Climate Change and Fisheries

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Why Care about Fish?

• Provides 15% of the average per capita animal protein intake for 3 billion people

• West Africa: over 30% of average daily animal protein consumption in the region (Neiland, 2006)

• Most dependent countries (Anon 2000):
  – 46% Senegal,
  – 62% Gambia,
  – 63% Sierra Leone and Ghana
Why Care about Fish?

• 520 million people depend on the fisheries and aquaculture sectors for their livelihoods, 30-45 million in Africa

• West Africa:
  
  – Fish exports contribute on average 27.8% to total agricultural exports (Neilland, 2006)

  – Women dominate processing, retailing and local trading
Why Care about Fish?

<table>
<thead>
<tr>
<th></th>
<th>Employment (fishers)</th>
<th>Value of Production (million$/yr)</th>
<th>Value of potential Production (million$/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Basins</td>
<td>25 500</td>
<td>17</td>
<td>62</td>
</tr>
<tr>
<td>Senegal-Gambia</td>
<td>7 000</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Volta (rivers)</td>
<td>64 700</td>
<td>95</td>
<td>82</td>
</tr>
<tr>
<td>Chad (rivers)</td>
<td>6 800</td>
<td>18</td>
<td>72</td>
</tr>
<tr>
<td>Congo-Zaire</td>
<td>62 000</td>
<td>48</td>
<td>208</td>
</tr>
<tr>
<td>Atlantic coastal</td>
<td>6 000</td>
<td>47</td>
<td>179</td>
</tr>
<tr>
<td><strong>Major Lakes</strong></td>
<td><strong>227 000</strong></td>
<td><strong>295</strong></td>
<td><strong>749</strong></td>
</tr>
</tbody>
</table>

Bene & Nieland 2003
Changes in Distribution: Sardinella

Acoustic biomass *S. aurita* by country: contribution by each country to regional total (percentages). Shift towards Morocco in warm years 2000–2004 (Zeeberg et al 2008)
Flood and Fish Catches: Niger River Delta

Early stage of the fishing campaign (Dec. to early of March)

Final stage of the fishing campaign (end of March to July)

Morand & Kodio, 2004 courtesy of CP72 project
Climate Variability and Change Impact Pathways

Effects on:
- Production
- Ecology
- Fishing & Aquaculture operations
- Communities
- Livelihoods
- Wider society & Economy

Impacts on:
- Species composition
- Production & yield
- Distribution
- Diseases
- Coral bleaching
- Calcification
- Safety & efficiency
- Infrastructures
- Loss/damage to assets
- Risk to health & life
- Displacement & conflict
- Adaptation & Mitigation costs
- Market impacts
- Water allocation

CLIMATE
- Ocean currents
- ENSO
- Sea level rise
- Rainfall
- River flows
- Lake levels
- Thermal structure
- Storm Severity
- Storm frequency
- Acidification

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WorldFish & Climate Change

• Diagnosing climate change vulnerability
  – Impacts
  – Vulnerability assessment at different scales

• Understanding current coping mechanism and adaptation responses
  – Climate variability (droughts and floods)
  – Local Knowledge and modeling

• Building the capacity to respond and adapt at different scales
  – Technological innovation/aquaculture
  – Adaptive management
  – High level policy involvement
Theme 1: Diagnosis
Vulnerability

‘the degree to which a system is susceptible to climate change, and is unable to cope with the negative effects of climate change’ (IPCC, 2007)
**Vulnerability of national economies**

**EXPOSURE**
Nature and degree to which countries are exposed to predicted climate change

**SENSITIVITY**
Degree to which economies & people are likely to be affected by fishery-related changes

**POTENTIAL IMPACTS**
All impacts that may occur without taking into account planned adaptation

**ADAPTIVE CAPACITY**
Abilities and resources to cope with climate-related changes

**VULNERABILITY**

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Components of vulnerability

Exposure
• 2050 surface temperatures (HadCM3 model, 2 scenarios)

Sensitivity (Fisheries dependency – marine and inland)
• Landings and contribution of fisheries to employment, exports and dietary protein (FAO, World Bank)

Adaptive capacity
• Human development indices (health, education, governance, and economy size)

Vulnerability
• 132 nations
• Robust to different methods of weighting and combination

See Allison et al. (2009) Fish and Fisheries
Africa: 2/3 of most vulnerable countries
Very low adaptive capacity. High nutritional dependence
Marine and inland production closely related to climatic variation
Limitations of the study

1. Present day vulnerability to future climate change

2. Surface temperature as a proxy & pathways in ecosystems not addressed

3. Adaptive capacity indicator not enough fisheries oriented

Quest_Fish Project
Case studies:

- Humboldt Current (Peru)
- South China Sea (Indonesia, Malaysia, Vietnam)
- Canary and Guinea Current (Mauritania, Senegal, Ghana)
• Developing scenarios for 2050 in order to understand the major drivers of change in fisheries production systems in the context of climate change

• Develop indicators of ‘future vulnerability” in Mauritania, Senegal and Ghana (national scale)

• Tool to promote planned adaptation at the national and regional level

• Involvement of experts and NARs
Research Challenges

• Currently no downscaling of GCM for Guinea Current

• Similar work should be done for inland fisheries but there is a lack of data

• No hydro-climate data => no fisheries model => lack of understanding of ecosystem dynamics and impacts on livelihoods

• One solution indigenous knowledge but not sufficient for climate change predictions
Theme 2: Adaptation to Current Climate Variability
Adaptation to Climate Variability

• Understanding what are the factors that build resilient fisherfolk communities => Challenge Program project in the Niger River Basin => more research is needed in WA

• At the individual and household level:
  – Prey switching
  – Migration
  – Diversification outside the fisheries sector

But can these be sustained in the future?
Theme 3: Mitigation and Adaptation to Future Climate Change
Adaptation to future climate change: ideas....

• Issue of scale
• Planned or autonomous adaptation?
• What role for aquaculture and Integrated Aqua. Agri.?
• Interactions with other sectors (water management)

• Public Private Partnerships:
  – Microfinance
  – Eco labeling; food miles....
Mitigation: ideas...

- Species richness of estuary and mangrove areas (Baran, 2000)
- Deforestation: Smoked fish trade and household energy consumption, illegal logging
• Africa is the only continent where fish supply per person is declining (Delgado et al 2003)

• The impacts of climate change on Africa will be severe (IPCC 2007)

Action is needed

Thank You! Merci! m.badjeck@cgiar.org