West African Regional Climate Change Workshop: on Fisheries and MPAs

Gambia – Senegal Sustainable Fisheries Program (Ba Nafaa)

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Participants to the Regional Climate Change Workshop on Fisheries and MPAs

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Introduction

In late March 2011, USAID's Gambia-Senegal Sustainable Fisheries Project convened a four-day climate change workshop in the coastal town of Mbodiene, Senegal, just south of Dakar. The 47 participants came from government agencies from the seven countries that participate in the West Africa Sub-regional Fishing Commission (known by its French acronym CRSP) (Mauritania, Senegal, Cape Verde, The Gambia, Guinea, Guinea Bissau, and Sierra Leone) and from other regional initiatives. Among the regional initiatives were the UNDP Adaptation to Coastal Climate Change project, the Canary Current Large Marine Ecosystem Project, and Africa Adapt program. Represented government agencies included, fisheries, parks and wildlife, and environment (see participant list in Appendix 1). The Workshop was organized by the Coastal Resources Center at the University of Rhode Island and WWF's West African Marine Eco-region Program (WAMER).

The workshop focused specifically on climate change impacts, vulnerability and adaptation strategies to minimize the adverse impacts of climate change on marine fisheries and marine diversity in MPAs.The specific objectives included:

- Consolidating information on regional climate change initiatives in coastal areas and marine ecosystems
- Assessing climate change issues in fishing communities and marine ecosystems and actions taken to date across each of the CSRP countries and identifying similarities of key issues and responses across countries
- Identifying needs and opportunities for mainstreaming adaptation considerations and actions into national, sub-national, and local level strategies and initiatives

The basis for the Workshop is founded on the importance of the marine environment and fisheries in this sub-region to livelihoods, exports, food and protein. The interconnected coastal and marine environment of the West African CSRP sub-region is a highly productive ecosystem with globally significant marine biodiversity. A number of marine protected areas are found in the sub-region, including the Banc d'Arguin, Djoudj, Diawling, Saloum, and Tanbi, among others. These ecologically, socially, and economically critical features of the West African sub-region region are severely threatened by anthropogenic activities and climate change accelerates the negative impacts of these human pressures. This makes it all the more critical and urgent to increase understanding and awareness of climate change and to increase support for national adaptation actions and regional coordination and cooperation opportunities.

Environmental Pressures Accelerate GCC Impacts

A common finding from the Workshop is that the countries in the West African sub-region face similar coastal and marine environmental concerns, especially habitat destruction, coastal erosion, floods and droughts resulting from extreme weather conditions, soil and groundwater salinization and overfishing. Potential changes in ocean circulation and upwelling patterns were further expressed as major concerns for marine fisheries (see **Appendix 2** for country summaries of environmental and climate change concerns, national policies regarding climate change, and strategies and activities in response to climate change). Mauritania and Senegal additionally

listed desertification as one of their major concerns, leading to an increase in migration to coastal areas and, consequently, increasing pressures on marine resource. The degradation of cultivatable lands and the resulting decline in agriculture further adds to the general trend of inland populations relocating to coastal zones, increasing the already intense pressures on marine resources.

These existing problems are likely to become more serious threats for coastal locations and fishing communities when coupled with the projected impacts of climate change. Non-sustainable resource use, including overfishing, reduces the adaptive capacity of natural systems, decreasing resiliency and the ability of stressed communities and ecosystems to respond to climatic changes. For example, sand mining for construction, alteration of waterways, population pressure, and improper siting of infrastructure leave both the communities and the environment with increased vulnerability to climate change.

The projected changes in climate and physical environments for the West Africa region include:

- Air temperature increases of 0.5°C per decade
- Increased surface water temperatures
- Sea level rise, inundation, and loss of coastal habitat and infrastructure
- Soil and ground water salinization
- Coastal erosion
- Changes in the seasonality and amount of precipitation
- Increased variability and intensity of storms
- Changes of ocean circulation and upwelling patterns
- More frequent occurrence of eutrophic conditions
- Increase in evaporation
- Increased ocean acidity and salinity, and changes in levels of dissolved oxygen

These changes are expected to have many diverse social, economic and ecological effects in marine and coastal ecosystems, including:

- Reduced resilience and mortality of coral reef, mangrove and other wetland ecosystems
- Changes in fish species distribution, composition, abundance and migration patterns
- Changes in ecological timing of events, such as fish spawning
- Loss of habitat, such as nesting and feeding sites for marine turtles
- Loss of bird roosting and feeding sites, which could impact bird migration patterns
- Introduction of diseases and invasive species

Related social concerns include threatened food security, increased vulnerability to natural disasters, an increase in disease outbreak and a decline in the availability of potable water.

CSRP REGION:

The Sub regional Fishing Commission (CSRP) is an intergovernmental organization created in 1985. The CSRP includes 7 countries (Mauritania, Senegal, The Gambia, Cape Verde, Guinea Bissau, Guinea, and Sierra Leone), which have a combined coastline of 3500 km and a combined Exclusive Economic Zone (EEZ) of 1,500,000 km2. This shared marine ecosystem includes many important habitat types, such as estuaries, mangrove forests, coral reefs, cliffs, and seagrass beds.

The goals of the CSRP include:
- Harmonization of policies concerning marine resource use and conservation in the sub region
- Adoption of a communal strategy for international proceedings
- Cooperation on a sub regional level in matters of environmental surveillance
- Improving the capacity of member nations to conduct research in the fishing sector at a sub regional level

Map of the CSRP sub region

A **key conclusion** of the workshop was the need for proactive adaptation to the negative environmental changes resulting from the combination of climate change and intense anthropogenic pressure without waiting for conclusive data that disentangles the effects of climate change from other factors. Planned adaptation strategies should be based on an examination of current vulnerabilities and possible no-regrets actions (actions that would achieve positive development benefits even without significant climate change).

Common adaptation strategies supported by all participants included increased cooperation and collaboration on climate change projects on national and regional levels, incorporation of climate change adaptation strategies in national policy, and efforts to build awareness and support for climate change measures in local communities.

Lessons Learned from Field Trip

The environmental pressures and climate change concerns described above were displayed in a field trip to the coastal communities of Djifere, Palmarin, and Joal. Participants saw examples of fishing communities severely affected by erosion, major changes to wetlands and coastal waterways, salt water intrusion, and overexploitation of fish stocks. At each site, human pressures have increased the vulnerability of fishing communities and the fishery itself to climate change impacts. In this way, the field visit helped workshop participants visualize first-hand many of the environmental and social concerns related to climate change. Place-based adaptation measures of beach and coastal reforestation, and establishment of Marine Protected Areas were also shown.

Coastal erosion

Significant portions of the coastline in Senegal have been lost to coastal erosion in the past view decades, forcing these communities to retreat or relocate. The causes are both anthropogenic and natural, with human pressures creating conditions for natural storm events and coastal processes to have greater impacts. According to local sources, the coastline has receded 130 meters in the fishing community of Djifère since 1987. Fluctuations in the strength of the Canary Current (which flows along North to South along the west coast of Africa) and the Canary Upwelling were also mentioned.

Mangrove restoration

The site of a mangrove reforestation project supported by the Adaptation to Coastal Climate Change (ACCC) program was visited. This project aims to build local awareness of the importance of mangrove forests and to educate stakeholders on reforestation techniques. The project conducted local training sessions, which included information on the evaluation of potential reforesting sites, proper timing for mangrove planting, and the necessary spacing of mangroves to facilitate the collection of oysters from within mangrove forests.

Severe erosion at fishing village in Palmarin, Senegal

Community–managed MPA

Participants visited the community-managed MPA in Joal. Management strategies in the MPA include a three-kilometer no-fishing zone, followed by an additional five-kilometer zone open only to fisherman using responsible fishing practices, as defined by the community. This area is also a site of heavy coastal erosion, which has resulted in the loss of important bird and turtle nesting grounds (including Africa-Europe-Arctic migratory bird species, West African continental migratory species and non-migration species).

Joal fish landing site

A meeting was held at Joal with the local fishing association and participants toured the fish landing site. Committee members responded to questions concerning their perceptions of climate change, the changes they have seen in the coastal zone and fisheries that they at least partially contribute to climate change, and their views on the role of MPAs.

Fisherman spoke of a noticeable decline in stocks starting in 1981. They also spoke of major changes in the coastline and water level since the 1970s as well as significant fluctuations in water levels in the past 10 years. The overall trend at the landing site is an increase in the size of the beach, as opposed to the decreases in beach size that was seen in other villages along the coast. Fishermen acknowledge the role of MPAs in rebuilding depleted fish stocks, citing differences in catches inside and outside protected zones.

Approximately 60% of all fish in Senegal are landed in the coastal village of Joal. Despite the enormity of the fishing activity in Joal, there is no longer a fish meal or fish processing plant on-site. All catches are shipped to Dakar, approximately 115 kilometers away.

Locals described an enormous increase in fishing efforts in Joal the past few decades. A decade long drought in the 1980s brought many inlanders to the coast, raising the population of Joal from under 10,000 to nearly 40,000 today. Locals claim to have seen a tenfold increase in the number of boats in Joal since the 1970s, due both to an increase in the number of fishermen as well as the number of boats per family (which has risen from an average of one to an average of five).

Fisherman claimed to have first started noticing a decline in stocks in 1981. According to locals, before this period it was possible to fill a boat with fish in the course of the day, without fishing at night. By 1992, fishermen were obligated to stay out for 48 hours to catch the same amount of fish.

Key conclusions

- Many of the environmental problems seen are originally a result of overuse of resources or poor management. They are now being exacerbated by climate change.
- Local community participation and ownership in climate change projects or strategies is critical.
- Local capacity building and sensitization are important and needed.
- Continued research is necessary to quantify the changes seen in coastal and marine environments and to assess the vulnerability of these regions to further changes.
- Resource management and enforcement of regulations is a major area for improvement.

Climate Change and Fisheries

A presentation prepared by Dr. Hanady DIOP from CSRP characterized the artisanal fishery of the sub-region. Key facts include the following:

- Total fishing production in the CSRP sub-region is approximately 1,500,000 tons annually, with slightly under half (700,000) coming from artisanal fishers.
- Around 70 % of catches in the CRSP sub-region are exported, for a total value of 450 million USD in 2004.
- The fishing industry in the CSRP includes around 30,000 pirogues (of which about 50% are motorized) and 700 industrial fishing boats, both national and foreign.
- There has been a continuing decline in the capture of principal species (primarily pelagic fish species) in the CSRP zone starting in 2003.
- Stock analyses have shown that nearly all principal species are either fully exploited or over-exploited.
- There have been major increases in fishing efforts in the past 50 years, including increases in the total number of boats, increases in the number of motorized boats and in the power of motors, and increases in the duration of fishing trips.

Major technical and commercial concerns in the CRSP fishing industry include a lack of appropriate management plans, a lack of enforcement of regulations, illegal and un-declared fishing, an overcapacity of fishing vessels, and an insufficient expertise in quality assurance and product traceability. Additionally, a lack of cooperation and consistency between countries has made international efforts ineffective. The associated environmental problems include an overexploitation of important commercial stocks, and destruction of essential habits and changes to ecosystems. In these already weakened ecosystems, the impacts of climate change (including but not limited to changes in species diversity and abundance, increases in ocean salinity, and coastal erosion) can have devastating effects.

Suggestions for improvement included changes in management techniques and improved implementation, improvements in policy coherence between countries, increases in efforts to minimize illegal fishing, and increases in efforts to strengthen the CSRP as an institution and the cooperation between the CSRP and other organizations.

Country break-out groups worked on climate change and fisheries mainstreaming options and actions at the national level. Groups additionally discussed opportunities for collaboration among stakeholders for funding, research, regulation, planning and implementation to make fishing communities more resilient to climate change. Common suggestions listed by most or all countries included:

- Increases in scientific research to improve the understanding of climate change and its potential consequences
- Improvements in communication and information sharing between governments and other stakeholders to facilitate collaboration and to avoid overlap
- The creation of a sub-regional climate change surveillance system
- The harmonization of legislation on an international level

- The incorporation of climate change in national fisheries policy and strategies

Other suggestions included capacity building on a local level, environmental education projects in schools, and strengthening the network of sub regional MPAs.

Climate Change and MPAs

The importance of MPAs for marine ecosystem conservation and their links to climate change was discussed based on an in depth presentation given by Dr Mallé Diagana, Convention on Biodiversity (CBD) Project Leader. Reasons for creating MPAs listed include:

- Preservation of biodiversity and essential ecological processes
- Increases in fish stock size and renewal rates
- Safeguarding of sites of cultural, historical or religious importance
- Preservation of sites for research, education and recreation
- Protection of the coastline against natural disasters

A study of more than 100 MPAs showed that inside MPAs, population density increased 91% and species diversity was 31% higher. Changes between MPA sites and non-MPA sites were noticeable in as short as 2 years, although ecosystem improvements were dependent on the level of MPA managements and protection. A network of MPAs allows for the inclusion of a larger area with more diverse ecosystems important in the biological cycles of different marine organisms (including feeding, breeding and spawning sites). Additionally, a network of MPAs helps reduce conflicts linked to resource use and facilitates the existence of multiple systems of users. Despite the potential benefits of MPAs, a lack of proper MPA management and assessment has left the actual results of West African MPAs unclear.

Properly managed MPAs can provide many services that can help minimize the negative effects of climate change and to help improve ecosystem resilience. The creation of MPAs and MPA networks can help:

- Contribute to the overall resilience of marine environments
- Minimize other stressors in an ecosystem (which improves its ability to respond and adapt to climate change)
- Provide a solid foundation for ecosystem based adaptation strategies
- Help maintain the biological and ecological connectivity between marine environments
- Help facilitate climate change adaptation by protecting ecologically important habitats
- Protect certain marine habitats that absorb large quantities of carbon dioxide. Coastal habitats (such as marshes, mangroves and sea grass beds) can store up to 71% of the total quantity of carbon found in marine sediments

The need for an increase in the number of MPAs and improvements in their management was emphasized, with a particular focus on the importance of MPAs in improving ecosystem resilience to climate change.

Map of CSRP (excluding Sierra Leone) Marine Reserves, National Parks, Community Marine Protected Areas and Other Marine Protected Areas

Summary of Regional Climate Change Initiatives with Coastal and Fisheries Focus

Representative of multi-country climate change initiatives with a coastal and marine focus in the CSRP region made presentations and they were discussed by Workshop participants. These initiatives include, but are not limited to:

1) The Adaptation to Coastal Climate Change (ACCC) Project

The ACCC project is funded by the Global Environment Facility (GEF) and implemented by the United Nations Development Program (UNDP) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) of the Intergovernmental Oceanographic Commission (IOC). The four year effort is being implemented in five West African countries (Cape Verde, Gambia, Guinea Bissau, Mauritania and Senegal) and ends in 2011.

This main objective of this project is to implement measures to strengthen the resilience of vulnerable communities to the impacts of climate change. Project goals include:

- Identification of pilot protection and adaptation actions in hot spots vulnerable to erosion and climate changes
- Implementation of pilot protection and adaptation actions within the framework of integrated coastal area management (e.g.: protection of mangroves, reinforcement of sand dunes, urban planning, and strengthening legislation)
- Formulation of national and regional strategies of coastal adaptation to combat erosion, extraction of sand, and destruction of mangroves

The project is also concerned with understanding the causes of coastal change, socio-economic and environmental impacts, existing legislation, and previous experience of adaptation to climate change and coastal erosion.

The ACCC Project website: http://www.accc-afr.net/

2.) Canary Current Large Marine Ecosystem (CCLME) Project

The CCLME Project is a GEF funded project executed by the United Nations Environmental Program (UNEP) and the Food and Agriculture Organization of the United Nations (FAO). It works with the seven West African countries most dependent on the Canary Current Large marine Ecosystem, including Morocco, Mauritania, Senegal, The Gambia, Guinea Bissau, Guinea, and Cape Verde.

The stated objective of this project is to "reverse the degradation of the Canary Current Large Marine Ecosystem caused by over-fishing, habitat modification and changes in water quality by adoption of an ecosystem approach." Key project goals include:

- Multi-country agreement on priority transboundary issues, and governance reforms and investments to address priority transboundary issues
- Support a sustainable legal/institutional framework for the CCLME
- Strengthened transboundary institutions, regional policies and instruments
- Enhanced stakeholder involvement in transboundary marine priority setting and strategic planning, including 7 functioning National Inter-Ministry Committees
- Improved knowledge and capacity to address transboundary issues
- Demonstrated management actions addressing priority transboundary concerns

The CCLME Project is a five-year initiative beginning in April 2010. The initiative is forming a Climate Change Working Group, with a first meeting planned for May/June 2011.

The CCLME Project website: http://www.canarycurrent.org/

3) Adaptation Fund

The Adaptation Fund is a financing mechanism created under the Kyoto Protocol to assist developing country Parties to the UN Framework Convention on Climate Change (UNFCCC) that are particularly vulnerable to the adverse effects of climate change in meeting the costs of adaptation, and to finance concrete adaptation efforts that are country driven. The priorities of the Adaptation Fund include:

- Supporting adaptation priorities determined by and within developing countries
- Supporting consistency across national development, poverty reduction and climate change strategies
- Ensuring special attention to the particular needs of the most vulnerable communities

The Centre de Suivi Ecologique (CSE) in Senegal has been accredited as an Adaptation Fund implementation agency. This means that the CSE has the authority to submit proposed adaptation projects directly to the Adaptation Fund Board and to receive and distribute funds directly from it.

The Adaptation Fund website: http://www.adaptation-fund.org/

4) Gambia-Senegal Sustainable Fisheries Project (Ba Nafaa)

The Ba Nafaa projectis a five-year regional initiative supported by the U.S. Agency for International Development (USAID)/West Africa Regional Mission. The Ba Nafaa Project is implemented by the Coastal Resources Center, University of Rhode Island and the WWF-WAMER. The goal is to promote sustainable fisheries management including the shared marine and coastal resources between The Gambia and Senegal. As a regional initiative, the project also supports cooperation, sharing of best practices and learning across the CSRP region, including the regional workshop on climate change, fisheries and MPAs that is the subject of this Proceedings Report.

Goals of the Project are to:

- Contribute to government objectives of sustained and increased social and economic benefits for artisanal fishing communities including food security, and increased income and employment.
- Strength institutional capacity at all levels of governance to implement a fisheries co-management approach
- Reduce unsustainable and destructive marine resource use practices, including bycatch of marine turtles and juvenile fishes
- Protect key habitats and marine areas important in the life stages of commercially important fish as well as threatened and protected species of marine turtles and mammals

Ba Nafaa project web page: http://www.crc.uri.edu/index.php?projectid=108

Principal Findings and Outcomes from the Workshop

Break-out groups worked on regional action on climate change priority actions with respect to fisheries and MPAs. Groups were asked to discuss:

1) What they would like to see funded in their country between the different departments (fisheries, park, and environment) related to climate change adaptation over the next three years
2) What they would like to see happen in the sub region that would serve them practically

The **first group** (composed of Mauritania and Senegal) listed the fight against poverty, the preservation of ecosystems, and the promotion of sustainable fishing strategies as the main areas for action. Proposed activities in the fight against poverty and the promotion of sustainable fishing management strategies included improved management of fishing effort, an evaluation of stocks and other ecological indicators, a training session on fishing regulations and responsible fishing techniques, and promotion of participatory fisheries governance plans. Proposed activities for the preservation of ecosystems included an increase in ecological research, habitat restoration, an improvement in the MPA network and the creation of new MPAs.

The **second group** (composed of Guinea Bissau and Guinea Conakry) listed the main issues that need to be addressed as overfishing and other anthropogenic stressors, a lack of information and documentation on the current and potential future consequences of climate change on fisheries and MPAs, sedimentation in estuaries and other dangers for important breeding and feeding grounds for marine species, a lack of synergy between institutions, and a lack of sustainable financing for projects. Priority activities included support for research (including the distribution of currently available information), improvement and extension of the MPA network, and the incorporation of climate change adaptation into current policy and regulations.

The **third group** (composed of Cape Verde, the Gambia, and Sierra Leone) listed a lack of governance as the main sub-regional concern, and they proposed three activities to approach this issue. First, they emphasized the need for communication and an exchange of information

between stakeholders. Next, they stated that regional and local key issues must to be better researched and understood. Lastly, they proposed that efforts be made to build local support for climate change adaptation strategies. Specific suggestions included the creation of a region wide marine climate change observatory initiative. They also proposed training and capacity building sessions for local communities and institutions.

Looking for commonalities across the Group findings, Workshop participants together came to an agreement on what they saw as priority regional action on climate change with respect to fisheries and MPAs. This included:

- Promotion of training, capacity building and outreach efforts
- Mainstreaming climate change considerations and adaptation strategies into fisheries and MPA policies and management plans
- Collaboration and information sharing between institutions
- Improved understanding and data on coastal and marine climate change impacts, and the development of a regional observation system
- Improvement and extension of MPA networks
- Protection and rehabilitation of mangroves and other critical habitat
- Support for poverty alleviation and livelihood diversification activities

The "implementation gap" was considered one of the main hurdles for regional action in West Africa, and the need for realistic and practical approaches to these problems was emphasized.

A process was agreed to for advancing these ideas to a further level of detail and for creating a proposal for a regional-scale climate change adaptation activity that could be submitted for funding to a donor organization, such as the Adaptation Fund. The process has the following steps and components:

1) Creation of a small working group to prepare a draft project description. It was agreed that the group should be comprised of volunteer experts from the CSRP countries as well as experts from the Centre de Suivi Ecologique (CSE), Coastal Resources Center (CRC)/University of Rhode Island, Wetlands International (WI), the West African Network of Marine Protected Areas (RAMPAO), and the World Wildlife Fund-WAMER

   Workshop country participants expressing willingness to assist in this step included:

   Sonia Elsy Mérino (Cape Verde), Kolleh Bangura (Sierra Leone), Famara Drammeh (The Gambia), Mamadou Bhoye Sow (Guinea Conakry), Eliman Ba (Senegal), Aminata Correra (Mauritania) and Inluta Incom (Guinea Bissau)

2) Share project draft more widely for feedback comments and reactions from all countries
3) Revision of project draft based on feedback
4) Second Regional Workshop to discuss and finalize project description and potential funding mechanisms
5) Submission of project proposal to Adaptation Fund and/or other donors

6) If awarded a grant, establishment of a Steering Committee for project oversight, comprised of country representatives, CSE, URI, WI, CSRP (Sub-regional Fishing Commission), and WWF
7) Project implementation by national teams, with technical support where requested from CSE, URI, WI, RAMPAO and WWF

This workshop provided an opportunity for organizations and government agencies across the CSRP West Africa sub-region to come together to discuss climate change concerns in marine environments, to exchange information, and to identify region-wide needs. The Second Regional Workshop, tentatively planned for early 2012 will bring these actors back together a second time with the goal of developing more concrete plans to address these issues. The specific goal of this second workshop will be to advance the aforementioned project, whose development and implementation will be a major step toward the overall goal of region-wide collaboration and action on issues of climate change, marine ecosystems and fishing communities in West Africa.

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Appendix 2

Summary of Country Contexts

In terms of

Climate Change, Fisheries and MPAs

MAURITANIA

At stake:

The fishing industry:

- Accounts for around 50% of the total revenue from foreign economies
- Provides more than 25% of the national budget
- Provides 6-10 % of GDP
- Includes around 30,000 jobs (36 % of the total number of jobs)

Climate Change Concerns and Predicted Impacts:

Key concerns listed in the National Adaptation Plan of Action include:

- Decrease in available water resources
- Degradation of pasture lands and loss of livestock
- Degradation and disappearance of forests
- Serious degradation of agricultural land
- Elevated risk of a rupture in the littoral dunes

Coastal zone vulnerability:

- Sea level rise: exposure of large areas and infrastructure, with risks of serious flooding
- Threats to national economic growth due to the fact that the littoral zone is a principal area of national development
- Increase in the rate of coastal erosion, notably on the littoral zone of Nouakchott where large morphological changes can already be seen
- Threats to biological diversity (risk of flooding on the islands of the National Park of Banc D'Arguin)

Legal and Institutional Background:

- United Nations Framework Convention on Climate Change (UNFCCC) and the Strategic Framework in the Fight against Poverty 2011-2015 were ratified
    - Designated authority for the UNFCCC adaptation Fund: Minister of State, next to the Prime Minister of the Environment and Sustainable Development
- Two National Communications to the UNFCCC were completed in 2001 and 2008
- The NAPA was completed in 2004
- The National Plan of Action for the Environment was completed in 2006

Adaptation Strategies and Activities:

Coastal zone adaptation projects include:

- Preservation of Nouakchott's coastline natural defenses (dunes)
- Establishment of an observation system to increase safety of the sectors of the city built in zones vulnerable to flooding
- Protection and restoration of mangroves in Diawling National Park

SENEGAL

At Stake:

- Marine fisheries harvested along the coast of Senegal play a critical role in food security, livelihoods, local and national economic growth and well being
- The fishing industry provides an estimated direct and indirect employment of 600,000 people—17 percent of the total labor force
- Coastal populations, infrastructure and ecologically important wetlands at risk of loss due to sea level rise, erosion, salinization and salt water intrusion

Climate Change Concerns and Predicted Impacts:

- Wetland degradation and mangrove mortality
- Salinization of soil and freshwater sources
- Irregularities in rainfall, causing floods or droughts
- Coastal erosion
- Desertification and advancing dunes
- Changes in upwelling patterns

Predictions for the future of the fishing industry as a result of anthropogenic stressors and climate change:

- A global decline in catches and their estimated commercial value starting in 2030
- A cumulative loss between 2020 and 2050 of 68 billion FCFA, or 3.23% of the average GDP in the period from 1981-2005
- Reduced public heath associated with a drop in the consumption of marine products and therefore in consumption of animal protein
- A drop in the profitability of the artisanal fishery

Legal and Institutional Background:

- NAPA completed in 2006 with Environmental Agency the delegated implementing authority
- Two National Communications in 1997 and 2010

Current Adaptation Strategies and Activities:

- Increase in the number and size of MPAs and improvements in their management
- Establishment of an early warning system
- Fisheries co-management and sustainable fishing practices
- Use of energy sources that emit less carbon dioxide
- Protection of the littoral zone (including fishing)
- Public awareness and education

CAPE VERDE

At Stake:

- Significant marine and terrestrial biodiversity
- Artisanal fisheries, which provide 5,000 direct and 25,000 indirect jobs
- Physical phenomena that contribute to the productivity of marine ecosystems, including:
    - Canary Current, Equatorial counter-current and North Equatorial Current
    - Local upwellings (island effect and current induced)

Climate Change Concerns and Predicted Impacts:

- Coastal erosion and degradation
- Salinization and salt intrusion in water wells
- Flooding of low-lying coastal areas
- Air and sea temperature increases
- Changes in upwelling patterns

Legal and Institutional Background:

- The designated authority for the UNFCCC is an Inter-ministerial Authority (2009)
- CCC focal point: INMG, with the DGA sharing climate change responsibilities
- First National Communication completed in 2000, Second National Communication almost complete
- ENPACCC, Mar. 2000
- First NAPA prepared in 2005 with priorities of water resources, agro-husbandry, coastal zones, and tourism

Current Adaptation Strategies and Activities:

NAPA (2005) coastal priorities and strategies include:

- Rehabilitate coastal ecosystems and build structures to protect coastal zones
- Support alternative economic activities among the users of artisanal fisheries
- Improve MPA management
- Promote key marine species research
- Support the modernization of artisanal fisheries

Specific research efforts and field activities:

- NMG/INDP – climate monitoring and atmospheric research - TENATSO/EUROSITE
- Implementing country of Adaptation to Coastal Climate Change (ACCC) regional project with national focus on shoreline fortification through dune fixation
- APPECCAO project with objectives to support the improvement of fisheries practices and policies to increase the adaptive capacity of the fisheries sector and to mainstream climate change strategies in fisheries policy
- GEF Climate Change Adaptation project with a focus on hydraulic resources

THE GAMBIA

At Stake:

- The fishing and tourism industries play a large role in the national economy
- The greater part of the city of Banjul is less than 1m above sea level- with a 1m sea level rise, the vast majority of the city would be lost
- A sea level rise would also lead to loss of important cultural sites, infrastructure and feeding and nesting grounds for turtles and migratory birds

Climate Change Concerns and Predicted Impacts:

- Destruction of fisheries infrastructure (landing sites and structures, fishing pier) from the sea level rise and erosion of coastal lands
- Loss of oyster, fish breeding and nursing grounds from mangrove degradation
- Reduction of fish catch due to changes in ocean circulation, temperature, acidity, etc
- Loss of freshwater resources due to saline intrusion and reduced precipitation
- Decreased tourism activity, revenues and profitability
- Severe infrastructure loss (especially in the capital city) and relocation of populations
- Inundation of critical flood plains

Legal and Institutional Background:

- UNFCCC signed and the Department of Water Resources is the designated UNFCCC Focal Institution
- First National Communication was completed in 2003 and the Second National Communication is currently being finalized
- NAPA completed in 2007
- National Climate Committee created

Current Adaptation Strategies and Activities:

- Improvements in education and communication
- Improvements in fisheries co-management, including management planning, closed oyster harvesting season, and improved fisheries research and data collection
- Implementing country of Adaptation to Coastal Climate Change (ACCC) regional project, and the regional COAST project
- Creation of protected areas and forest reserves in the coastal zone
- Collection of information and data on climate change parameters
- Increases in community forestry and the creation of a riparian vegetation belt
- Control of sand mining and increases in beach nourishment
- Rehabilitation of protected wetland areas

GUINEA BISSAU

At Stake:

- Guinea Bissau has a considerable coastal zone with large expanses of lowlands which would be very vulnerable to rising sea levels
- The fishing industry plays a large role in the national economy

Climate Change Concerns and Predicted Impacts:

- Erosion
- Floods
- Salinization
- Changes in the timing and quantity of precipitation
- Changes in the salinity and the temperature of surface waters
- Changes in phenology (the timing of biological events)
- Changes in the abundance and distribution of species
- Introduction of invasive species and diseases
- Reduced mixing of the water column and anoxia
- Ocean acidification
- Changes in oceanic currents and upwellings

Legal and Institutional Background:

- First National Communication to the UNFCCC and the NAPA were completed in 2006
- The Second National Communication is under review
- At the national level, the designated authority for the UNFCCC Adaptation Funds is the National Program on Climate Change in the office of the General Direction of the Environment

Current Adaptation Strategies and Activities:

- The 2006 NAPA recommendations related to fisheries and Marine Protected Areas include the development of a Integrated Coastal Resource Management Program and a Coastal Action Plan, with the goals of:
    - Rehabilitating maritime ecosystems, beaches and other littoral zones
    - Controlling urbanization and constructing maritime passages
    - Improving research devoted to marine resources
    - Developing small scale mariculture
- Actions underway related to fisheries and marine ecosystems:
    - Specific research activities, changes in policy, field work and field activities, and education and awareness building
    - Introduction of new policies in the fishing and maritime economy sectors that allows for the incorporation of climate change adaptation measures (policy mainstreaming)
    - Introduction of environmental education into the national education system

GUINEA

At Stake:

Fishing industry:

- Annual fish consumption in Guinea is about 13kg per person per year
- Source of many jobs, and supports more than 8000 households
- Contributed $5 million to the National Treasury in 2004 (2.5% of the National Budget)

Climate Change Concerns and Predicted Impacts:

Impacts already being observed:

- Decrease in the amount of rainfall and reoccurring droughts since the 1970s
- Drying of rivers, other water sources and soils
- Declines in agricultural production
- Shortage of potable water supplies
- Early and frequent flooding in certain regions (notably in Kankanin 2001, Boke in 2003, and Gaoual in 2005)
- Spreading of waterborne diseases

Potential ecological and environmental consequences of temperature increase and sea level rise:

- Submersion of low-lying areas along the coast
- Changes in types of vegetation
- Destruction of the mangrove in certain areas
- Migration and disappearance of certain animal species
- Soil salinization and a resulting loss of cultivated land

Legal and Institutional Background:

- A National Advisory Committee for the Environment was established
- Policy letters were adopted on the development of agriculture, the development of livestock farming, the development of fisheries and aquaculture, and forestry
- A National Action Plan for the Environment (NAP) was developed
- A NAPA was formulated

Current Adaptation Strategies and Activities:

- Protection and restoration of fragile ecosystems
- Creation of protected areas
- Promotion of appropriate technologies in terms of adaptation
- Promotion of alternative revenue generating activities
- Promotion of traditional knowledge
- Promotion of improved information, communication and environmental education
- Protection of spawning grounds
- Promotion of fire management and the fire defenses

SIERRA LEONE

At Stake:

Vulnerable environments:

- Coastal environments: 350 km of coastline with 144 km of beaches and 6km of cliffs
- Estuarine environments: 4 major estuaries all lined with mud flats and mangroves, managed by Forestry, Ministry of Fisheries and Marine Resources, and Local Councils
- River systems: both the Sierra Leone River and the Aberdeen Creek are Ramsar Sites

Social concerns:

- 3.5 million people (out of a total population of 6 million) live along the coast line with a population growth of 2.4 - 2.6% per annum, one of the highest in the world
- Vulnerable mangrove environments support the livelihood of rice farmers and fishermen
- The fishing industry a plays a major role in national economy

Climate Change Concerns and Predicted Impacts:

- Increase in frequency of extreme weather events, including severe storms, droughts and floods
- Increase in occurrence of water-borne diseases such as cholera and typhoid
- Damage of fragile economic structures (including fish landing sites, jetties, houses) from floods and coastal erosion
- Salt water intrusion in estuaries, freshwater systems, and soils, affecting freshwater fisheries and agriculture

Legal and Institutional Background:

- The First and Second National Communications completed in 2006 and 2011
- NAPA completed in 2008 - identifies priorities and adaptation options to cope with climate change impacts
- EPA (established in 2008) coordinates and monitors the implementation of all environmental policies, programs and projects and is responsible for enforcement and compliance to promote sustainable environmental development
- The relevant sectors are responsible for mainstreaming climate change into sectoral policies and activities

Current Adaptation Strategies and Activities:

- Protected area network for biodiversity conservation and carbon sequestration
- Regional coastal and marine conservation program (PRCM)
- Institutional support to transboundary fisheries management research
- Coastal erosion, early warning development project
- Proposed strategies and needs: sustainable management of coastal estuaries, coastal erosion control, environmental education and public awareness program