15^h45:

Ousmane DIANKHA, Aliou BA, Patrice BREHMER, Timothée BROCHIER, Modou THIAW, Bamol Ali SOW, Amadou Thierno GAYE, and Hervé DEMARCO.

“Influence of climatic variables on *Sardinella* recruitment dynamics in Senegalese waters.”

15^h40-16^h00: *Coffee break*

Poster teaser

- 16^h00-16^h05:

Naby Souleymane FAYE, Massal FALL, Constance AGBOBA and Ndiaga THIAW.

« Evaluation de la diversité et du statut ILR des poissons des côtes sénégalaises à partir de données de campagnes scientifiques démersales côtières (2001-2015) »

- 16^h05-16^h10 :

Ahmed Bbabou DEDAH, Cheikh Baye BRAHAM, and Nicolas BEZ.

« Modèles **hiérarchiques à espace d'états pour les relations prédateur-proie** et les **estimations d'abondance**. »

- 16^h10-16^h15:

Ibrahima NDIAYE, Ismaïla NDOUR, Assiatou BALDE, Patrice BREHMER, and Modou THIAW.

« Seasonal distribution of fish eggs and larvae along the Senegal-Gambia marine area. »

- 16h15-16h20:

Mor GUEYE and Massal FALL.

« Diagnostic des campagnes démersales côtières réalisées au Nord du Sénégal par le Centre de Recherches Océanographiques de Dakar ».

- 16^h20-16^h25:

Elizandro RODRIGUES, Rainer KIKO, Patrice BREHMER, Eric MACHU and Osvaldina SILVA.

« Analysis of zooplankton samples from AWA scientific research on board of R/V Thalassa 2014 using the zooscan approach. »

- 16^h25-16^h30:

INTCHAMA Jeremias, Vitorino NAHADA, INCOM Inluta, ROBALO Hermenegildo, ALMEIDA Amadeu, NBUNDE Mario, JUMPE Raul.

« Suivi Biologique de *Polydactilus Quadrifilis* dans la rivière de Cacheu. »

- 16^h30-16^h35:

NBUNDE Mario, NAHADA, Victorino, INCOM Intulo, FUNNY Rita, MENDA Abrigo, INTCHAMA Jeremias, JUMPE Raul.

« Principaux résultats de la campagne de pêche scientifique dans la rivière de Cacheu. »

- 16^h35-16^h40:

Ivanice MONTEIRO, Pericles SILVA, and Heino O. FOCK.

« Linking local fisheries observations to climate - a first analysis of historical data from Cabo Verde. »

- 16^h40-16^h45:

Pericles SILVA, Ivanice MONTEIRO, Victor STIEBENS, Matthias SCHABER, and Heino O. FOCK.

« Vertical habitat use and diving behaviour of yellowfin tuna, *Thunnus albacares*, in Cabo Verde. »

- 16^h45-16^h50:

Dimingou THOUR, Médoune DIOP, Patrice BREHMER, Malick DIOUF, Ross WANLESS, and Justine DOSSA.

« Typology of small-scale fishing gear impact on seabirds in the Senegalo-Mauritanian Upwelling. »

- 16^h50-16^h55:

Patrice BREHMER, Joern SCHMIDT, Adama MBAYE, Aliou BA, Ousmane DIANKHA, Ahmed TALEB, Idissa Lamine BAMY, Osvaidna SILVA, Aka Marcel KOUASI, Vitorino NAHADA Ahmed TALEB, Aka Marcel KOUASI, Zacharie SOHOU, Abdelmalek FARAJ and Massal FALL

“The interest of smartphone use for field Fisheries and marine environmental sciences surveys in West Africa; a demonstration project AWaphone”

- 16^h55-17^h00:

PATRICE BREHMER, ALIOU BA, TIMOTHÉE BROCHIER, JULIEN BARDES, ISMAILA NDOUR, SYLVAIN BONHOMMEAU, TRISTAN ROUYER, PHILIPPE CURY, ALASSANE DIENG, MASSAL FALL AND CHRSTIAN CHABOUD

“Monitoring small scale fisheries (canoe) in West Africa using low coast global positioning system: A demonstration project AWAGPS”

Oral communications (14th December morning, Plenary room)

- 08^h45-09^h00:

Cheikh Baye BRAHAM and Nicolas BEZ.

« Estimation robuste des indices d'abondances acoustiques »

- 09^h00-09^h15:

Dedah Ahmed BABOU and Nicolas BEZ.

« Modélisation semi-markovienne pour l'inférence des trajectoires de bateaux de pêche: application aux données VMS de la flotte thonière française et pélagique de la ZEEM. »

- 09^h15-09^h30:

Luc B. BADJI, Maik TIEDEMANN, Heino O. FOCK, Papa NDIAYE, and Didier JOUFFRE.

«Horizontal distribution of dominant pelagic fish eggs in West African waters. »

- 09^h30-09^h45:

Modou THIAW, Saliou FAYE, Pierre-Amaël AUGER, Timothée BROCHIER, and Patrice BREHMER.

« Effect of climate variability on decadal changes in small pelagic fisheries in the West African upwelling Ecosystem: the case of *Sardinella aurita* in Senegal. »

- 09^h45-10^h00:

Bocar Sabaly Baldé, Modou Thiaw, Fambaye Ngom, Kamarel Ba, Werner Ekau, Oumar Sadio, Massal Fall, Alassane Sarr, Malick Diouf, and Patrice Brehmer

“Dynamics of *Ethmalosa fimbriata* in Southern Senegal.”

10^h00-10^h20: Coffee break

- 10^h20-10^h25:

Kamarel BA, Jean Michel AMATH SARR, Modou THIAW, Ndiaga THIAM, Massal FALL, Omar Thiom THIAW, and Didier GASCUEL.

« Fishing effects on Senegalese Octopus stock in the context of climate variability. »

- 10^h25-10^h40:

Abdoulaye SARRÉ, Hervé DEMARCO, Saliou FAYE, Jens Otto KRAKSTAD, Djiga THIAO, Salahedine EL AYOUBI, and Patrice BREHMER.

« Climate-driven shift of *Sardinella aurita* stock in Northwest Africa ecosystem as evidenced by robust spatial indicators. »

- 10^h40-10^h55:

Salaheddine EL AYOUBI, Abdallah BOUHAIMI, and Tadanori FUJINO.

« Estimation des index de réflexion acoustique des deux principaux petits pélagiques dans la région nord-ouest africaine : la sardine et la sardinelle. »

- 10^h55-11^h10:

Ndiaga THIAM, Yoland PLOURDE, Massal FALL, Modou THIAW, Moustapha DEME, and Babacar FAYE.

« Etude de la performance de la grille Nordmore dans la pêcherie crevette de gamba au Sénégal. »

- 11^h10-11^h25:

Naby Souleymane FAYE, Massal FALL, Constance AGBOBA et Ndiaga THIAM.

« Evaluation de la diversité et du statut ILR des poissons des côtes sénégalaises à partir de données de campagnes scientifiques démersales côtières (2001-2015). »

- 11^h25-11^h40:

Kandioura NOBA, Ngansoumana BA, Moussa Yagame BODIAN, and Mame Samba MBAYE.

« Les algues, un important levier de développement : état des connaissances au Sénégal. »

- 11^h40-12^h00:

Round table, synthesis and recommendation

12^h00-14^h00: Lunch Break

Session 3: “Physical-biogeochemical coupling: processes and control of small pelagic fish”. Afternoon 14th December 2016. Plenary room Dara

CHAIRMEN: Dr Éric MACHU (IRD, France), and Dr Vamara KONÉ (CRO, Ivory Coast)

Term of Reference

This session, co-sponsored by AWA and IUEM, will present the latest work in the WP3 thematic "Physical-biogeochemical coupling: processes and control of small pelagic fish" of the AWA project. A particular focus will be made on the biodiversity of plankton communities and their relationship to the physical and biogeochemical environment. As first link in the food chain, plankton biodiversity plays a critical role throughout the life cycle of small pelagics either through their nutritional quality or through their potential toxicity. Closely related to environmental conditions, global changes are likely to modify the communities involved, so it is crucial to understand their structure.

Oral communications

- 14^h00-14^h20:

Eric MACHU, Abdoul Wahab TALL, Capet XAVIER, Siny NDOYE, Alban LAZAR, François BAURAND, Pierre-Amael AUGER, and Patrice BREHMER.

« Oxygen variability over the southern Senegalese shelf. »

- 14^h20-14^h40:

Khassoum CORRERA, Eric MACHU, and Daouda DIOUF.

« Distribution and Biomass of phytoplankton over the Senegalese shelf: A need for regional ocean colour algorithm. »

- 14^h40-15^h00:

Herve DEMARCO, Saliou FAYE, Eric MACHU, and Khassoum CORREA.

« Planktonic diversity in the Senegalese upwelling system: what can we learn now from the the spatial observation? »

- 15^h00-15^h20:

Amidou SONKO, Patrice BREHMER, Guillaume CONSTANTIN DE MAGNY, Amy GASSAMA, Ousmane DIANKHA, Cheik DIOP, Ibrahima CISSE, Massal FALL, Luc FINOT, Maryvonne HENRY, Yoba KANDE, Mariline DIARA, and François GALGANI.

« Etude de la toxicité globale, de la qualité des eaux et des microplastiques de la peninsula du Cap vert, Sénégal. »

- 15^h20-15^h40:

Vamara KONE, Christophe LETT, Pierrick PENVEN, Bernard BOURLÈS, and Sandrine DJAKOURÉ.

« A biophysical model of *Sardinella aurita* early life history in the northern Gulf of Guinea. »

15^h40-16^h00: Coffee break

Oral communications

- 16^h00-16^h20:

Baye Cheikh MBAYE, Siny NDOYE, Xavier CAPET, and Eric MACHU.

« Influence of fine scale processes on fish larvae retention in the Senegalese Upwelling region. »

- 16^h20-16^h40:

Timothée BROCHIER, Pierre-Amaël AUGER, Laure PECQUERIE, Eric MACHU, Xavier CAPET, Modou THIAW, Omar ETTAHIRI, Cheikh-Baye BRAHAM, Omar ETTAHIRI, Najib CHAROUKI, and Patrice BREHMER.

« Population traits in Small pelagic fish model: emergence from interactions between turbulent environment and individual behaviors in Upwelling Systems. »

Poster teaser

- 16^h40-16^h45

Eric MACHU, Madjid HADJAL, Adama BADIANE, Anne DONVAL, Beatriz BEKER, Pierre RAMON, Raffaele SIANO, and Xavier CAPET.

“Phytoplankton distribution and biodiversity on the shelf of southern Senegal”.

- 16^h45-16^h50

Yoba KANDE, Patrice BREHMER, Guillaume CONSTANTIN DE MAGNY, Amy Gassama SOW, Amidou SONKO, Ousmane DIANKHA, Aba DIOP, Luc FINOT, Ibrahima CISSE, Massal FALL, Oumar SADIO, Mariline DIARA, and Francois GALGANI.

« Study of the spatial variability of marine pollution around the peninsula of Cape Verde. »

- 16^h55-17^h00

Rachel .U. SHELLEY, Geraldine SARTHOU, Georges TYMEN, R. Losno, Luis TITO DE MORAIS, A., BENHRA, F.Z. BOUTHIR, Eric MACHU, Christophe MESSENGER, Thomas GORGUES, and Patrice BREHMER.

« A case study of aerosol trace element deposition to Moroccan coastal waters: Lessons from the AWA Project. »

- 17^h00-17^h05

Eric MACHU, Marc SOURRISSEAU, Jeremie HABASQUE, Yves COLY, Xavier CAPET, and Patrice BREHMER.

« Zooplankton distribution on the shelf of southern Senegal. »

- 17^h45-18^h00

Habib SENHOR, Frederic Hourdin, Jean-Yves GRANDPEIX, Jerónimo ESCRIBANO and Eric MACHU. LMDz simulation of transport and deposition of mineral dust over the North Eastern Tropical Atlantic.

- 18^h00-18^h30

Round table, synthesis and recommendations

Thematic Session 4: «Economics integrated into the ecosystem approach to marine management». Afternoon 13th December 2016, Signara 1 room

CHAIRMEN: Dr Didier JOUFFRE (IRD, France), Dr Joern SCHIMDT, (University of Kiel ‘CAU’, Germany), Mustapha DEME (ISRA/CRODT, Senegal)

The session 4 of ICAWA 2016, will focus communications and posters related to the economics and ecosystem approach to marine management in the West Africa region. Along with economics and ecosystemic studies *sensu stricto*, multi-species analysis, social science analysis, transdisciplinary approaches and methodological studies when related to the marine management of West-Africa waters will be taken into account in the thematic range of this session 4 of ICAWA 2016.

Oral communications (13rd December afternoon)

- 14^h00-14^h15:

Abou Ciré BALL, and Elimane Abou KANE.

« **Etude comparative de l’intégration économique des régimes d’accès aux pêcheries industrielles pélagiques : Quels apports à l’aménagement de cette pêche ?** »

- 14^h15-14^h30:

Aliou BA, Jörn SCHMIDT, Kira LANCKER, Christian CHABOUD, Philippe CURY, Djiga THIAO, Malick DIOUF, and Patrice BREHMER.

« Profitability and economic drivers of small pelagic fisheries in West Africa: a twenty year perspective. »

- 14^h30-14^h45:

Ould Abidine Ould Mayif.

« Nouveau système de gestion des ressources halieutiques en Mauritanie. »

- 14^h45-15^h00:

Elimane Abou KANE, and Abou Ciré BALL.

« TAC et Quotas de pêche expérimentale à la langouste rose, une nouvelle opportunité de développement économique en Afrique de **l’Ouest : Quelles valeurs ajoutées à l’économie mauritanienne?** »

- 15^h00-15^h15:

Elimane Abou KANE, Thomas VALLÉE, and Patrice GUILLOTREAU.

« Dilemme des Taux Admissibles des Captures en Quotas individuels : illustration bioéconomique dans les accords de pêche RIM-UE. »

- 15^h15-15^h30:

Moustapha DEME.

« Politiques de pêche et mutations dans les pêcheries artisanales sénégalaises dans un contexte de surcapacité. Fisheries policies and dynamics in the Senegalese small-scale fisheries in a context of overcapacity. »

15^h40-16^h00: Coffee break

- 16^h00-16^h15:

Ely BEIBOU.

« Système d'information sous régional : vers une approche collaborative. »

- 16^h15-16^h30:

Timothée BROCHIER, Pierre AUGER, Djiga THIAO, Alassane BAH, Sidy LY, Tri Nguyen-HUU, and Patrice BREHMER.

« Unexpected evolution of Thiof fisheries in Senegal: insight from mathematical and informatics bio-economic models. »

- 16^h30-16^h45:

Didier JOUFFRE, Dado SENGHOR, Ibrahima DIALLO, Khady DIOP, and group IndiAWA.

« **Événements écologiques marquants survenus dans les écosystèmes marins d'Afrique de l'Ouest: un devoir d'inventaire.** »

- 16^h45-17^h00:

Joanny TAPÉ, KONAN KOUADIO Justin, and DIAHA N'Guessan Constance.

« Utilisation des modèles statistiques de type SARIMA pour l'évaluation de la pêche de poissons porte-épée en Côte-d'Ivoire. »

- 17^h00-17^h45-:

Mohamed Lamine CAMARA, Ibrahima DIALLO, and Didier JOUFFRE.

« **Importance socioéconomique de l'Ethmalose et distribution spatio-temporelle de son abondance en Guinée.** »

- 17^h45-18^h00:

Timothée BROCHIER, Nguyen Trong HIEU, Pierre AUGER, Eric MACHU, Trinh Viet DUOC, and Patrice BREHMER.

Optimal fishing agreement between neighboring countries sharing a common migratory fish population

- 18^h00-18^h30:

Round table Synthesis and recommendation

Thematic Session 5 « The Marine Protected Area (MPA) in West Africa ». Afternoon 13rd December 2016, Chapiteau room

CHAIRMEN: Dr Suzanne TRAORE (RAMPAO), Dr Modou THIAW (ISRA/CRODT, Senegal), and CI Abdoulaye DIOP (DAMCP, Senegal)

Characterized as one of the most fishing grounds, the West African coast is today subject to a drastic scarcity of fish resources. According to the latest COFI/FAO report, the majority of fish stocks of the region are fully exploited or overexploited. Beyond the economic stakes associated with fishing activities for coastal countries and for various stakeholders in the region, this decline of fish stocks, mainly due to overfishing and IUU fishing, constitutes a major threat to Marine and coastal biodiversity and to food security of an important segment of the coastal population. This worrying situation has led the sub region scientists to reflect on ways and means to put in place effective and efficient measures to preserve and to regenerate declining fish stocks.

The creation of the Regional Network of MPAs in West Africa - RAMPAO, in 2007, was the completion of this sub-regional dynamic. It was supported by a regional political commitment, guided by a regional strategy of MPAs signed in 2003 by the member states of the CSRP and promoted by international recommendations (World Summit on Sustainable Development 2002, Convention on Biological Diversity 2004). Today, RAMPAO is an interconnected network of 32 MPAs covering more than 2 million hectares in the 7 member states of the SRFC. Its goal is to work for the West African ecoregion conservation of the marine and coastal biodiversity, to contribute to the regeneration of fisheries stocks and to restore critical habitats. Although MPAs have preserved ecologically and / or commercially valuable emblematic sites and species, their contribution to the management of the fisheries either individually or through a network is still controversial.

The purpose of this session is to provide skills with scientific data to strengthen the role of MPAs in fisheries management through oral communications, posters presentation and exchanges. Thus, we will exchange extensively on: 1) Scientific results (quantitative and qualitative data) to characterize and assess MPA efficiencies in the regeneration of fish stocks; 2) socio-economic challenges to be faced in order to effectively establish a coherent, representative and interconnected MPA network to achieve its assigned objectives; and (3) perspective for making MPAs an effective tool in sustainable fisheries management in West Africa coastal region.

Oral communications

- 14^h00-14^h20:

Rui FREITAS, Corrine ALMEIDA, and Carlos EL FERREIRA.

« Reef fish and benthic community structure of Santa Luzia Marine Reserve in Cabo Verde Islands, Eastern Atlantic. »

- 14^h20-14^h40:

Ousmane DIANKHA.

« Overview of biodiversity in Senegal's MPA network in 2015. »

- 14^h40-15^h00:

Ousmane DIANKHA, Fatima BA, and Mamadou DIOP.

« Study of the ichthyofaunic population of the marine protected area (MPA) of Cayar in 2015. »

- 15^h00-15^h20:

Christian CHABOUD, Jörn SCHMIDT, Adama MBAYE, Modou THIAW, and Patrice BREHMER.

« Economics impact of MPA implementation on small pelagic fisheries in Senegal. »

Poster teaser

- 15^h20-15^h25:

Serigne Fallou NGOM, Oumar SADIO, Modou THIAW, Justin KANTOUSSAN, Saliou FAYE, Ismaila NDOUR, Bamol Ali SOW, and Patrice BREHMER.

« Effects of the Bamboung Marine Protected Area (Saloum, Senegal) on fish communities: an approach based on the bio-ecological indicators analysis. »

- 15^h25-15^h30:

Sousa Cordeiro.

Marine Protected Area in Guinea Bissau, the IBAP Experience

- 15^h30-15^h35:

Modou THIAW, Salla DIOUF, Oumar SADIO, Justin KNATOUSSAN, Saliou FAYE, Ismaila NDOUR, and Bamol Ali SOW.

« Effects of Marine Protected Areas on Demersal Coastal Fisheries: The Case of the Joal-Fadiouth MPA (Senegal) »

- 15^h35-15^h40:

Oumar SADIO, Hamet Diaw DIADHIOU, Monique SIMIER, and Jean-Marc ECOUTIN.

« **Effet Spillover d'une Aire marine Protégée estuarienne en Afrique de l'Ouest : le cas de l'AMP de Bamboung (Saloum, Sénégal)** »

15^h40-16^h00: Coffee break

- 16^h20-16^h40:

Khady DIOP, Khady DIOUF, Méry Dialwé NDIONE, Hamet Diaw DIADHIOU, Papa NDIAYE, and Didier JOUFFRE .

« Reproductive parameters of a catfish (*Arius latiscutatus*Günther, 1864) inside and outside the Bamboung Marine Protected Area (Saloum Delta), Senegal. »

- 16^h40-17^h00:

Modou THIAW, Oumar SADIO, Justin KANTOUSSAN, Saliou FAYE, Ismaila NDOUR, Bamol Ali SOW, and Patrice BREHMER.

« Changes in the fish assemblage structures of marine protected areas in West Africa: the case of a tropical estuarine MPA (Bamboung) and a coastal and marine MPA (Joal-Fadiouth). »

- 17^h00-17^h30:

Ali Mohamed ABDOU SALAM, Ngasoumana BA, Ismaïla NDOUR, Modou THIAW, and Patrice BREHMER.

« Seasonal variability of phytoplankton composition inside and outside the Marine Protected Areas of Joal-Fadiouth and Bamboung in Senegal (West Africa). »

- 17^h30-17^h50:

Abdou GUEYE , Sandra KLOF, Modou THIAW, Saliou FAYE, Adama MBAYE, Siny NDOYE, Xavier CAPET, Abdoulaye DIOP, and Patrice BREHMER

« Découverte de pétrole et de Gaz au Sénégal : environnement marin, zones de pêche protégées et aires marines protégées » ; Plaidoyer pour une prévention collective des risques écologiques.

- 17^h50-18^h20:

Round table, Synthesis and recommendation « Marine Protected Area (MPA) in West Africa ».

Stand BIRDLIFE: « Marine important Bird Areas in West Africa: important tools to marine spatial planning towards the conservation of seabirds and marine life »

CONVENERS: Miguel LECOQ (Senegal) and Justine DOSSA (Senegal)

The Alcyon project was launched in 2013 (by FIBA who in 2015 handed over the project to BirdLife International) with the aim at protecting the seabirds in West Africa, through the identification of marine Important Bird and Biodiversity Areas (IBAs) in the region.

The marine IBAs are sites of international significance for the conservation of the world's seabirds but also for other marine biodiversity. Marine IBAs are the first robust approach in the identification of important areas for the conservation of seabirds at sea that have taken place in West Africa.

Accurate knowledge of the location of marine IBAs can be used to inform marine spatial planning through the designation of Marine Protected Areas or other management measures, and help identifying areas where shipping, renewable energy, fisheries, and oil spills are likely to have the greatest impacts on biodiversity.

During 2013-2016 BirdLife International, through the Alcyon project has identified a network of marine IBAs in West Africa. By compiling data collected by several researchers for more than 10 species, and by using a rigorous scientific approach, 13 sites covering a total area of 7,264,608 ha were mapped in 6 countries in the region. Marine IBAs are key tools for West African governments to achieve their obligations in fisheries management through an ecosystem approach.



Side event 1. « Scientific research and ICT (information and communication technologies) in the fisheries Monitoring Control and Surveillance ». All day 14th December 2016, Room Signara 1

CHAIRMEN: C^{dt} Babacar BA (SRFC-CSRП, The Gambia), Arnaud COMOLET (UNDP, United Nations) and Demba GUISSÉ (CNSP, Guinea)

Terme de référence

Depuis sa création en 1985, la Commission Sous Régionale des Pêches (CSRП) n'a ménagé aucun effort pour éradiquer la pêche illicite, non déclarée et non réglementée (pêche INN). Malheureusement, le phénomène est loin d'être éradiqué dans la sous-région et ce malgré les gros efforts consentis par les Etats membres et les partenaires techniques et financiers. En effet, les effets néfastes de ce fléau sont toujours palpables dans la zone CSRП et au premier rang desquels, l'insécurité alimentaire et le chômage.

C'est pourquoi, les 14^{ème} session ordinaire et 16^{ème} session extraordinaire de la Conférence des Ministres, tenues respectivement en septembre 2001 à Nouakchott et en Mars 2014 à Dakar, ont adopté des Déclarations sur la pêche INN dites Déclarations de Nouakchott et de Dakar dans lesquelles, la Conférence des Ministres, instance politique de décision de la CSRП, a instruit le Secrétariat Permanent de rechercher les voies et moyens pour apporter un soutien aux Etats membres dans leurs efforts de lutte contre la pêche INN. La Conférence a également instruit le Secrétariat Permanent d'inclure systématiquement la thématique « pêche INN » dans toutes les grandes manifestations de la Commission.

En application de ces différentes recommandations de la Conférence des Ministres, la CSRП a sollicité et obtenu du projet GoWAMER financé par le PNUD et l'Union européenne, **le financement d'un «Side Event» sur la pêche INN, pendant la conférence internationale « ICAWA 2016 ».** Le thème retenu pour cette activité phare du projet GoWAMER « La recherche scientifique et les nouvelles technologies de l'information comme outils de renforcement de la lutte contre la pêche INN dans la zone CSRП », est motivé par la volonté de la CSRП de renverser la tendance qui fait que rares sont les Etats membres de la CSRП où les résultats de la recherche sont mis en contribution pour orienter les activités SCS.

En effet, les cartographies des zones de pêche et les données bathymétriques des centres de recherche de la sous-région sont peu, voire inexploitées lors de la planification des opérations de surveillance des pêche **bien qu'étant les premiers éléments d'analyse des zones à « risque de pêche INN ».** Par ailleurs, **l'usage de dispositifs de concentration de poissons dans la zone CSRП constitue une menace sérieuse sur les ressources de la sous-région.** Il est même signalé **au Sénégal, une forme de pêche à l'appât qui mérite d'être suivi** par la recherche pour mieux appréhender ses impacts à long terme sur la ressource.

Le « Side Event » servira également de plateforme d'échanges sur les innovations technologiques en matière de lutte contre la pêche INN en vue de leur appropriation par les structures SCS et les centres de recherche de la sous-région.

Objectifs

L'objectif principal du « Side Event » est le renforcement de la lutte contre la pêche INN dans la zone CSRP avec comme corollaire la réduction de la pauvreté et le renforcement de la sécurité alimentaire des communautés côtières.

Les objectifs secondaires

- renforcer les capacités des centres de recherche de la sous-région en matière de cartographie de zones de **pêche et de collecte et d'analyse de données bathymétriques** ;
- renforcer la synergie entre les centres de recherche et les structures SCS des Etats membres ;
- **développer une méthodologie d'analyse des zones à « risque de pêche INN »** ;
- développer une stratégie **sous régionale de réduction de l'usage de dispositifs de concentration de poissons** dans la zone CSRP ;
- partager les résultats des innovations technologiques en matière de lutte contre la pêche INN.

Résultats attendus

- **la pêche INN est réduite dans l'écorégion WAMER** ;
- les capacités des centres de recherche de la sous-région en matière de cartographie de zones de pêche **et de collecte et d'analyse de données bathymétriques** sont renforcées ;
- la synergie entre les centres de recherche et les structures SCS de la sous-région est renforcée ;
- **la CSRP dispose d'une méthodologie d'analyse des zones à « risque de pêche INN »** ;
- les opérations nationales et sous régionales de surveillance des pêches sont mieux planifiées ;
- une stratégie sous régionale de réduction de **l'usage de dispositifs de concentration de poissons** dans la zone CSRP est disponible ;
- les résultats des innovations technologiques en matière de lutte contre la pêche INN sont partagés.

Oral communications

- 09^h30-09^h40:

Mot de bienvenue du Chairman

- 09^h40-10^h10:

Présentation des résultats du projet GoWAMER en matière de lutte contre la pêche INN par le PNUD

- 10^h10-10^h40:

Intervention de Monsieur Henri de Foucauld, Expert SCS international

10^h40-11^h00: Coffee break

- 11^h00-11^h30:

Intervention INDP (Cabo Verde)

- 11^h30-12^h00:

Intervention CNSHB (Guinée)

- 12^h00-12^h30:

Intervention CIPA (Guinée Bissau)

- 12^h30-13^h00:

Intervention IMROP (Mauritanie)

13^h00-14^h00: Lunch Break

- 14^h30-15^h00:

Intervention CRODT (Sénégal)

- 15^h00-15^h30:

Intervention DPSP (Sénégal)

- 15^h30-16^h00:

Intervention Monsieur CISSE (Greenpeace)

16^h00-16^h20: Coffee break

- 16^h20-16^h50:

Intervention Mamadou FAYE (Sénégal)

- 16^h50-17^h20:

Considérations générales et clôture du « side event » INN

- 17^h20-17^h40:

Table ronde, synthèse and recommandation.

Side-event 2: “What technical and economic model(s) to foster the development of aquaculture in sub-Saharan countries: the case of West Africa”. Morning 14th December Signara 2 and Afternoon 15th December 2016, Chapiteau

CHAIRMEN: Dr Hamet Diaw DIADHIOU (ISRA/CRODT, Senegal), and Dr Melecony Célestin BLE (CRO, Ivory Coast)

Term of Reference

In the context of fish stock overexploitation and climate change, aquaculture is often mentioned as an alternative of fisheries to produce fish and provide animal protein for population. This old idea has made its way in Asia and western countries, but at this time raises number of problems or challenges in Africa unequally spread around countries. Indeed, African aquaculture production remains low according to the potential in this field particularly in sub-Saharan countries. Only some countries such as Nigeria mainly with tilapia and catfish and South Africa on various species set up a competitive aquaculture industry. This situation of failure that persists in the continent reflects different locks among which we have identified lack on:

- knowledge on fish farming technologies by the local population;
- production of aquaculture seed;
- profitable economic environment favorable for aquaculture investment;
- support from states in aquaculture sector;
- efficient indicators for fish farming monitoring;
- aquaculture development of policy and value chain;
- development of low cost and efficient fish feed;
- friendly method for disease detection and control;
- marine fish domesticated;
- genetic improvement of domesticated fish species;
- genetic information on aquaculture species in Africa;
- governance;
- capacity building

Currently many efforts are made over Africa (e.g. by the African Union UA) to try to raise awareness about fish farming. Almost everywhere in Africa pilot operations which are carried out to attempt to make available aquaculture technologies and skills for African private sector. Hopefully these efforts could lead to favourable decision making because Africa demography increase and concurrently will occur an increase of animal protein in the near future. This **side event is an opportunity to discuss around the themes “how to improve the technological development of aquaculture in Africa” including technological aspects, sociological and economical ones and taking into account their impact on the environment.** The discussion will conduct toward the redaction of recommendations for regional organisations (e.g. ECOWAS, UEMOA, UA) to provide new technological solutions and overcome the main locks to improve aquaculture development in West Africa.

Session covenor canceled Waly Ndiaye Ndiango.

Oral communications (14th morning, Room Signara 2)

- 08^h30-08^h45:

Cheikhna GANDEGA

« Les Modèles Techniques et Economiques pour favoriser le Développement de l'Aquaculture en Mauritanie. »

- 08^h45-09^h00:

DJIBA Abdoulaye, BAMY Idrissa Lamine, and BILAL Abdoulah Samba

« Analyse diagnostique transfrontière »

- 09^h00-09^h15:

Mamadou Sileye NIANG, Hahmet Diaw DIADHIOU, and Patrice BREHMER

« The use of the phytase in aquaculture, its zootechnical interests and the possibilities of incorporation in the feed. »

- 09^h15-09^h30:

Abdoulaye LOUM, Mariama SAGNE, Jean FALL, and Malick DIOUF

« Effets de différents régimes protéiques sur la croissance, la survie et la composition biochimique de la chair du tilapia *Oreochromis niloticus* Linnaeus (1758) »

- 09^h30-09^h45:

Melecony Célestin BLE

« La recherche aquacole au centre de recherches océanologiques en côte **d'ivoire**: acquis et perspectives. »

- 09^h45-10^h00:

Hamet Diaw DIADHIOU, Ismaïla NDOUR, and Mamadou Silèye NIANG

« Impacts potentiels **du Biofloc et de l'Aquaponie dans l'amélioration de la productivité des systèmes aquacoles au Sénégal** »

10^h00-10^h20: Coffee break

- 10^h20-10^h25:

Khali Rakhmane NDIAYE, DIADHIOU Hamet Diaw, NGUER Ahmed Tidiane, NIANE Abdoulaye, and BREHMER Patrice

« **Quel modèle technique et économique d'aquaculture** adapté au contexte sénégalais? »

- 10^h25-10^h40:

Diatou Sow, Hamet Diaw DIADHIOU, Mamadou Sileye NIANG, Fulgence DIEDHIOU, and Anis DIALLO

« Efficacité des filtres biologiques à base de copeaux de cocos et des pierres ponces, sur la qualité de l'eau utilisée dans l'élevage des poissons »

- 10^h40-10^h55:

Maurice CORREA, Hamet Diaw DIADHIOU, Mamadou Sileyé NIANG, Fulgence DIEDHOU, and Anis DIALLO

« Etude de de la fécondité de *Tilapia Oreochromis niloticus*, souche de la vallée du fleuve Sénégal en fonction du poids »

- 10^h55-11^h10:

Sonnia Nzilani MUSYOKA

« Potential use of bioremediation methods for aquaculture wastes in coastal areas »

- 11^h10-11^h25:

Abdoulaye LOUM, Ousmane SARR, Jean Fall, Malick DIOUF, and Mariama SAGNE

« **Contribution à l'étude sur l'utilisation des liants naturels dans l'alimentation du tilapia (*Oreochromis niloticus*)** »

- 11^h25-11^h40:

Cheikh Ibrahima FALL MBACKÉ, Hamet Diaw DIADHIOU, Mamadou Sileyé NIANG, Anis DIALLO, Fulgence DIEDHIOU.

« Etude de la croissance des alevins de souches différentes de *Tilapia Oreochromis niloticus* en aquarium »

- 11^h40-11^h55:

Melecony Celestin BLÉ, Olivier MIKOLASEK, Marc OSWALD, Thomas Efole EWOUKEM, Ibrahim Imorou TOKO, Pierre MEKÉ, Adja Ferdinand VANGA, and Minette Tomedi EYANGO

« Contribution des systèmes piscicoles familiaux innovants à la promotion de la pisciculture **en Afrique de l'Ouest et du Centre** »

- 11^h55-12^h10:

Hamet Diaw DIADHIOU, Alioune Badara BADJI, and Abdoulaye DIALLO

« La pisciculture traditionnelle en Basse Casamance dans un contexte de changement climatique »

- 12^h10-12^h30:

Hamet Diaw DIADHIOU, Anis DIALLO, Waly Ndianco NDIAYE, Moustapha DÈME, and Adama MBAYE

« Amélioration de la durabilité des fermes piscicoles de *Tilapia* en Afrique »

12^h00-14^h00: Lunch Break

- 14^h00-14^h20:

Mohamed MEGAHED

« Sustainable conservation of aquatic genetic resources: Application of biological, biotechnological and molecular methods. »

- 14^h20-17^h00:

All participants. Round table, synthesis and recommendation.

Side-event 3: “Understand coastal processes to better manage the West Africa coast”. Morning 15th December 2016, Chapiteau Room

CHAIRMEN: Rafael ALMAR (IRD, France), Moussa SALL (MOLOA, Senegal), and Abou BAMBA (CA, Ivory Coast)

Guest of Honor Pr. Dr. Ir. J.A. ROELVINK (UNESCO, The Netherland)

Term of reference

Coastal zones are essential for social and economic developments. In West Africa, coastal zones represent 80% of the regional economic activity (UEMOA). The entire coast experiences a large erosion rate that reaches 10 m/year at Cotonou (Benin). Because most countries in West Africa are facing the same vulnerability to erosion, it has become a major regional issue. Located at the interface between ocean and continent, the coasts are vulnerable to environmental hazard and are currently facing an intensification of risk associated with increasing human pressure and the context of global climate change. West Africa countries are currently facing a rapidly growing demographic pressure and uncontrolled exploitation of resources associated with rapid economic development. The natural environmental vulnerability of the coastal zones (i.e. extreme events of tropical storms, erosion, flooding) conjugated with demographic pressure increases hazard for human activities and represents a limitation for coastal development (maritime transport, tourism, urban development). One of the principal limitations to our knowledge of coastal dynamics is a lack of appropriate integrated observations (multi-scale, structured in a network, maintained over long term) and numerical tools (regional to coastal areas, hydro-morphological nearshore dynamics). There is a strong need for a greater understanding and estimation of present dynamics and future evolution (ALOC-GG 2011 report, global warming impact, Stive, 2004).

This session aims at providing our current knowledge on the understanding of the processes responsible for the observed large coastal variability and erosion, quantifying their impact; by reviewing current projects, actions undertaken so far, monitoring and modeling tools employed. This session also reviews solutions in anticipating coastal evolution and improve coastal zone management techniques and politics toward an integrated strategy for risk mitigation.

Oral communications

- 09h00-09h15 :

Overview of the Keynote speech: Prof. dr. ir. J.A. Dano ROELVINK

"Understand coastal processes to better manage the West African coast"

- 09h15-09h45 :

Moussa SALL

« La MOLOA 2013-2016 : éléments du bilan du littoral ouest africain »

- 09h45-10h00 :

Rafael ALMAR

« COASTVAR: understanding the processes responsible for the observed large coastal variability and quantifying their impact. »

10^h00-10^h30: Coffee break

- 10h30 - 10h45 :

Edward J. ANTHONY, Amadou T. DIAW, Alioune KANE, Philippe DUSSOUILLEZ and Thomas J. FLEURY
« Dynamique de la flèche littorale de la Langue de Barbarie de 1954 à 2016. »

- 10h45 - 11h00 :

Folly Serge TOMETY, Yves Du-PENHOAT, Zacharie SOHOU, Cossi Georges DEGBE, Christian A. H. ADJE

« strong event analysis measured by "ALIZE" bouys in cotonou area »

- 11h00 - 11h15:

Frederic BONOU

« Monitoring of hydrodynamic and morphological parameters by video imagery: Grand POPO Beach »

Poster teaser

- 11h15-11h20 :

France FLOC'H, G. RODIER MABIALA, Rafael ALMAR, Yves DU PENHOAT, N. HALLS, Bruno CASTELLE, T. SCOTT, C. DALY

« Nearshore Sedimentary transfer: On Flash Rip Activity Quantification »

- 11h20-11h25 :

Habib NGROM, Abdoulaye NDOUR, Isabelle NIANG, Boubacar FALL, Kader BA

« Impacts des structures de protection sur les littoraux sableux: l'exemple de la station balnéaire de Saly (Petite Côte, Sénégal) »

- 11^h25-11^h30

Marion JAUD, Christophe DELACOURT, Jerome AMMANN, P. ALLEMAND, and P. GRANDJEAN

« Drones photographes pour le suivi du littoral »

- 11^h30-11^h35

Jérome AMMANN, Christophe DELACOURT, Marion JAUD, Nicolas Le DANTEC, Philippe Grandjean, Yosef AKHTMAN, Kévin BARBIEUX, and Dragos CONSTANTIN

« Drone HyperSpectral »

- 11^h35-12^h00 :

Discussions and recommandations

12^h00-14^h00: Lunch Break

Side-event 4: « Environmental marine law in West Africa ». Morning 13rd December 2016, Room Chapiteau

CHAIRMEN: Pr. Ibrahima LY (UCAD, Senegal), Dienaba Beye TRAORÉ (SRFC-CSRP, Senegal) and Dr. Marie BONNIN (IRD, France)

Terme de référence

Cette session sur le droit de l'environnement marin s'intéressera aux problématiques juridiques en lien avec les thématiques du programme AWA. Les présentations porteront à la fois sur des analyses de l'évolution du droit et sur les modalités de son application aux différentes échelles (locales, nationales, internationales). Les contributeurs sont invités à présenter des communications soit en lien avec le droit applicable à l'exploitation des ressources halieutiques dans la sous-région, soit sur le traitement juridique des éléments pouvant limiter les capacités de pêche des pays de la sous-région, comme par exemple le traitement judiciaire des atteintes à l'environnement marin.

Oral communications

- 10^h40-11^h00:

Marie BONNIN, Ibrahima LY, Betty QUEFFELEC, and Moustapha NGAIDO

« Droit de l'environnement marin et côtier au Sénégal. »

- 11^h00-11^h20:

Fatma NDIAYE

« Pêche durable et adaptation au changement climatique: les nécessaires réformes du droit des pêches dans l'espace CEDEAO »

- 11^h20-11^h40:

Mohamed Ayib DAFFE

« **L'encadrement** juridique des câbles sous-marins et les activités de pêche. »

- 11^h40-12^h00:

Abdou GUEYE, and Cheikh GUEYE

« Analyse du dispositif de réduction de risque environnemental de l'industrie pétrolière offshore sur la Petite Côte du Sénégal. »

- 12^h00-12^h20:

Dienaba Beye TRAORÉ

« Les questions juridiques liées à biodiversité marines au-delà des juridictions nationales. »

Side-event 5: « Toward the establishment of a scientific council for SFRC member's states ». Morning 15th December, Plenary room

CHAIRMEN: Cdt Babacar BA (SRFC-CSRP, Senegal), Dr Patrice BREHMER (IRD, Senegal), Dr Joern SCHIMDT (University of Kiel 'CAU', Germany)

Guest of Honor **Mohamed M'Barek O. SOUEILIM (IMROP, Mauritania)**

Terme de reference

La CSRP est un organisme intergouvernemental créé par voie de convention le 29 mars 1985 qui regroupe sept (07) Etats membres (Cabo Verde, Gambie, Guinée, Guinée Bissau, Mauritanie, Sénégal et Sierra Leone) dont le siège est à Dakar au Sénégal ; ses Organes sont:

- La Conférence des Ministres (Ministres en charge des pêches) qui se réunit en session ordinaire tous les deux (02) ans et en session extraordinaire à chaque fois que de besoin.
- Le Comité de Coordination, composé par les Directeurs des pêches des Etats membres. Il est un organe technique consultatif de la Conférence des Ministres. Il se réunit également en session ordinaire tous les deux (02) ans pour préparer la Conférence des Ministres et en session extraordinaire à chaque fois que de besoin.
- Le Secrétariat Permanent, est l'organe d'exécution, chargé de la mise en œuvre des décisions de la Conférence des Ministres. Il est dirigé par un Secrétaire Permanent et dispose de trois (03) départements et divers Services.

En dehors de ces organes statutaires, le Secrétariat Permanent bénéficiait du soutien technique de trois (03) Groupes de travail : le groupe de travail des juristes, le groupe de travail Suivi, Contrôle et Surveillance, le groupe de travail Recherche.

Ces groupes de travail ont été très actifs de par le passé en alimentant la réflexion sur des thématiques majeures adressées par la CSRP comme la gestion durable des petits **pélagiques**. Cette réflexion sur les petits pélagiques a d'ailleurs fortement influencé le dossier de requête du projet CCLME. Aujourd'hui, force est de constater que ces groupes de travail ont connu, ces dernières années, une léthargie préjudiciable à la réflexion au niveau de la CSRP. Toutefois, depuis 2013, il est noté un certain regain des activités des groupes de travail des juristes et du SCS sur des dossiers importants comme la saisine du TIDM et l'élaboration de la Convention SCS; démontrant ainsi la pertinence de ces entités de réflexion et de conseil.

A ce propos, la Convention SCS établit la Commission Technique SCS comme un organe consultatif ayant pour mission de renforcer la collaboration et la coopération sur les activités sous régionales SCS. Cette commission est composée des directeurs des structures SCS des Etats membres. La CSRP souhaite ainsi étendre la démarche au domaine de la recherche qui constitue un pan important de **l'aménagement des pêcheries**.

Objectifs

L'objectif principal est d'initier la réflexion sur la mise sur pied de la Commission Technique Recherche.

Les objectifs secondaires

- réfléchir sur la pertinence de la mise sur pied de la commission ;
- mettre en place un groupe de réflexion chargé de
- travailler sur la mission, la composition et les attributions de la commission ;
- élaborer un plan de travail de la commission ;
- choisir des thématiques à soumettre à la réflexion de la commission.

Résultats attendus

- la réflexion pour la mise sur pied de la Commission Technique Recherche est initiée;
- un groupe de réflexion est mis en place en vue de :
 - définir la mission, la composition et les attributions de la commission INN,
 - élaborer un plan de travail de la commission ;
 - choisir des thématiques à soumettre à la réflexion de la commission.

Oral communications

- 09h00-09h15 :

Introducing speech

Cdt Babacar BA (SRFC) and Patrice BREHMER (IRD, FRANCE)

- 09h15 - 09h45 :

Words on history of science commission on marine and fisheries sciences in West Africa
M'Barek O. SOUEILIM (Head of IMROP, MAURITANIA)

- 09h45 - 10h00 :

Is the structure and organization of ICES/CIEM an example for a scientific council on “Marine Fisheries and Ocean” for West Africa?

Dr Joern SCHMIDT (Kiel University ‘CAU’, GERMANY), the German representative in the Science Committee (SCICOM) of the International Council for the Exploration of the Sea ‘ICES’

10^h00-10^h30: Coffee break

- 10h30 - 10h35 :

Noel KEENLYSIDE represented by Patrice BREHMER

CS4AWA, A research proposal on Climate Service for the AWA region (Submitted to JPI ERA4CS)

CS4AWA’s main objective is to develop better tools, methods, and standards on how to produce, transfer, communicate, and use reliable climate and related information for the African Atlantic coastal region. It will, thus, contribute to the development of climate services (CS) for this region; where to our best knowledge, no consistent CS exist for Ocean sectors, despite their great societal and economic significance, and despite an urgent demand (see e.g., Ocean climate declaration of Dakar, 2015), particularly since CoP21. CS4AWA has three specific objectives that contribute to integration and application of climate science for decision-making, and research for co-development of advanced CS: 1. To integrate improved climate predictions with coastal erosion (and associated risks, 1), marine ecosystems, and fisheries bio-economic impact models to provide relevant user demanded information for the three African Atlantic large marine ecosystems (LME): Canary Current (CCLME), Guinea Current (GCLME), and Benguela Current (BCLME). 2. To support science based decision-making at local, national, regional and international level by analysing how climate change (CC) impacts will affect the socio-economic development of the coastal zone, with focus on small-scale fishing communities and coastal populations. 3. To co-develop advanced tools, methods and instruments to produce, transfer, communicate and use scientific information and model outputs in order to enhance the capacity of decision-makers to deal with climate uncertainties knowledge.

In the first, knowledge of user requirements gained from the AWA and PREFACE projects will be refined with respect to climate impact prediction capabilities and according to the UG. The second will assess whether user requirements are being met, and revisit user and researcher expectations. The final workshop will provide products and summary information

to the UG, evaluate whether expectations were met, and design the next step in CS based on **CS4AWA's results. We will develop CS using seasonal and long-term** climate predictions. Climate predictions from PREFACE using innovatively corrected models will drive regional marine ecosystem, fisheries, and coastal impact models for the three LMEs. Output from AWA and PREFACE bio-economic models that integrate survey derived user behaviour with climate predictions will be used to assess the vulnerability of small scale fishing communities and identify appropriate adaptation strategies. Uncertainty measures will be provided by multi-model data. CS4AWA will develop an interactive web-platform as a key instrument to disseminate CS products to the UG: general public, academia, and decision makers.

This project and its AWA and PREFACE precursors actively contribute in capacity building in African countries on the Atlantic coast both in natural and social sciences, through active involvement and training (including summer schools and graduate level courses) of CC impacts researchers from the region. CS4AWA will engage these African countries in using CS and increase market opportunities locally and for Europe. CS4AWA will thus improve the communication of prediction uncertainties to the stakeholder community. We will communicate climate knowledge in a way that is both scientifically sound and easily understood, facilitating decision making, and integrating into the broader context of societal, economic, and environmental changes.

- 10h35 - 10h45 :

Mecki KRONEN (GIZ, GERMANY) for Sector program Sustainable Fisheries and Aquaculture, led by Dr. Mark PREIN. Global Programme on Risk Assessment and Management for Adaptation to Climate Change (Loss and Damage) funded by German government and implemented by GIZ (global programme managed by Dr. Michael SIEBERT).

“Sustainable management and influences of/adaptation to climate change in W-Africa».

This theme will allow to discuss the various issues, including climate change (and L&D) but also regional approaches to sustainable artisanal fisheries.

- 10^h45 - 10^h55 :

Xavier CAPET, Patrice BREHMER, Eric Machu, and Timothée BROCHIER.

« Regional consequences of climate changes on the West African coastal environment: identifying knowledge gaps »

Climate change will impact the coastal socio-ecosystems in various ways. This will be particularly true along the West African shores where no specific regional projection exercise has been carried out so far. We propose to present 1) the type of approaches that have been implemented for other coastal regions, e.g. in other upwelling systems to gain insight into the regional/local consequences of climate change; 2) the needs of regional stakeholders; 3) the scientific programs that could address these needs.

- 10^h55-11^h00 :

Patrice BREHMER, Thierry HORAREAU, BLOOMER Paulette, Fambaye NGOM SOW, Braham BAYE, Hamet Diaw DIADHIYOU and Massal FALL.

“Conservation genetics of fish in Western Africa to improve regional fisheries management”

In western Africa, multiple species of marine fish are exploited by a large fishing community. The exploitation of this resource calls for the establishment of appropriate management and conservation strategies at national and regional levels, which must start with the correct species identification of catches at fish landing sites. To improve fisheries management in West Africa, research actions have recently been developed, but surveys for the correct identification of species and delimitation of stocks are still in need as e.g the famous sardinella shared stock between Morocco, Mauritania, Senegal, Gambia, Guinea Bissau. Research of the past two decades established that molecular approaches are the best to fill the need especially in poor data area. To address these challenges, we propose a

research programme for improving the identification of catches following two objectives. The first objective is to implement a biodiversity collaborative survey on landing sites, with small scale fishermen, using a barcoding approach which will provide a reference barcode library for future studies. This objective may also help discovering new species, establish data base, follow inventory of genetic resources and identify taxonomic ambiguities as well as traceability of fishing product for e.g. exportation. The second is the development of appropriate molecular tools for the delimitation of potential genetic stocks in West Africa for selected fish of high economic importance. The project involves a network of collaborators which will facilitate different aspects of the study including collection/sampling and laboratory procedures. The outcomes of the project include the development of a molecular resource for West African fish, improvement of fisheries management particularly for transboundary species and a better understanding of their biodiversity along the East Atlantic. The project will also contribute to building human capacity in fish identification as well as strengthening a collaboration network between Mauritania to Guinea and South Africa. Scientific outputs will include identification tools, reports for national and regional fisheries organizations, conference communications, and scientific articles in international peer-reviewed journals. The new knowledge gathered by the project will be crucial for better management of commercial and threatened fish in West Africa as well as establish a precedent for future studies on other commercially important taxa.

- 11h00-11h05 :

Joern SCHMIDT (CAU, Germany)

Socio economics in West Africa vs Climate change: potential extension of AWA-Preface field surveys

- 11h05 - 11h10 :

Abdelmalek FARAJ (Head of INRH, Morocco)

The « Blue belt initiative » in the context of CoP22

- 11h10 - 12h10 :

Discussions on the interest of the establishment of a scientific **council for SFRC member's** states, and recommendations.

Side-event 6: “Contribution of human and social sciences research for ecosystemic approach of fisheries management in West Africa” Morning 14th, room Chapiteau and morning 15th December plenary Room

CHAIRMEN: Dr Adama MBAYE (ISRA/CRODT, Senegal) and Dr Assane FALL (IMROP, Mauritania)

Terme de Reference

Contribution des recherches en sciences humaines et sociales dans la gestion **écosystémique des pêches en Afrique de l’ouest.**

L’approche écosystémique reconnaît l’importance de la prise en compte de la dimension humaine, économique et sociales dans la gestion des pêches pour mieux cerner le fonctionnement des éléments constitutifs de l’écosystème et leur connectivité. Elle permet de disposer de meilleures informations scientifiques sur les écosystèmes.

En Afrique de l’ouest les sciences sociales gagnent de plus en plus de terrain dans la recherche halieutiques tant dans les programmes de recherches que dans la prise en compte même de leurs résultats dans la gouvernance des pêches et la préservation de la diversité biologique (recherche sur les savoirs traditionnels, initiatives locales de cogestion, gestion participative, résilience et vulnérabilité des communautés, ...).

Néanmoins, des efforts restent à faire pour mieux prendre en comptes les questions **d’ordre sociales et économiques qui se posent avec acuité dans la gestion des pêche et au moment où les sciences biologiques elles-mêmes font de plus en plus recours à aux recherche participative impliquant les populations locales.**

Ce « Side Event » : Contribution des recherches en sciences humaines et sociales dans la **gestion écosystémique des pêches en Afrique de l’ouest » est alors une occasion pour faire le bilan des recherches en sciences sociales intégrant les approches écosystémiques, mais aussi proposer un certain nombre d’axes de travail et d’orientations destinés à renforcer la collaboration entre les chercheurs dans les domaines de l’éco-biologie, l’environnement et ceux des sciences économiques et sociales pour une meilleurs ancrage des activités humaines et sociales pour soutenir les processus et approches écosystémique.**

- Bilan et amélioration des connaissances sur **l’impact des résultats de recherche en science économique et sociales dans la préservation de la biodiversité et le changement climatique ;**
- **Développement d’approche interdisciplinaire de la recherche halieutique en sciences sociales (économie, socio-économie, anthropologie) ;**
- **Identification et mise en œuvre d’un système de collaboration socio-économique régional de la pêche entre les chercheurs en Afrique de l’ouest (notamment des états membre de la CSRP).**

Cette rencontre scientifique constitue une opportunité pour les chercheurs en sciences sociales de réfléchir sur les voies et moyens de renforcer la participation aux approches écosystémique pour le développement de la recherche scientifique dans le domaine de la **pêche et des ressources halieutiques en Afrique de l’ouest.**

Oral communications (Morning 14th, room chapiteau)

- 14^h00-14^h20:

Assane Dedah FALL.

« **Des pêcheurs sénégalais à la sauvette à l'industrie de la farine et de l'huile de poisson en Mauritanie** »

- 14^h20-14^h40:

Elizia Silva Da CRUZ.

« Sustainable Development: The contribution of fishing communities to the sustainable management of fisheries resources »

- 14^h40-15^h00:

Adama MBAYE, Timothée BROCHIER, Fambaye NGOM, Ibrahima Cissé, and Aliou BA.

« Impact de la saisonnalité des petits pélagiques sur leur chaîne de valeur au Sénégal »

- 15^h00-15^h20:

Adama MBAYE, Marie-Christine CORMIER-SALEM, Jörn SCHMIDT, and Patrice BREHMER

“**Climate change: What kind of knowledge, what type of adaptation for what type of West African artisanal fisher folk.**”

15h40-16h00: Coffee break

Poster teaser

- 16^h00-16^h10:

El hadj Bara DEME, Patrice BREHMER, and Daniel RICARD.

« La cogestion locale des pêcheries comme dynamique émergente de gestion durable des ressources halieutiques au Sénégal »

- 16^h10-16^h20:

Assane Deda FALL, and Mouhamed Abderrahmane Aly MEYNATT.

“Le système «Feugue diaye» ou le positionnement ethno-identitaire des pêcheurs ndiagolais dans la pêche pélagique »

- 16^h20-17^h00:

Round table “Contribution of human and social sciences research for ecosystemic approach of fisheries management in West Africa”.

3Rd International Workshop “Indicators for an Ecosystem Approach to the Management of Fisheries and the Marine Environment in West African Waters (IndiAWA)”; Afternoon 14th to morning 15th December 2016, room Signara 2

Chairman: Didier JOUFFRE (IRD / MARBEC, France) and Ibrahima DIALLO (CNSHB, Guinea)

Terme de référence

IndiAWA is a research and expertise network focusing on indicators and ecosystem approaches for fisheries and global change in West Africa. The long term objective of the indiAWA working group is to develop and promote regional solutions for an Ecosystem Approach to the management of fisheries and the marine environment in West Africa waters. This 3rd international Workshop, indiAWA 2016, will focus on the organisation of future work of indiAWA consortium for 2107 and specially on the identification of a set of collective studies to be performed and published during the coming year on national ecosystem case studies proposals and/or on methodological proposals related to marine indicators and ecosystem analysis in West Africa.

Sessions/side events report, synthesis and recommendations Conservation Awards. 15th December 2016, Plenary Room (Dara)

CHAIRMAN: Babacar BA (SRFC), Patrice BREHMER (IRD, France), and Heino FOCK (TI, Germany)

- 14^h00-14^h15:

Session 1. Observation and modelling of ocean physics supporting the ecosystem approach to marine management

Dr Bamol Ali Sow (UASZ, ZIGUINCHOR), Dr Heino FOCK (TI, GERMANY), and Dr Alban LAZAR (UPMC, FRANCE)

- 14^h15-14^h30:

Session 2. Variability of pelagic productivity in West-African waters

Dr Idissa Lamine BAMY (CNSHB, GUINEA), Dr Aka Marcel KOUASI (CRO, IVORY COAST), and Dr Osvaldina SILVA (INDP, CABO VERDE)

- 14^h30-14^h45:

Session 3. Physical-biogeochemical coupling: processes and control of small pelagic fish

Dr Vamara KONÉ (CRO, IVORY COAST) and DR Eric MACHU (IRD, SENEGAL)

- 14^h45-15^h00:

Session 4. “Economics integrated into the ecosystem approach to marine management”.

Mr Mustapha DEME (CRODT, SENEGAL), Dr Joern SCHMIDT (CAU, GERMANY), and Dr Didier JOUFFRE (IRD, FRANCE)

- 15^h00-15^h15:

Session 5. “Marine Protected Area (MPA) in West Africa”.

Dr Modou THIAW (CRODT; SENEGAL) and Mme Marie Suzanne TRAORE (RAMPAO)

15h15-15h25: Coffee break

- 15^h25-15^h40:

Side event 1. Scientific research and ICT (information and communication technologies) in the fisheries Monitoring Control and Surveillance.

Cdt Babacar BA (CSRP) and MR Arnaud COMOLET (PNUD, UNDP)

- 15^h40-15^h55:

Side event 2. What technical and economic model(s) to foster the development of aquaculture in sub-Saharan countries: the case of West Africa

Dr Hamet Diaw DIADHIOU (ISRA/CRODT, SENEGAL), and Dr Celestin BLÉ (CRO, IVORY COAST)

- 15^h55-16^h10:

Side event 3. Understand coastal processes to better manage the West African coast

Dr Rafael ALMAR (IRD, France), Moussa SALL (CSE, MOLOA) and Abou BAMBA (ABIDJAN CONVENTION)

- 16^h10-16^h25:

Side event 4. “Environmental marine law in West Africa”

Pr Ibrahima LY (UCAD), Dienaba B. TRAORÉ (CRSP), AND Marie BONNIN (IRD, FRANCE)

- 16^h25-16^h40:

Side event 5. Toward the establishment of a scientific council for SFRC member’s states

Cdt Babacar BA (CSRP), Patrice BREHMER (IRD SENEGAL) and Joern SCHMIDT (CAU, GERMANY)

- 16^h40-16^h45:

Side event 6. “Contribution of human and social sciences research for ecosystemic approach of fisheries management in West Africa”

Dr Adama MBAYE (SENEGAL), and Hassane FALL (MAURITANIA)

- 16^h45-16^h50:

International Working Group IndiAWA: Indicators for an Ecosystem Approach to the Management of Fisheries and the Marine Environment in West African Waters”.

Dr Didier JOUFFRE (IRD, FRANCE) and Dr Ibrahima DIALLO (CNSHB, GUINEA)

- 16^h50-16^h55:

Marine Important Bird Areas in West Africa: important tools to marine spatial planning towards the conservation of seabirds and marine life

Miguel Lecoq (Birdlife, GUINEA BISSAU)

- 16^h55-17^h00:

Interest of “Greenpeace Africa” in the SRFC and AWA research and actions at the level of West Africa

Ibrahima Cisse (GREENPEACE)

- 17^h00-17^h15:

Conservation Awards Ceremony Go-Wamer

Arnaud COMOLET (PNUD, UNITED NATIONS)

- 17^h15-17^h20:

ICAWA 3rd Conference Closing

Cdt Babacar BA (SRFC), Patrice BREHMER (IRD, FRANCE) and Heino FOCK (TI, GERMANY)

Flyers ICAWA 2016
ICAWA 2016 ANNOUNCEMENT

Project structure

WP 0. Project management

WP 1. Observation and modelling of ocean physics supporting the ecosystem approach to marine management

WP 2. Variability of pelagic productivity in West-African waters

WP 3. Physical-biogeochemical coupling: processes and control of small pelagic fish

WP 4. Economics integrated into the ecosystem approach to marine management

WP 5. Education, Training and Capacity-building. Capacity Development in physical oceanography and marine ecology in West Africa



FUNDERS



Joint proposals by the Federal Ministry of Education and Research (BMBWF/Germany) and the IRD (France) under the patronage of the French Ministry for Higher Education and Research (MESR) and the French Ministry of Foreign and European Affairs (MAEE).

Locally implemented by the SRFC Sub Regional Fisheries Commission (Dakar, Senegal)

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AWA

Commission sous régionale des pêches

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Trilateral German-French-African research Initiative In Sub-Sahara Africa



AWA

Ecosystem Approach to the management of fisheries and the marine environment in West African waters



AWA Context

Coastal countries in West Africa are heavily dependent on the Atlantic ocean. Consequently, social development, fisheries, and tourism all face major changes associated with the impact of climate variability and of global warming on the upwelling system. Overexploitation combined with rapid climate change puts marine ecosystems under severe pressure. Local climate variability is one of the causes of coastal erosion and modulates the upper ocean temperature, which determines the suitability of a marine area for fish. Many fish stocks in the species-rich and highly productive West African waters are being depleted.



Toward a West African observatory of marine environment using a modeling and observation platform

The ecological models which reproduce biological interactions of marine organisms in their habitat need coordinated efforts in several disciplines to characterise effectively global change introduced on the continental shelf of West Africa. Though, currently such a tool is nearly the only approach to major investigations for the dilemmas which decision-makers are faced in the context of climate change and overexploitation. Best practices will be to work on observational methods which allow validation of Key ecological processes for efficient assessment and scenario simulation purposes.

Objectives

The main processes which drive ecosystem dynamics are identified and their knowledge improved;

- Disentangling the effects of fishing and climate change ;
- The knowledge of the interplay between ocean physics, biogeochemistry, marine life and human impact is strengthened;
- The EAMME tools are developed;
- A more rational and sustainable use of living marine resources is achieved;
- Build the foundation of a West African observatory;
- Create a sub-regional task force on the ecosystem approach to the management of fisheries and the marine environment in West African waters under the effect of climate change.



Important dates

Call for abstract: 15 October

First announcement: 15 June

Deadline for abstract submission: 30 November

Deadline for registration: 7 December

Paper pre-submission: 16 December

CoP22: 7-18 November

Local technician organizing committee

- Babacar BA (Chair), CSRP
- Patrice BREHMER (chair), IRD
- Amadou TOURE, CSRP
- Ndagoue DIOGOUL, Prestataire
- Toussainte BOISSY, CSRP
- Marie Madeleine GOMEZ, CSRP

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- SCHMIDT Jorn, CAU-Germany
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- TALEB SIDI Mahfoud, ISSM-Mauritania

Finance

- Mouhamadou Makhtar SECK, SRFC
- Cheick Tidiane DIA, SRFC

website

- Charles BEYE, CSRP
- Couly Laba DIOGOUL, Prestataire

SOCIAL EVENT

Visit of the « Mamelle » lighthouse at the extreme West coast of Africa and diner in an original West African restaurant (Art & Afrique)

PRESS BRIEFING

Mame Fatou TOURE DIENE, CSRP

POSTER EXHIBITION

Océan et Climat. Des échanges pour la vie (IRD)

ACCOMMODATION

Rooms are available at half board negotiated conference rates of 84 € (55 000 F CFA) at:

Hôtel des Almadies VACAP-SA

Almadies, Dakar

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CONFERENCE REGISTRATION

Marie Madeleine GOMEZ

www.awa-project.org/ICAWA2016registration

AWA

SRFC/CSRP

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Ecosystem Approach to the management of fisheries and the marine environment in West African waters



2nd announcement

ICAWA
INTERNATIONAL CONFERENCE

13-15 December 2016
Hotel des Almadies VACAP, Dakar



BENIN CABO VERDE IVORY COAST GAMBIA GUINEA GUINEA BISSAU MAURITANIA SENEGAL

Context

Within the framework of AWA, financed by IRD (France) and BMBF (Germany), the SRFC is to support the member states and associated West African partners with concrete actions and enhanced advisory capacities on the new fisheries management approaches.

It must be noted that coastal states of West Africa face host of problems, notably, overexploitation of fisheries resources together with climate change. The consequences of the two phenomena on the fisheries resources are at the heart of debates between managers to which researchers of the sub-region take part. The multidisciplinary approach adopted in AWA allows the interaction of ecologists, biogeochemists, oceanographers, sociologists, economists and climatologists. The long term objective of this conference is to promote the development of an Observatory to monitor, simulate and predict key parameters of the ecosystem of North West Africa. Aside the regular sessions, this year, the organizers will provide feedback from the CoP22 held in Morocco and encourage the participation of Moroccan partners. As last year, we will emphasize fight against Illegal, unreported and unregulated fishing (IUU) as well as aquaculture in West Africa, moreover a special event will focus on Coastal erosion.

Scope of the Conference

The primary objective of the conference is to permit member states of the SRFC and partners from West Africa and northern countries to put in place a sustainable fisheries and marine environment management systems based on biological, ecological, laws, economic and social state of the art knowledge. In this way the conference organizer would like:

- to enhance fisheries management mechanisms in West Africa and particularly of the member states of the SRFC;
- Improve knowledge on the effects of climate change on living marine resources relative to the functioning of their habitats;
- and enhance and train students including researchers of institutions and universities of West Africa in view of propagating AWA in the region.

Conference Topics

The conference will be structured in thematic sessions and side events. Two working groups will also take advantage of the conference venue.

- **Session 1: "Observation and modelling of ocean physics supporting the ecosystem approach to marine management"**
Chairmen: Dr. Bamol Ali SOW (UASZ, Senegal), Dr. Alban LAZAR (UPMC, France) and Gerd KRAUS (Geomar, Germany)
- **Session 2: "Variability of pelagic productivity in West-African waters"**
Chairmen: Dr. Aka Marcel KOUASSI (CRO, Ivory Coast), Dr. Idrissa Lamine Barry (CNSHB, Guinea), and Dr. Osvaldina SILVA (INDP, Cabo Verde)
- **Session 3: "Physical and biogeochemical coupling: processes and control of small pelagic fish"**
Chairmen: Dr. Eric MACHU (IRD, France) and Dr. Vamara KONÉ (CRO, Ivory Coast)
- **Session 4: "Economics integrated into the ecosystem approach to marine management"**
Chairmen: Moustapha DEME (ISRA/CRODT, Senegal), Dr. Didier JOUFFRE (IRD, France) and Dr. Joern SCHIMDT (CAU, Germany)
- **Session 5: "The marine Protected Area in West Africa » joint session with « Marine Important Bird Areas in West Africa"**
Chairmen: Dr. Modou THIAW (ISRA/CRODT), Dr. Suzanne TRAORÉ (RAMPAD) and Abdoulaye Diop (DAMCP, Senegal)
Stand BIRDLIFE: Marine Important Bird Areas in West Africa: important tools to marine spatial planning towards the conservation of seabirds and marine life.
Justine DOSSA (Senegal) and Miguel LECOQ (Guinea Bissau)
- **International Working Group IndiAWA: "Indicators for an Ecosystem Approach to the Management of Fisheries and the Marine Environment in West African Waters".**
Chairmen: Dr. Didier JOUFFRE (IRD, France) and Ibrahima DIALLO (CNSHB, Guinea)

During the conference some majors "side event" will be organized at the sub regional level.

- **Side-event 1: "Scientific research and ICT (information and communication technologies) in the fisheries Monitoring Control and Surveillance"**
Chairmen: Cdt Babacar BA (SRFC-CSRP), Arnaud Comolet (United Nations, UNDP) and Demba GUISSÉ (Guinea)
- **Side-event 2: "What technical and economic model(s) to foster the development of aquaculture in sub-Saharan countries: the case of West Africa"**
Chairmen: Dr. Hamet DIADHOU (CRODT, Senegal) and Dr. Célestin BLE (CRO, Ivory Coast). Guest of Honor Pr. Grant VANDENBERG (UQAL, Canada)
- **Side-event 3: "Understand coastal processes to better manage the West African coast"**
Chairmen: Rafael ALMAR (IRD, France), Moussa SALL (MOLOA) Abou BAMBA (Convention d'Abidjan) Guest of Honor Prof Dr. Ir. J.A. ROELVINK (UNESCO, Netherland)
- **Side-event 4: "Environmental Marine Law in West Africa"**
Chairmen: Pr. Ibrahima LY (UCAD, Senegal), Dr. Marie BONNIN (IRD, France), and Dienaba Beye TRAORÉ (SRFC-CSRP)
- **Side event 5: "Toward the establishment of a scientific council for SFRC member's states"**
Chairmen: Cdt Babacar BA (SRFC-CSRP), Dr. Patrice BREHMER (IRD, Senegal) and Dr. Joern SCHMIDT (CAU, Germany). Guest of honor Mohamed M'barek O. Soueilim (IMROP, Mauritania)
- **Side event 6: "Human dimension in West African fisheries in a framework of adaptation and governance"**
Chairmen: Dr. Adama MBAYE (CRODT, Senegal) and Dr. Hassane Dedah FALL (IMROP, Mauritania)

The AWA project is a trilateral German-French-African Research initiative in Sub-Saharan Africa





COMMISSION SOUS-RÉGIONALE DES PÊCHES
SUB-REGIONAL FISHERIES COMMISSION



1st ANNONCEMENT ICWA 2016

Dears,

The Sub Regional Fisheries Commission's Permanent Secretary is honoured to inform you that, after the success of the first edition, the second International conference "***Ecosystem Approach to the management of fisheries and the marine environment in West Africa waters***" will be held the 17th, 18th and 19th November 2015 in Dakar, Senegal, organized during implementing project of the AWA project.

In this effect, supplementary information will be sent in near future (2nd announcement). Specific "side event or regular session" can be added to the program of the conference as for the 2014 edition, do not hesitate to send us a message in this way or contact the PI of AWA Working Package.

Faithfully

Marie Madeleine GOMEZ on behalf of my co-organizers

Please accept our apologies for the duplicate

Contact : Marie Madeleine Gomez <mariemadeleine.gomez@spcsrp.org>

2nd ANNOUNCEMENT ICAWA

International Conference “Ecosystem Approach to the Management of Fisheries and the Marine Environment in West African Waters” (AWA)

Dear colleagues,

The Permanent Secretary of the Sub Regional Fisheries Commission is honoured to inform you that the second International conference “*Ecosystem Approach to the Management of Fisheries and the Marine Environment in West African Waters (AWA)*” will be held, with the COP21 Label, the 17th to 19th November 2015 in Dakar, Senegal at the Hotel Le Ndiambour.

Scientific Communications and Posters

Participants who wish to make presentations, can submit, no later **31th October 2015**, to the Scientific Committee of the Conference an abstract of their communication(s) or poster(s) presentation via the following e-mail mariemadeleine.gomez@spscrp.org with copy to patrice.brehmer@ird.fr. You will receive a notification within fifteen days after the submission of your abstract.

Invitation letters

The participants who need invitation letters to attend the meeting can submit their request to assistant program who can reach through the following e-mail: mariemadeleine.gomez@spscrp.org.

Thematic sessions and Side events

The conference will be split in plenary and sub commission rooms according to scientific contributions. The agenda will be sent after the deadline of abstract submission.

Session 1: “Observation and modelling of ocean physics supporting the ecosystem approach to marine management”

Session 2: “Variability of pelagic productivity in West-African waters”

Session 3: “Physical and biogeochemical coupling: processes and control of small pelagic fish”

Session 4 : “Economics integrated into the ecosystem approach to marine management and economic benchmarking”

Session 5: “Marine Protected Area (MPA) in West Africa”

Side-event 1: “Environmental marine law”

Side-event 2: “Blue economy: Improved the technological development of aquaculture in Africa”

Side-event 3: “The port inspection and exchange of information as a tool for strengthening the fight against IUU fishing in the SRFC area”

Side-event 4: “COP21/CMP11¹ toward a common declaration for African Tropical Atlantic countries”.

Side-event 5: “Human dimension in West African fisheries in a framework of adaptation and governance”.

International Working Group IndiAWA: “Indicators for an Ecosystem Approach to the Management of Fisheries and the Marine Environment in West African Waters”.

International PREFACE Workshop: ‘Bio-economic modeling of African Fisheries in the Atlantic’ (opening just after the conference start the 20th).

Accommodations

¹ 21st Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change.

Rooms are available at half board negotiated conference rates of 84 € (55 000 F CFA) at:

Hôtel Le NDIAMBOUR

Dakar Plateau, 121 Rue Carnot

www.lendiambour.com

Phone: (+221) 33 889 42 89)

Other available hotels within the vicinity of the conference venues at no-negotiated rate are:

Hôtel AL AFIFA

Dakar Plateau, 46 Rue Jules FERRY

Phone : (+221) 33 889 90 90

Hôtel DU PLATEAU

Dakar Plateau, 62 Rue Jules FERRY

Phone : (+221) 33 823 15 29

Hôtel GANALE

Dakar Plateau, 38 Rue Amadou Assane NDOYE

Phone : (+221) 33 889 44 44

www.ganalehotel.com

Registration

Online registration will be made at <http://www.awa-project.org/inscription-conference/>

In case of online registration problems, you may contact directly the assistant of the program through the following e-mail mariemadeleine.gomez@spcsrp.org with copy to patrice.brehmer@ird.fr and the mail object should read « Registration to AWA Conference 2015 ».

Registration Fees

- 50 € for foreignstudents of projects;
- 100 € for the partners and affiliates to the project;
- 300 €for other participants.

Registrations fees can be paid by credits cards or in cash. Registration fees could be waived upon request for Sub-Saharan citizens (e-mail:mariemadeleine.gomez@spcsrp.org).

Advice to travelers

Please refer to the following website www.diplomatie.gouv.fr/fr/conseils-aux-voyageurs/conseils-par-pays/senegal-12357/

Other information

Additional information will be posted on the website of both the AWA project www.awa-project.org and SFRC www.spcsrp.org

Yours Sincerely.

Please accept our apologies for any duplication.

List of institutional partners and participants attending ICAWA 2016

ICAWA 2016 Institution and laboratories participant list

African Confederation of Artisanal Fisheries Professional (CAOPA), Senegal
Agence Nationale d'Aquaculture (ANA), Senegal
Agencia Canaria de Investigación, Innovación y Sociedad de la Información (ACIISI), Spain
APDRA Pisciculture paysanne, France
BirdLife International, Senegal
BirdLife South Africa, South Africa
Bureau Opérationnel de Suivi du Plan Sénégal Emergent (PSE), Senegal
Canary Current Large Marine Ecosystem (CCLME) project, Senegal
Center for International Collaborative Research, Nagasaki University, Japan
Center of Tropical Marine Ecology (ZMT), Germany
Centre de Coopération Internationale de Recherche Agronomique pour Développement (CIRAD), France
Centre de Recherche Halieutique (CRH), France
Centre de Recherches Océanographiques de Dakar Thiaroye (CRODT), Sénégal
Centre de Recherches Océanologiques d'Abidjan (CRO), Côte d'Ivoire
Centre de Suivi Ecologique Africain (CSE), Senegal
Centre National de Recherche Scientifique (CNRS), France
Centre National de Surveillance et de Protection des Pêches (CNSP), Guinea
Centre National des Sciences Halieutiques de Boussoura Conakry (CNSHB), Guinea
Centro de Investigaçao Pesqueira Aplicada (CIPA), Guinea Bissau
Centro de Operações de Segurança Marítima (COSMAR), Cabo Verde
Collectif National des Pêcheurs Artisansaux du Sénégal (CNPS), Senegal
Commision Sous Régionale des Pêches (CSRP), Senegal
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Mauritania
Direction de l'Environnement et des établissements Classés (DEEC), Senegal
Direction de la Protection et de la Surveillance des Pêches (DPSP), Senegal
Direction des Aires Marines Communautaire Protégée (DAMCP/MEDD), Sénégal
Direction des Parcs Nationaux (DPN), Senegal
Direction des Pêches Maritimes (DPM), Bénin

Direction des Pêches Maritimes (DPM), Senegal
Direction Générale des Pêches (DGP), Guinea Bissau
Ecole Supérieure Polytechnique (ESP), Senegal
ENDA Tiers Monde, Senegal
Environments and Paléoenvironnements Oceanic and continental (EPOC), France
EPFL École polytechnique fédérale de Lausanne, Suisse
Estudios Ambientales y Oceanografía S.L. (ECOS), Spain
European Centre for Research and Education in Environmental Geosciences (CEREGE), France
Fisheries Department (FD), The Gambia
Fondation Internationale du Banc d'Arguin (MAVA), Senegal
Gendarmerie Nationale (GN), Senegal
Geodetic Engineering Laboratory TOPO, Suisse
Gesellschaft für Internationale Zusammenarbeit (GIZ), Senegal
Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany
Greenpeace, Africa
Greenpeace, Senegal
Helmholtz Centre for Ocean Research Kiel (GEOMAR), Germany
Institut français pour l'exploitation de la mer (Ifremer), Bastia, Corse, France
Institut français pour l'exploitation de la mer (Ifremer), Issy-les-molineaux, France
Institut français pour l'exploitation de la mer (Ifremer), Plouzané, France
Institut de Recherche pour le Développement (IRD), France
Institut de Recherches Halieutiques et Océanologiques du Bénin (IRHOB), Benin
Institut des Sciences Halieutiques, Cameroun
Institut Fondamental d'Afrique noire (IFAN), Senegal
Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER), France
Institut National de Recherche Halieutique (INRH), Agadir, Maroc
Institut National de Recherche Halieutique (INRH), Casablanca, Maroc
Institut Pasteur de Dakar (IPD), Sénégal
Institut Sénégalais de Recherches Agricoles (ISRA), Senegal
Institut Supérieur des Sciences de la Mer (ISSM), Mauritania
Institut Universitaire De Pêche et d'Aquaculture (IUPA), Senegal
Institut Universitaire Européen de la Mer (IUEM), France
Institute of Marine Research (IMR), Norway
Instituto Milenio de Oceanografía (IMO), Chile
Instituto Nacional de Desenvolvimento das Pescas (INDP), Cabo Verde
International Chaire UNESCO in Mathematical Physics and Application (ICMPA), Benin

Intitut Mauritanien de Recherches Océanographiques et des Pêches (IMROP), Mauritania
JEAI LEH-AO, Senegal
JEAI RELIFOME, Cameroon
Laboratoire Commun de Microbiologie (LCM), Senegal-France
Laboratoire d'Etudes et de Recherches en Politiques et Droit de l'Environnement et de la Santé (LERPEDES), Senegal
Laboratoire d'Océanographie et des Sciences de l'Environnement et du Climat (LOSEC), Sénégal
Laboratoire de Biologie et d'Ecologie des Poissons en Afrique de l'Ouest (LABEP-AO), Senegal
Laboratoire de Météorologie Dynamique (LMD), France
Laboratoire de Morphologie et d'Hydrologie (LMH), Senegal
Laboratoire National de Recherches sur les Productions Végétales (LNRPV), Senegal
Laboratoire de Physique de l'Atmosphère et de l'Océan Siméon Fongang (LPAO-SF), Senegal
Laboratoire de Physique de l'Atmosphère et Mécanique des fluides (LAPA-MF), Ivory Coast
Laboratoire de Recherches sur les Zones Humides, Bénin
Laboratoire d'Etudes et de Recherche en Géomatique (LERG), Sénégal
Laboratory of Social and Economic Studies of the Mauritanian, Mauritania
Leibniz Center for Tropical Marine Ecology (ZMT), Germany
Marine Nationale (MN), Senegal
Ministère de l'Environnement et du Développement Durable (MEDD), Senegal
Ministère de la Pêche et l'Economie Maritime(MPEM), Senegal
National Institute of Oceanography and Fisheries (NIOF), Egypt
National Research Institute of Fisheries Engineering, Fisheries Research Agency, Ibaraki, Japan
NEPAD, African union, Africa
Thünen Institute for Sea Fisheries (TI), Germany
UICN, Mauritanie
UMMISCO Unité de modélisation mathématique et informatique des systèmes complexes, France
UMR Amure, Centre de droit et d'économie de la mer, France
UMR CERAMAC, Centre d'Etudes et de Recherches Appliquées au Massif Central et aux Espaces Fragiles, France
UMR CEREGE, Centre Européen de Recherche et d'Enseignement de Géosciences de l'Environnement, France
UMR EPOC, Environnements et paléoenvironnements océaniques et continentaux, France
UMR ESE, Ecologie et Santé des Ecosystèmes, France
UMR ESPACE-DEV, Espace pour le développement, France
UMR GRED, Gouvernance Risque Environnement Développement, France
UMR ISEM, Institut des Sciences de l'Evolution de Montpellier, France
UMR Laboratoire de Géologie de Lyon, France

UMR Laboratoire Géosciences Océan, France
UMR LDO, Laboratoire Domaines Océaniques, France
UMR LEGOS, Laboratoire d'Etudes en Géophysique et Océanographie Spatiales, France
UMR LEMAR, Laboratoire des sciences de l'environnement marin, France
UMR LMD, Laboratoire de Météorologie Dynamique, France
UMR LOCEAN, Laboratory of Oceanography and Climate, France
UMR LOG, Laboratoire d'Océanologie et de Géosciences, France
UMR LOPS, Laboratoire d'Océanographie Physique et Spatiale, France
UMR LST, Laboratoire de Sciences de la Terre, France
UMR MARBEC, MARine Biodiversity, Exploitation and Conservation, France
UMR MOI, Institut Méditerranéen d'Océanographie, France
UMR MIVEGEC, Dakar, Sénégal
UMR NM, Neuropharmacologie Moléculaire, Faculté de Médecine Laennec, France
UMR PALOC, Patrimoines locaux et gouvernances, France
UNDP, United Nations
UNESCO-IHE, The Netherlands
Union Européene
Union nationale des mareyeurs exportateurs du Sénégal (UPAMES), Senegal
Unité de Bactériologie Expérimentale, Sénégal
Universidade Federal Fluminense, Brazil
Université Aix-Marseille, France
Université Alioune Diop de Bambey (UADB), département mathématique, Bambey, Sénégal
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Université d'Abomey Calavi (UAC), Bénin
Universite de Bordeaux, France
Université de Bretagne Occidentale (UBO), France
Université de Cabo Verde (UNI-CV), Cabo Verde

Université de Douala, Cameroun
Université de Dschang, Cameroun
Université Félix Houphouet Boigny, Ivory coast
Université de Kiel (CAU), Germany
Université de Laval, Québec, Canada
Université de Nantes, France
Université de Parakou, Bénin
Université de Toulouse, France
Université de Talence, France
Université Gaston Berger (UGB), Senegal
Université Ibn Zohr Faculté des Sciences, Maroc
Université Peleforo Gon Coulibaly, Côte d'Ivoire
Université Pierre et Marie Curie (UPMC), France
Université Plymouth, United Kingdom
Université Toulouse 3 Paul Sabatier (UT), France
University Hokkaido, Field Science Center for Northern Biosphere, Japan
University of Cape Town, South Africa
University of Bergen, Norway
University South Eastern Kenya, Kenya
University Tokyo of Marine Science and Technology, Japan
US IMAGO Unité de Service, Instrumentation, moyens analytiques, observatoires en géophysique et océanographie (IRD), Senegal
US IMAGO Unité de Service, Instrumentation, moyens analytiques, observatoires en géophysique et océanographie, France

List of authors and participants ICAWA 2016

Below the table showing all the contributors to the ICAWA 2016 scientific communication and poster *i.e.* not include in this list all the institutional and country representatives as well as visiting students.

Country	Fist name	Last name	Institution/organisation
CABO VERDE	ANTONIO FILIPE LOBO	DE PINA	UCV
GAMBIA	SHEGUELLA	SARR	SCS
BENIN	SERGE FOLLY	TOMETY	IRD/IRHOB/CIPMA
SENEGAL	ALI MOHAMED	ABDOU SALAM	CRODT
JAPAN	KOKI	ABE	NRIFE
BENIN	CHRISTIAN	ADJE	IRHOB
SENEGAL	CONSTANCE	AGBOBA	UCAD/FST
SENEGAL	PHILIPPE WENCESLAS	AHODEKON	GREENPEACE AFRICA
FRANCE	RAFAEL	ALMAR	IRD
BISSAU GUINEA	AMADEU	ALMEIDA	CIPA
CABO VERDE	CORRINE	ALMEIDA	UNICV
FRANCE	PEDRO	ALMEIDA	IRD
JAPAN	KAZUO	AMAKASU	TUMS
FRANCE	EDWARD	ANTHONY	CEREGE
SENEGAL	KAMAREL	BA	CRODT
SENEGAL	FATIMA	BA	DAMCP
SENEGAL	ALIOU	BA	IRD/CRODT/UCAD
SENEGAL	BABACAR	BA	SFRC
SENEGAL	NGANSOUMANA	BA	UCAD/FST
SENEGAL	KADER	BA	UCAD/FST
SENEGAL	ADAMA	BADIANE	ESP/LPAOSF
SENEGAL	ALIOUNE BADARA	BADJI	CRODT
SENEGAL	LUC BONAVENTURE	BADJI	IFAN
SENEGAL	BOCAR SABALY	BALDE	IUPA/IRD-CRODT
SENEGAL	ASSIATOU	BALDE	UCAD/FST
MAURITANIA	ABOU CIRE	BALL	IMROP
IVORY COAST	ABOU	BAMBA	ABIDJAN CONVENTION
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MAURITANIA	ELY	BEIBOU	IMROP
FRANCE	BEATRIZ	BEKER	LEMAR
GAMBIA	ANNA	BENGA CHAM	FD
MOROCCO	ALI	BENHRA	INRH
MAURITANIA	ALAIN	BERGE	AMBASSADE
MAURITANIA	MEISSE	BEYAH	IMROP
SENEGAL	CHARLES	BEYE	SRFC
FRANCE	NICOLAS	BEZ	IRD/MARBEC
IVORY COAST	MELECONY CELESTIN	BLE	CRO
SENEGAL	TOUSSAINTE	BOISSY	SRFC
BENIN	FREDERIC	BONOU	IRD
MOROCCO	ABDALLAH	BOUHAIMI	UIZ

MOROCCO	FATIMA ZOHRA	BOUTHIR	INRH
MAURITANIA	CHEIKH BAYE	BRAHAM	IMROP
GERMANY	PETER	BRANDT	GEOMAR
FRANCE	PATRICE	BREHMER	IRD/LEMAR
FRANCE	TIMOTHEE	BROCHIER	IRD/UMMISCO
BENIN	EMMANUEL	C. MIDINOUEWA	UAC
GUINEA	MOHAMED LAMINE	CAMARA	CNSHB
FRANCE	XAVIER	CAPET	LOCEAN/CNRS
FRANCE	ROSELYNE	CARTHERON	TELESPAZIO
FRANCE	CRISTELE	CHEVALIER	UMR MIO
SENEGAL	IBRAHIMA	CISSE	GREENPEACE AFRICA
SENEGAL	YOUSSOUPH	COLY	LOSEC
SENEGAL	MAURICE	COREA	CRODT
FRANCE	MARIE-CHRISTINE	CORMIER-SALEM	IRD/PALOC
SENEGAL	KHASSOUM	CORREA	UCAD
SENEGAL	MOHAMED AYIB	DAFFE	UCAD/FSJP
FRANCE	DOMINIQUE	DAGORNE	IRD/ IMAGO
FRANCE	CHRISTOPHER	DALY	IUEM/UBO
FRANCE	DENIS	DAUSSE	UMPC/LOCEAN
MAURITANIA	AHMED BABOU	DEDAH	IMROP
BENIN	COSSI GEORGES	DEGBE	IRHOB
FRANCE	HERVE	DEMARCO	IRD/MARBEC
SENEGAL	MOUSTAPHA	DEME	CRODT
FRANCE	JULIE	DESHAYES	UMPC/LOCEAN
FRANCE	JEAN LUC	DEVENON	UMR MIO
MAURITANIA	MAMADOU	DIA	IMROP
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SENEGAL	MODOU	DIAKHATE	UCAD/LPAOSF
GUINEA	IBRAHIMA	DIALLO	CNSHB
SENEGAL	ABDOULAYE	DIALLO	CRODT
SENEGAL	ANIS	DIALLO	CRODT
SENEGAL	ABDOULAYE	DIALLO	IPVS
SENEGAL	AHMED	DIAME	GREENPEACE AFRICA
SENEGAL	OUSMANE	DIANKHA	DAMCP
SENEGAL	MARILINE	DIARA	MEDD
SENEGAL	AMADOU T.	DIAW	UCAD/LERG
SENEGAL	NDAGUE	DIOGOUL	IRD/CRODT
SENEGAL	MAMADOU	DIOP	DAMCP
SENEGAL	KHADY	DIOP	IRD/MARBEC
SENEGAL	ABDOULAYE	DIOP	MEDD
SENEGAL	MIKA	DIOP	SRFC
SENEGAL	YACINE	DIOP	SRFC
SENEGAL	CHEIKH	DIOP	UCAD/FMPO
SENEGAL	MEDOUNE	DIOP	UCAD/IUPA
SENEGAL	MALICK	DIOUF	UCAD/IUPA

SENEGAL	ABDOULAYE	DJIBA	CNFTP
FRANCE	ANNE	DONVAL	CNRS/LEMAR
CABO VERDE	CORRINE	DO ROSARIO TIMAS ALMEIDA	UNICV
SENEGAL	JUSTINE	DOSSA	BIRDLIFE
SENEGAL	FATOU	DOUMBOUYA	UCAD
BENIN	YVES	DU-PENHOAT	IRD/LEGOS
FRANCE	PHILIPPE	DUSSOUILLEZ	CEREGE
FRANCE	JEAN-MARC	ECOUTIN	IRD/LEMAR
MOROCCO	SALAHEDDINE	EL AYOUBI	INRH
FRANCE	JERONIMO	ESCRIBANO	LMD
MOROCCO	OMAR	ETTAHIRI	INRH
MAURITANIA	ASSANE	FALL	IMROP
SENEGAL	MASSAL	FALL	CRODT
SENEGAL	JEAN	FALL	UCAD/IUPA
MOROCCO	ABDELMALEK	FARAJ	INRH
SENEGAL	ABDOULAYE	FATY	UCAD
SENEGAL	ALIOUNE	FAYE	UCAD/IUPA
SENEGAL	LUC	FINOT	IRD/US IMAGO
FRANCE	THOMAS	FLEURY	CEREGE
FRANCE	FRANCE	FLOC'H	IUEM/UBO
GERMANY	HEINO	FOCH	THIENEN
CABO VERDE	DELVIS	FORTES	ACOPECA
CABO VERDE	RUI	FREITAS	UCV
JAPAN	TADANORI	FUJINO	CICR
BISSAU GUINEA	RITA	FUNNY	CIPA
FRANCE	FRANÇOIS	GALGANI	IFREMER
MAURITANIA	CHEIKHNA	GANDEGA	IMROP
SENEGAL	AMY	GASSAMA	UCAD/FMPO
SENEGAL	AMADOU	GAYE	UCAD/ESP
SENEGAL	MARIE MADELEINE	GOMEZ	SRFC
FRANCE	THOMAS	GORGUES	IRD LOPS
FRANCE	JEAN-YVES	GRANDPEIX	UMPC/LMD
SENEGAL	MOR	GUEYE	CRODT
SENEGAL	ABDOU	GUEYE	ENDA
SENEGAL	NASSIROU	GUEYE	UCAD
FRANCE	PATRICE	GUILLOTREAU	UNIV NANTE
GUINEA	DEMBA	GUISSE	SCS
FRANCE	JEREMIE	HABASQUE	IRD/LEGOS
SENEGAL	MADJID	HADJAL	ESP/LPAOSF
GERMANY	JULIA	HOFFMANN	KU
FRANCE	FREDERIC	HOUSDIN	UMPC/LMD
BISSAU GUINEA	INLUTA	INCOM	CIPA
BISSAU GUINEA	JEREMIAS	INTCHAMA	CIPA
IVORY COAST	TAPE	JOANNY	CRO
FRANCE	JULIEN	JOUANNO	LEGOS

FRANCE	DIDIER	JOUFFRE	IRD
BISSAU GUINEA	RAUL	JUMPE	CIPA
SENEGAL	GUEDEL	KA	SRFC
SENEGAL	YOBA	KANDE	UADB
MAURITANIA	ELIMANE ABOU	KANE	IMROP
SENEGAL	ALIOUNE	KANE	UCAD/LMH
GERMANY	JOHANNES	KARSTENSEN	GEOMAR
GUINEA	ISMAEL	KEITA	DPM
FRANCE	ELODIE	KESTENARE	LEGOS
FRANCE	NICOLAS	KOLODZIEJCZYK	LOPS
IVORY COAST	JUSTIN KONAN	KOUADIO	CRO
IVORY COAST	AKA MARCEL	KOUASSI	CRO
SENEGAL	LALA	KOUNTA	UCAD/LPAOSF
GERMANY	GERD	KRAHMANN	GEOMAR
FRANCE	RAYMOND	LAË	IRD LEMAR
MAURITANIA	MOHAMED LEMINE	LAFDAL	GARDE COTE
GUINEA	MOHAMED	LAMINE CAMARA	CNSHB
FRANCE	REMI	LOSNO	UMR CNRS 7583
SENEGAL	ABDOULAYE	LOUM	UCAD/IUPA
SPAIN	FERNANDEZ	LOUZARA	ECOS
FRANCE	ERIC	MACHU	IRD/LOPS
SENEGAL	MAME SAMBA	MBAYE	UCAD/FST
SENEGAL	BAYE	MBAYE	UCAD/LPAOSF
SENEGAL	MOUSSA	MBENGUE	ADEPA
GERMANY	KRONEN	MECHTHILD	GIZ
EGYPT	MOHAMED	MEGAHED	NIOF
BISSAU GUINEA	ABRIGO	MENDA	CIPA
FRANCE	CHRISTOPHE	MESSAGER	PRIVATE
JAPAN	KAZUSHI	MIYASHITA	FSCNB
CABO VERDE	IVANICE	MONTEIRO	INDP
KENYA	SONNIA NZILANI	MUSYOKA	SEKU
BISSAU GUINEA	VITORINO	NAHADA	CIPA
BISSAU GUINEA	MARIO	NBUNDE	CIPA
IVORY COAST	JACQUELINE	N'CHO AMALACHY	CRO
SENEGAL	MASSATA	NDAO	MPEM
SENEGAL	SOULEYE	NDAO	UCAD /LERPDES
CANADA	WALY NDIANCO	NDIAYE	UNI LAVAL
GAMBIA	ADJA MARIAMA	NDIAYE	FD
SENEGAL	KHALIL RAKHMANE	NDIAYE	BOS(PSE)
SENEGAL	PAPA	NDIAYE	IFAN
SENEGAL	NDEYE AIDA	NDIAYE	ISRA/LNRPV
SENEGAL	MAMADOU	NDIAYE	SURVEILLANCE
SENEGAL	FATMA	NDIAYE	UCAD
SENEGAL	IBRAHIMA	NDIAYE	UCAD/FST
SENEGAL	ISMAÏLA	NDOUR	CRODT
SENEGAL	ABDOULAYE	NDOUR	UCAD

GAMBIA	AMIE	NDURE	FD
SENEGAL	SERIGNE FALLOU	NGOM	CRODT
SENEGAL	FAMBAYE	NGOM	CRODT
SENEGAL	HABIB	NGOM	UCAD
IVORY COAST	CONSTANCE	N'GUESSAN	CRO
SENEGAL	MAMADOU SILEYE	NIANG	CRODT
SENEGAL	LAMINE FALL	NIASS	SFRC
SENEGAL	KANDIOURA	NOBA	UCAD/FST
BISSAU GUINEA	JULIEN KOKOUVI	NOUMONVI	DPM
BENIN	VICTOR	OPEKTCHIA	IRHOB
FRANCE	YANNICK	PERROT	IRD/LEMAR
FRANCE	PIERRE	RAMON	IFREMER
BISSAU GUINEA	HERMENEGILDO	ROBALO	CIPA
CABO VERDE	ELIZANDRO	RODRIGUES	NIFD
SENEGAL	MAMADOU	SADIO	CEREGE
SENEGAL	OUMAR	SADIO	IRD/LEMAR
SENEGAL	MARIE THERESE	(ATAUME) SAGNA	UCAD/ISE
SENEGAL	MARIAMA	SAGNE	UCAD/IUPA
GAMBIA	DAWDA	SAINE	CAOPA
MAURITANIA	CHEIKH IBRAHIMA	SAKHO	IMROP
SENEGAL	ISSA	SAKHO	UT
SENEGAL	MOHAMED AYIB	SALIM DAFTE	LERPDES
SENEGAL	MOUSSA	SALL	CSE
SENEGAL	OUSMANE	SARR	UCAD/IUPA
SENEGAL	ABDOULAYE	SARRE	CRODT
FRANCE	GERALDINE	SARTHOU	CNRS INSU
GERMANY	JÖRN	SCHMIDT	CAU
GERMANY	FLORIAN	SCHÜTTE	GEOMAR
SENEGAL	AICHETOU	SECK	GIDEL /UCAD
SENEGAL	MOUHAMADOU M.	SECK	SRFC
SENEGAL	HABIB	SENGHOR	UCAD/LPAOSF
SENEGAL	EL HADJI BALLE	SEYE	UICN
FRANCE	RACHEL	SHELLEY	CNRS/LEMAR
FRANCE	RAFFAELE	SIANO	IFREMER
CABO VERDE	PERICLES	SILVA	INDP
CABO VERDE	ELISIA	SILVA DA CRUZ	INDP
FRANCE	MONIQUE	SIMIER	MARBEC
BENIN	ZACHARIE	SOHOU	IRHOB
SENEGAL	AMIDOU	SONKO	UCAD
FRANCE	MARC	SOURISSEAU	IFREMER
SENEGAL	DIATOU	SOW	CRODT
SENEGAL	MAGUEYE	SOW	ECO VISION
SENEGAL	MOUSTAPHA	SOW	UASZ
GAMBIA	IBRAHIMA	SYLLA	CSRP
SENEGAL	AMADOU	T. GAYE	UCAD/LPAOSF
MAURITANIA	MAHFOUD OULD	TALEB	ISSM

SENEGAL	ABDOUL WAHAB	TALL	LOSEC
SENEGAL	CIRE	TALL	SRFC
IVORY COAST	JOANNY	TAPE	CRO
CABO VERDE	MECILDES	TAVERES	DGP
FRANCE	LUIS	TITO DE MORAIS	IRD LEMAR
SENEGAL	NDIAGA	THIAM	CRODT
SENEGAL	ALASSANE	THIAM	SRFC/PRAO
SENEGAL	MODOU	THIAW	CRODT
SENEGAL	OMAR THIOM	THIAW	UCAD/IUPA
SENEGAL	DIMINGOU	THIOUR	UCAD/IUPA
SENEGAL	MBAYE	TINE	UGB
SENEGAL	AMADOU	TOURE	SRFC
SENEGAL	MAME FATOU	TOURE	SRFC
FRANCE	GEORGES	TYMEN	LEMAR
SENEGAL	SUZANNE	TRAORE	RAMPAO
SENEGAL	DIEYNABA BEYE	TRAORE	SRFC
FRANCE	THOMAS	VALLEE	UNIV NANTE
WEST AFRICA	INVITED STUDENTS	NOT REGISTERED	UGB, UCAD, UASZ, UADB, ETC...

ICAWA 2016 pictures



Some participants







ICAWA Award laureate 3rd edition







'AWA' PROJECT

Build the foundation of a West African observatory

Create a sub-regional task force on the ecosystem approach to the management of fisheries and the marine environment in West African waters under the effect of climate change

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