Marine Resource Governance in the Eastern Caribbean (MarGov Project)

CERMES MarGov Project Document 12

Report of the Fishers Forum: "Climate change and small-scale fisheries in the Caribbean" at the 61st Gulf and Caribbean Fisheries Institute (GCFI), Gosier, Guadeloupe 10-14 November 2008

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CRDI Centre de recherches pour le développement international

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Contents

Acknowledgements ii

1. Background 1

2. Objectives and arrangements 1

3. Fishers Forum 2

3.1 PRESENTATIONS 2
3.2 DISCUSSION 6

4. Fishers Forum field trip 7

5. Conclusion 7

6. Appendices 8

APPENDIX 1: FISHERS FORUM AGENDA 8
APPENDIX 2: FORUM INTRODUCTION BY P. MCCONNEY 9
APPENDIX 3: KEYNOTE PRESENTATION BY L. NURSE 9
APPENDIX 4: RESEARCH PRESENTATION BY P. JAMES 13
APPENDIX 5: FISHERS FORUM PHOTOGRAPHS 16
APPENDIX 6: FORUM FIELD TRIP PRESENTATION 17

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Acknowledgements

The Board and Program Committee of the GCFI made it possible to hold the Forum as a session in the main programme with simultaneous translation (English, French, Spanish), elevating it from being a side session as it was in 2007, and providing all facilities and equipment.

Travel sponsorship for the fisher leaders of the session (Anderson Kinch and Mitchell Lay), and the research presenter (Philmore James) came from the International Union for Conservation of Nature (IUCN) through a small research grant on the interactions between climate change and small- scale fisheries in the eastern Caribbean. The grant was awarded to the Centre for Resource Management and Environmental Studies (CERMES) at the University of the West Indies (UWI) Cave Hill Campus in Barbados as a pre-programme activity of the IUCN Caribbean Initiative.

Travel sponsorship for the keynote presenter and research co-supervisor (Leonard Nurse) was provided through a grant for policy research on Sustainable Aquatic Resource Management (SARM) awarded to CERMES by the International Institute for Sustainable Development (IISD) of Canada.

Travel and research supervision by Patrick McConney was with the aid of a grant from the International Development Research Centre (IDRC), Ottawa, Canada. The Forum was arranged in part under the auspices of the IDRC-funded Marine Resource Governance in the eastern Caribbean (MarGov) project being executed by CERMES. MarGov private sector sponsors Sol and Island Heritage contributed to the communication aspects of the Forum.

The Forum field trip was arranged and fully sponsored by local fisherfolk especially due to the efforts of Nicolas Diaz, Secrétaire Général, Comité Régional des Pêches Maritimes et des Elevages Marins de Guadeloupe.

1. Background

From its inception, the Gulf and Caribbean Fisheries Institute (GCFI) has addressed issues of concern to fishers and others along the fish chain from harvest to postharvest, to fisheries scientists and to fisheries managers. The scope includes the recreational and commercial large and small-scale fisheries of the Wider Caribbean. Over time the focus also changed from development to management and conservation. Allied topics such as aquaculture and marine protected areas (MPAs) were added to the programme (go to www.gcfi.org). Emerging topics such as climate change are also increasingly being addressed at GCFI. The annual meeting of the GCFI is the leading forum at which fishers, managers, researchers, students and others interested in Caribbean fisheries and related matters regularly exchange ideas or information.

Over the past two decades the proportion of fisher participants at GCFI declined for a while as practically-oriented presentations, workshops and field trips gave way to academically-oriented science. Now the trend is for increasing fisher participation as the importance of resource users is appreciated in science and management. A reflection of this recognition has been the establishment of a Fishers Forum, and a field trip designed specifically for fishers, as parts of the GCFI annual meeting since 2007.

One of the points raised by fishers attending the 60th annual meeting of the GCFI in 2007 was that they heard about climate change generally, and about impacts on coral reefs, but little about how it may impact specifically upon the livelihoods associated with small-scale fishing. These include fishing, fish processing, trade and fisheries technical support services. Although much research by universities, intergovernmental organizations and non-governmental organizations is in progress, there has not been much aimed specifically at small-scale fisheries (SSF). The opportunity exists now to integrate SSF into the work of the University of the West Indies (UWI), Caribbean Community Climate Change Centre (CCCCC), Caribbean Natural Resources Institute (CANARI), International Union for Conservation of Nature (IUCN) and others, both in terms of doing research on impacts, but ultimately also in civil society mobilization for adaptation.

The Centre for Resource Management and Environmental Studies (CERMES) at the UWI Cave Hill Campus in Barbados thought it was appropriate to feedback a research response to the forum in which the points were raised and to stimulate the diverse audience at GCFI meetings to follow-up with further action. CERMES partnered with the IUCN to provide supervision and a research grant respectively for a MSc student to undertake research related to the topic of interest to fishers. The small project was titled "Impacts of climate change on small-scale fisheries in the eastern Caribbean". The 2008 GCFI Fishers Forum was organised mainly around providing feedback on the research in progress by the student and ongoing research on broader international and regional aspects of climate change being undertaken at CERMES and elsewhere. The aim was to facilitate development of practical research recommendations to IUCN for consideration as part of its new Caribbean Initiative. The Fishers Forum was also set in the context of fishers becoming more organised to have a greater say in fisheries policy, governance and management regionally. Hence it was arranged as part of CERMES projects on Marine Resource Governance in the Eastern Caribbean (MarGov) and on Sustainable Aquatic Resource Management (SARM).

The remaining sections of this report on the Fishers Forum, meant for general audiences, briefly describe the objectives and main actors, then summarise the proceedings of Forum and field trip. Appendices provide more detail on the agenda, presentations, places visited and participant interactions. The two oral presentations will be published in the GCFI Proceedings, and reports of the graduate research and final report to IUCN will be placed on the CERMES web site in due course.

2. Objectives and arrangements

The Fishers Forum was designed partly to fulfil the first aim of the IUCN-funded project. The aims were:

1. Provide participants, and especially fishers, at the 61st GCFI meeting in November 2008 with information on the impacts of climate change on small-scale fisheries in the eastern Caribbean in such a way as to stimulate follow-up research and action
2. Initiate a process of enabling fisher folk to interact with scientists and managers so as to reduce vulnerability to climate change and increase options for adaptation
3. Build capacity for the integration of fisheries and climate change research through the graduate studies of one of the sub-region's most experienced fisheries officers
4. Strengthen the interdisciplinary interactions within CERMES by collaboration across two major teaching and research streams offered in MSc specialization
5. Provide advice to IUCN and its members and partners in the region on opportunities for future work on issues related to the impacts of climate change on small-scale fisheries in the eastern Caribbean
6. Identify possible projects and activities for eventual implementation by UWI and other agencies, with IUCN support as appropriate

The project cut across several of the global and regional thematic priority areas outlined in the draft of the IUCN Caribbean Programme 2009-2012. In particular it related to issues of climate, poverty, livelihoods, governance and biodiversity conservation, all of which are of interest to IUCN.

The core team that assisted in organising the Forum were:

- Patrick McConney, CERMES, UWI, Barbados
- Leonard Nurse, CERMES, UWI, Barbados
- Philmore James, CERMES, UWI, Barbados
- Anderson Kinch, fishing industry, Barbados
- Mitchell Lay, regional fisherfolk leader, Antigua
- Brian Davy, IISD senior research fellow, Canada

Team members had multiple credentials and roles. For example, Philmore James is also a senior fisheirs officer in Antigua and Barbuda, and Anderson Kinch is on the GCFI board of directors. Mitchell Lay leads the coordinating unit for the Caribbean Network of Fisherfolk Organisations (CNFO). Leonard Nurse is a member of the Intergovernmental Panel on Climate Change (IPCC) All attended the forum.

The Forum field trip was arranged mainly by Nicolas Diaz, Secrétaire Général, Comité Régional des Pêches Maritimes et des Elevages Marins de Guadeloupe.

3. Fishers Forum

3.1 Presentations

The agenda (Appendix 1) was shown in the introduction given by Patrick McConney (Appendix 2), after which Anderson Kinch delivered opening remarks. Despite the delay in getting to this agenda item in the day's programme the room remained full. There were fewer fishers attending GCFI than in 2007, but at least half dozen commercial fishers were among those participating. Most other participants were NGO personnel, fisheries managers and fisheries scientists, listed in increasing order.

Leonard Nurse delivered the keynote presentation on *Incorporating Climate Change Projections into Caribbean Fisheries Management* (Appendix 3). The abstract from the draft paper is in the box below.

Abstract

Concerns over the socio-economic impacts of observed and projected changes of climate have been high on the research agendas of scientists the last several decades. According to the Intergovernmental Panel on Climate Change, the recent observed warming is largely human-induced, and the trend will continue at least into the next century owing to 'thermal inertia', directly related to the concentration of greenhouse gases already emitted to the atmosphere (IPCC, 2001, 2007). While there is a dearth of research on the specific effects of climate change on commercial and artisanal fisheries in the Caribbean, valuable insights can be gleaned from observations and projections in other jurisdictions. In contrast with some projections in middle and higher latitudes, the consequences of climate change on Caribbean fisheries are expected to be mostly negative. Adverse impacts on regional fisheries are likely to manifest themselves through habitat alteration and loss, reduced abundance and diversity, and possibly shifts in

distribution induced by changes in ocean currents. In light of these projections, stakeholders in the regional fishing industry might wish to give greater credence to the challenges posed by climate change and climate variability than currently appears to be the case. Appropriate response strategies may not require radical changes in current approaches to management, but rather more effective implementation of existing and proposed arrangements.

Source: Nurse, L. in press. *Incorporating Climate Change Projections into Caribbean Fisheries Management.* Proceedings of the 61st GCFI

Among the topics addressed in the presentation were the following:

- The global context linking climate change and fisheries: what do we know?
- What are the key climate change projections of relevance to the Caribbean fisheries sector?
- Vulnerability of Caribbean small-scale fisheries to climate change
- How may the Caribbean fisheries sector respond to climate change?

The penultimate topic above— vulnerability—is of special interest, and the following points were made:

*There is universal agreement that the vulnerability of any sector to climate change is a function of (a) the degree of exposure to the threat (b) the sector's sensitivity to the risk and (c) the capacity of the sector to cope with or adapt to the threat...Any objective assessment of small-scale fisheries in the Caribbean's would conclude that exposure and sensitivity to the climate change threat are **high**, while adaptive capacity is **low**… Among the reasons for this conclusion are:*

- *Observed and projected negative impacts (direct and indirect) on the sector, e.g. through habitat and ecosystem damage, e.g. bleaching of corals, additional stress on mangroves and seagrasses;*
- *Linkage between ocean warming as a triggering mechanism in the proliferation of harmful algal blooms and various diseases;*
- *Dependence of fisher folk on sector for employment, revenue generation and human well-being;*
- *In the Caribbean many fisher folk tend to reside in vulnerable, low-lying coastal areas which exposes their physical assets (e.g. boats, gear, homes) to climate-related events such as hurricanes, storm surge and sea-level rise;*
- *While the sector has demonstrated considerable resilience to climate variability in the past, factors such as lack of consistent governmental, access to capital on reasonable terms, weak fisher folk organizations and consequently low bargaining power will compromise adaptation capacity in the future;*
- *Lack of insurance and other institutional support to enable the sector to rebound in the aftermath of extreme events, which are projected to become more frequent and/or intense in the future*.

Participants received what Nurse termed a sample of key research questions that readily came to mind:

- *How will changing temperature, wind, salinity and circulation regimes affect the spatial and temporal abundance and migration patterns of commercially important species?*
- *What is the level of understanding of the population dynamics and seasonal availability of non-exploited species? What is the harvesting threshold beyond which these stocks might crash?*
- *Will there be a market for 'new' or non-traditional species? And what would be required to ensure the sustainability of that market?*
- *How do predators and prey respond under different climate change scenarios? (i.e. what is their sensitivity to various increments of warming, acidification, sea-level rise, etc)? What is their 'natural' adaptive capacity?*
- *Will climate change alter the values of parameters commonly applied in fisheries management models to estimate optimal production, yield, and levels of stock?*
- *Will there be a need to modify existing fisheries regulations and practices (e.g. extend/reduce closed seasons; issuance of permits for various fisheries), and introduce new technologies?*

This comprehensive keynote offered Philmore James the opportunity to focus directly upon the main topic of his MSc research in a presentation entitled *An Assessment of Potential Impacts of Climate Change and Climate Variability on Small-scale Fisheries in the Eastern Caribbean* (Appendix 4). His abstract is:

Abstract

Small-scale fisheries can play an important role with respect to key development issues such as poverty alleviation, food security and pro-poor growth especially in small island developing states (SIDS). The ecosystems in which fisheries operate are very vulnerable to several factors including climate change and climate variability. This paper focuses on potential impacts of climate change and climate variability on small scale fisheries in the Eastern Caribbean (EC). In response to a demand for more information on the likely impacts of climate change on small-scale fisheries particularly the livelihoods of Fishers the perceptions of fishers were assessed in three selected Eastern Caribbean island countries: Antigua and Barbuda, Barbados, and St. Kitts and Nevis. Rising sea surface temperatures, variable currents and rising fuel cost were among the main factors that affected the fisheries. The perceptions of fishers based on observations at sea were compared to available scientific information on climate change and climate variability. Fishers throughout the Eastern Caribbean have various perceptions of climate change and climate variability. They have also identified climate and other factors that impact fisheries. Based on the findings, suggestions were made of coping strategies that facilitate adaptation of small scale fisheries to climate change and climate variability. Possible areas for further research were also suggested. It is anticipated that these can assist in shaping future climate change adaptation strategies and project ideas for fisheries in the Caribbean.

Source: James, P. in press. *An Assessment of Potential Impacts of Climate Change and Climate Variability on Small-scale Fisheries in the Eastern Caribbean.* Proceedings of the 61st GCFI.

James presented fishers' perceptions of selected features related to fisheries or climate change as below.

Characteristic Feature related to Fisheries or Climate Change	**Perceptions of Fishers**
Understanding of Climate Change	Generally, it is perceived that there is global warming causing melting of polar ice sheets. Stronger and more frequent storms, effects of sea swells and impacts on the amount of fish being caught are also linked to climate change.
Fishing Distance/Depth/Time	Varies from country to country, depending on type of fishing, size and type of fishing vessel used and the general bathymetric conditions around the islands.
Fishing Activities	The type and extent of fishing activities vary from island to island. Trap fishing and different types and techniques of net and line fishing are common. Depending on the area, focus is on catching fin fish, lobster or conch.
Characteristic of Sea (Surface) Temperature	Few fishermen quoted specific sea surface temperatures but the majority believe that there is a general increase in SST. Increasing temperatures are perceived as causing a general decrease in fish catch.
Effects of Rain/Rainy Season	Some fishermen believe that there is a tendency to catch more fish during the rainy season. This is mainly attributed to more nutrients reaching the sea as well as mixing of fresh water.
Effects of tropical storms/hurricanes	Tropical storms are recognised as being destructive to fishing vessels, fishing gear and the physical environment in which fish survive. However, most fishermen take necessary precautions to weather the effects of storms.
Observance of Currents/ Upwelling currents and winter swells	There is a general perception that currents are getting stronger. Winter swells or ground swells are perceived to be more unpredictable and therefore may occur any time of the year.
Moon Phases and Fishing	Some fishermen, using hook and lines/trolling, believe in fishing according to moon phases. Other fishing methods in most cases occur independently of moon phases

Characteristic Feature related to Fisheries or Climate Change	Perceptions of Fishers
Observed Water Colour	Fishermen perceive that sea water colour varies throughout the region from clear or light blue to green or even brown. They believe that more fish is caught in the clear or blue water. Some relate the water colour to nutrients, volcanic activity or even dust from the Sahara.
Migratory Sea Birds	While different species of migratory seabirds are observed, there is no real recognition of changes in populations and migration patterns.
General marine life around Island	Many fishermen are unable to comment on general marine life. Divers, however recognise a general decline in the condition of coral reefs and sea grass in particular.
Sea Level Rise	Surprisingly, sea level rise is not considered a major issue. Most fishermen perceive that it will not have much effect on fishing activities.
Economics of Fishing	The cost of fuel, ice and bait seems to be the main elements for a fishing trip. This cost varies from island to island based on the type of fishing, distance of operation and the local price of fuel and engine oil. The price of fish also varies from country to country.
Fish Landings	In the south-Eastern Caribbean, the landings tend to be species specific and generally include more pelagic species while there is more 'mixed fish' in the northern Eastern Caribbean with a higher percentage of demersals. In general, it is perceived by fishermen that there is a recognisable decline in fish landings.

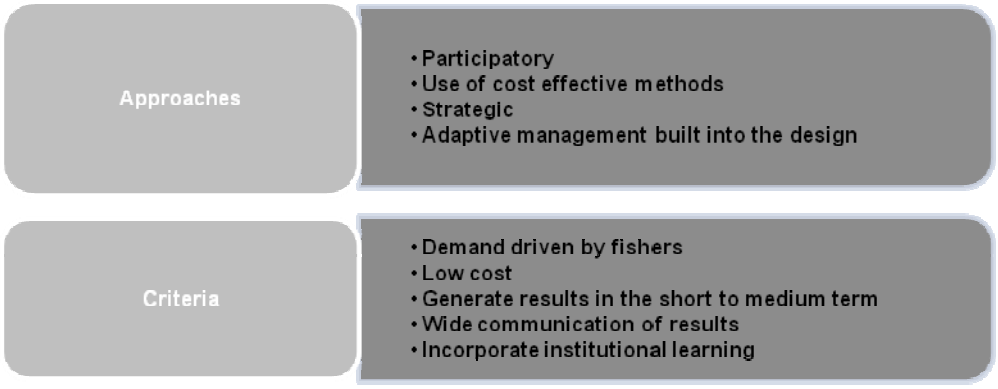
James summarized his findings in relation to the research questions of his graduate project as follows.

Research Questions	Summary of Related Findings
What do fishers consider to be the main features of climate change and variability?	Major elements stressed include global warming as experienced by rising air and sea temperatures, more variable rainfall patterns and totals and increased frequency and severity of tropical storms.
What do fishers perceive as the likely impacts of climate change and/or climate variability on small-scale fisheries at selected sites in the Eastern Caribbean?	The main perceptions are that there is a general decline in fish catch while the cost of fishing continues to rise as a result of increasing fuel prices. Natural fisheries habitats such as coral reefs and mangroves are also adversely affected.
Does scientific evidence support or refute the climate change and variability impacts on small-scale fisheries perceived by fishers?	Some of the perceptions are corroborated by facts. However, it may be still unsure what proportion of impacts may be attributed directly to climate change.
How can fishers cope with changes resulting from likely climate change impacts?	There are wide variations in responses. Shifting to other areas of economic activity, improved technology and fishing methods, more integrated management of fishing operations and abandoning fishing are some of the proposed solutions.
What future research is needed on issues related to the impacts of climate change and variability on small-scale fisheries in the Eastern Caribbean?	Several areas were suggested including: seasonal and local variations of currents around the Caribbean, the influence of local habitat on different fish species, migratory patterns of fish and bird species throughout the Caribbean region, possible impacts of climate change on marine invasive species and the occurrence of ciguatera in the north-eastern Caribbean, the relationship , if any, existing between sea level rise and fishing activity and possible linkages between changes in sea water colour and climate change.

The graduate researcher also shared with the audience some themes and emphases for research.

Theme	Research Emphases
Climate change indicators	What are fisher-relevant indicators of climate change?
Currents	Variations in fisher-observed seasonal and local currents
Habitats	Influence of local habitat changes on 'indicator' fisheries
Fish migration	What determines change in migratory patterns of fishes?
Sea Birds	Behaviour, etc. pattern changes of 'indicator' sea birds
Ciguatera	Climate change impacts on occurrence of ciguatera
marine invasive species	Climate change impacts on marine invasive species
sea water colour	Changes in sea water colour linkage to climate change
Communicating climate change	How to communicate climate change issues to fishers?
Mainstreaming climate change	How to include fisher climate issues in policies plans?
Socio-economic change	What market, technology, livelihood changes to prepare for?
Sea level rise	Does sea level rise matter when it comes to fisheries?

Also important were approaches and criteria related to implementing the proposed or any other research.



3.2 Discussion

After making some summarizing comments on the presentations, Mitchell Lay lead the GCFI meeting participants in a brief discussion. Participants remarked on the importance of addressing climate change. A participant from Puerto Rico said that it would be very useful to compare climate data sets with fisheries data sets for the region even if only to identify areas of potential interest. There was some discussion on the quality and availability of data and the importance of fishers' observations as part of this knowledge base. Comments from fishers confirmed that the research had touched on many of their areas of interest.

The meeting was reminded that although climate change was an emerging area of interest it should not be used as an excuse to neglect research and management interventions that had already proven vital to fisheries management. There was the danger of having fisheries management resources diverted away from the fundamental activities required for sustainable fisheries unless climate change research was put in the context of ongoing and planned initiatives or at least coordinated with these. Participants generally agreed with the Forum's proposed research questions and themes, but had no comments on the detailed development of projects around them.

In closing, Lay noted that the global issue of overharvesting was not being adequately addressed by the fishing industries in the Gulf and Caribbean. He hoped that the networking underway in the CARICOM countries could assist in addressing this. He also hoped that there would be more instances of scientists and managers going to fisherfolk such as will occur during the field trip and as one participant described

at Punta Allen in Mexico where fisherfolk have taken charge of their affairs. Lay also noted that climate change may bring about positive changes and provide opportunities for small-scale fisheries. These must not be overlooked because of the pervasive pessimistic outlook. Regarding next steps, Lay called upon fisheries authorities to be more aware and involved in climate change initiatives. Philmore James was identified as an example of this process starting and a possible catalyst. The role of GCFI in promoting regional information exchange was highlighted. Photographs taken during the Forum are in Appendix 5.

4. Fishers Forum field trip

At 1400 on Thursday 13 November a busload of about 25 participants (fishers, scientists, managers and students) set out for the nearby fish landing sites of St. Felix harbour and Petit Havre (see Appendix 6 for site photos). On site the visitors met with fisherfolk leaders from Guadeloupe who explained their fishing activities and issues from harvest to postharvest and including trade. In clusters, participants were able to share information and experiences in all three languages. The local hosts at Petit Havre also provided refreshments and the end of the trip that lasted almost 3 hours. Some topics of discussion included:

- Types of fishing gear and vessel used
- Use of the fishing harbour at St. Felix
- Rising costs of fishing operations
- Declining revenue from fish sales
- Regional fish marketing and trade
- French fishing industry organisations
- Welfare and social services available
- Interaction between fishing and other sectors
- Relations among fisherfolk organisations
- New and emerging impacts upon fishing

5. Conclusion

The 2008 GCFI Fishers Forum sought to tackle the topic of climate change in response to a demand for more information on this topic. Major sponsorship was received from IUCN for the research that went into answering the questions and other sponsors contributed to making the Forum a success as judged by its participants. Fishers present appreciated having the Forum, but it would be good to have more fishers at the Forum and fishers field trip in the future.

Several challenges will have to be overcome to sustain the Forum in future years and to ensure its continued development. Following the field trip there was renewed interest in making the 2009 Forum and field trip in Venezuela even bigger and better with more sponsorship available for fisher participation. It would also be encouraging to have fisher organisations and leading fishers play more prominent roles in designing and organising the Forum to better meet their needs and promote their ownership of the event.

6. Appendices

Appendix 1: Fishers Forum agenda

FISHERS FORUM
10 November 2008
16:45- 17:45

61st Annual Gulf and Caribbean Fisheries Institute
Hotel Arawak, Gosier, Guadeloupe, F.W.I.

1645 Introduction

...Patrick McConney, Senior Lecturer, CERMES, UWI Cave Hill Campus, Barbados and Fishers Forum organiser

1650 Opening remarks

...Anderson Kinch, Barbados Fisherman, Gulf and Caribbean Fisheries Institute Board Member and GMA recipient

1655 Keynote presentation: Incorporating climate change projections in Caribbean fisheries management

... Leonard Nurse, Senior Lecturer, CERMES, UWI Cave Hill Campus, Barbados and IPCC member

1715 Research presentation: Potential impacts of climate change and climate variability on small-scale fisheries in the eastern Caribbean

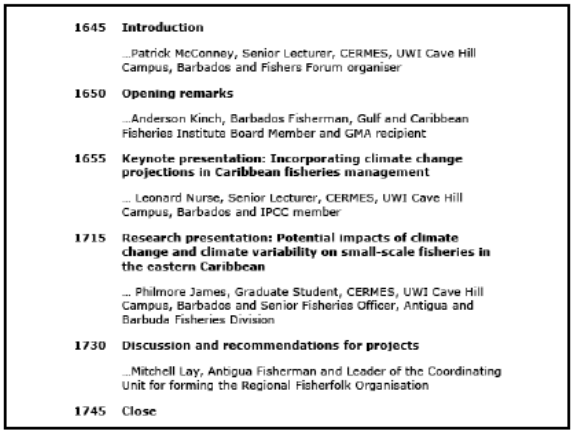
... Philmore James, Graduate Student, CERMES, UWI Cave Hill Campus, Barbados and Senior Fisheries Officer, Antigua and Barbuda Fisheries Division

1730 Discussion and recommendations for projects

...Mitchell Lay, Antigua Fisherman and Leader of the Coordinating Unit for forming the Regional Fisherfolk Organisation

1745 Close

Appendix 2: Forum introduction by P. McConney



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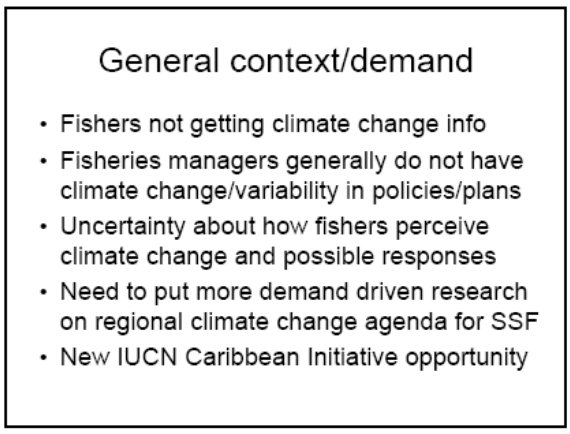
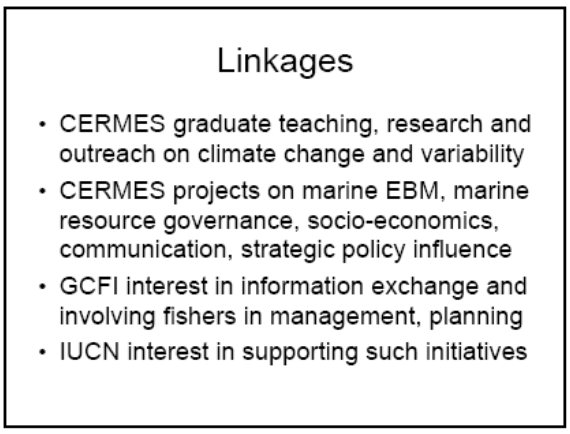


General context/demand

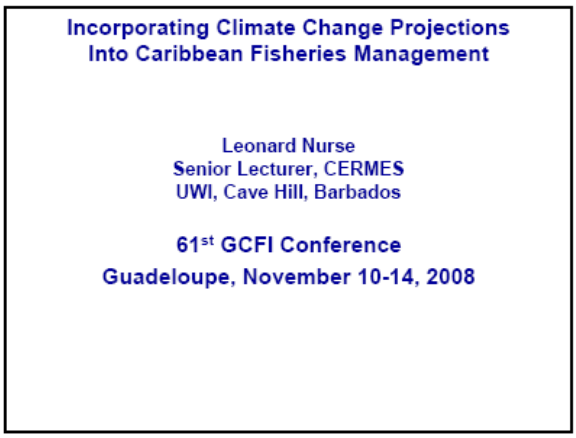
- Fishers not getting climate change info
- Fisheries managers generally do not have climate change/variability in policies/plans
- Uncertainty about how fishers perceive climate change and possible responses
- Need to put more demand driven research on regional climate change agenda for SSF
- New IUCN Caribbean Initiative opportunity



Linkages

- CERMES graduate teaching, research and outreach on climate change and variability
- CERMES projects on marine EBM, marine resource governance, socio-economics, communication, strategic policy influence
- GCFI interest in information exchange and involving fishers in management, planning
- IUCN interest in supporting such initiatives

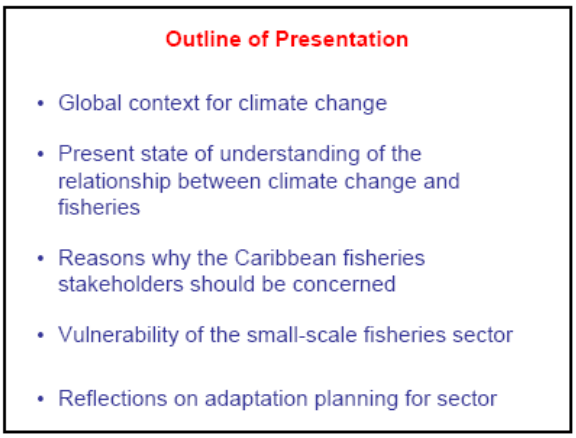
Appendix 3: Keynote presentation by L. Nurse



Incorporating Climate Change Projections Into Caribbean Fisheries Management

Leonard Nurse
Senior Lecturer, CERMES
UWI, Cave Hill, Barbados

61st GCFI Conference
Guadeloupe, November 10-14, 2008



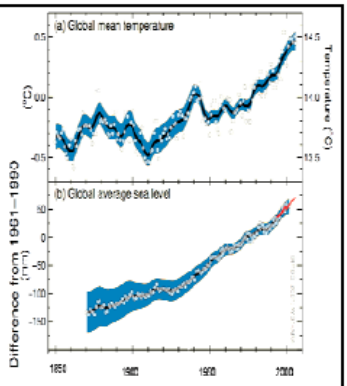
Outline of Presentation

- Global context for climate change
- Present state of understanding of the relationship between climate change and fisheries
- Reasons why the Caribbean fisheries stakeholders should be concerned
- Vulnerability of the small-scale fisheries sector
- Reflections on adaptation planning for sector

THE Global Context

Mean global temperatures increased by 0.7^0 C in the 100-year period 1906-2005

Rate of global mean sea-level rise approx. 10 times higher than rate of rise in previous 3000 years (IPCC, 2007)



Next 2 decades - warming of 0.2^0 C per decade projected

The Global Context

- Modeling → warming (approx. 0.1°C/decade) and sea level rise continue for centuries due to the *inertia*, even if GHG concentrations stabilized at year 2000 levels.
- Fisheries stakeholders should be concerned about the post-1900 increases in *frequency*, *intensity* and *persistence* of El Niño phases of ENSO, and observed trend of rising sea-surface temperatures.
- In present Century global ocean temperatures are projected to be 1.0^0 -2.0^0 C higher than the 1990 mean. In tropical oceans ^{0}Ts projected to be 2^0 C by the 2050s and 3^0 C higher by the 2080s, relative to the 1990 average.

The Global Context (cont'd)

- since publication of IPCC First Assessment Report (1990) →, large volume of literature on e observed and projected impacts of climate change and climate variability on terrestrial and marine habitats, and related flora and fauna.
- Evidence of wide spectrum of responses in all socio-economic sectors, including fisheries.
- Regrettably, research on impacts of climate change on Caribbean fisheries lagging behind other regions (e.g. N. Atlantic; Pacific).
- Notwithstanding the dearth of region-specific research, there is both an opportunity and a need for Caribbean fisheries stakeholders to build upon the existing global knowledge base.

Climate Change & Fisheries: What Do We know?

- Good understanding of *potential* impacts of climate change and climate variability on key factors and processes, e.g. *recruitment, abundance, migration*.
- *Changes in seasonality/intensity of coastal upwelling:* documented → e.g. California Current region, Gulf of Guinea, South Africa, Northwest Africa, Chile, India.
  - Δ In all these areas → decline in abundance of zooplankton biomass, fish and crustaceans.
  - Δ Literature → trends strongly correlated with increased GHG emissions, ocean warming, altered patterns of upwelling.

Climate Change and Fisheries: What Do We Know?

- *Poleward (or depth) shift in range of species*:

Δ Migration of pelagics (e.g. Atlantic mackerel and herring) poleward by approx. 0.5-0.8 degrees of latitude for every 1^0 C increase in SST.

Δ Two-thirds of exploited & non-exploited N. Sea species shifted poleward or to greater depth in past 30 years → elevated SST.

Δ Since 1900 - increase in tropical/sub-tropical species of planktonic foraminifera in California Current BUT reduced numbers of temperate & sub-polar species.

Δ California coast, 1931-94 → northward shift of 8 invertebrates → ^{0}T in the bay rose by 0.75^0 C.

Climate Change and Fisheries: What Do We Know?

- Emerging *climate-related changes:*

Δ Studies now show strong link between SSTs, changes in ocean circulation, patterns of larval transport and population dynamics.

Δ Research showing that climate impacts on a few '*leverage species*' could lead to far-reaching community level changes, altering the structure of 'traditional' fish assemblages.

Δ Also observational evidence → development and survival of many species may be adversely affected by changes in ocean chemistry linked to climate change → e.g. *ocean acidification*.

- Consensus? Impacts on fisheries largely negative. Climate- related impacts will be *exacerbated* by other human-induced stresses, including overfishing.

Should Caribbean Fisheries Sector Be Concerned?

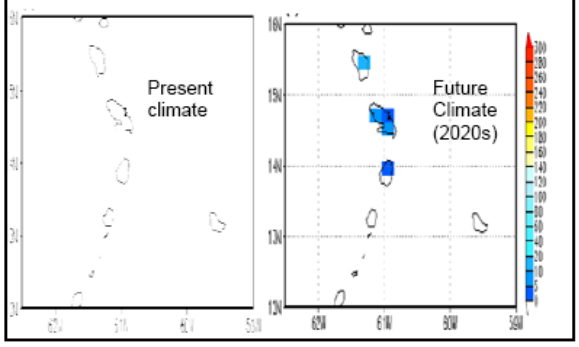
- sea-surface temperature trends

- :Observed temperatures changes in Caribbean in 20th Century consistent with global trend. 1990s warmest decade since 1900.
- Outputs from a suite of global climate models (GCMs) suggest that surface air ^{0}Ts in the Caribbean will continue to increase in present Century:
  - 0.5^0 -1.0^0 C between 2010-2039
  - 0.8^0 -2.5^0 C in the decades 2040-2069; and
  - 0.9^0 - 4.8^0 C between 2070 and 2099.

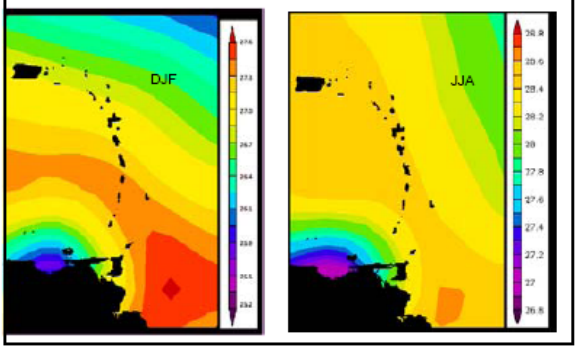
Should Caribbean Fisheries Sector Be Concerned?

- Recent climate model runs for the Eastern and Southern Caribbean → increase in sea surface temperatures can also be expected. Results suggest that SSTs will not only increase during the summer (JJA), but also in traditional 'cool' season (DJF).
- *Diurnal* and *seasonal* temperature ranges are decreasing → implications for Caribbean corals? → organisms consistently exposed to higher minimum and maximum ^{0}Ts than at present.

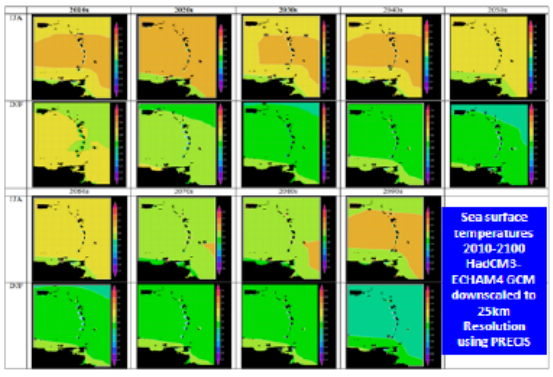
Extreme Temperature: Eastern Caribbean – Days with Temp ≥ 35° C
Source: UWI, Cave Hill Climate Modeling



Global Mean Sea-surface Temperatures – 2007
Observations
Data source: NOAA



SSTs for Caribbean (UWI, Cave Hill Climate Modeling)



Should Caribbean Fisheries Sector Be Concerned?

El Niño events - increased incidence, duration, intensity

- There is strong support from the observational records that elevated SSTs are a primary cause of coral bleaching.
- Most severe episodes coincide with years when El Niño signal is strongest, e.g. 1983, 1985, 1997/98, 2005/2006. In the 1997/98 event → 95% of Pacific corals bleached; 25-30% in Caribbean.
- The most recent intense bleaching episode in the Caribbean occurred during summer 2005 → area extending from Mexico to Tobago.

Δ Barbados case study → SSTs between 1-2° C above seasonal maxima → all nearshore and offshore habitats affected.

Branching coral

Brain coral

Bleaching could be annual or bi-annual unless increase in coral tolerance of 0.2-1.0⁰ C

Should Caribbean Fisheries Sector Be Concerned?

Ocean acidification – an emerging issue

- Effects not fully understood BUT worrisome.
  - World's oceans have become approx. 30% more acidic → reduction in pH from 8.2 to 8.1 units, since 1750.
  - Factor in development of organisms (e.g. corals) requiring carbonate ions to build shells.
  - Increasing fossil fuel use → more CO2 absorbed by the oceans → becomes acidic by removal of carbonate ions → restricts shell formation.
  - The *reef fishery* constitutes a vital component of small-scale activity → this sector likely to be seriously affected.

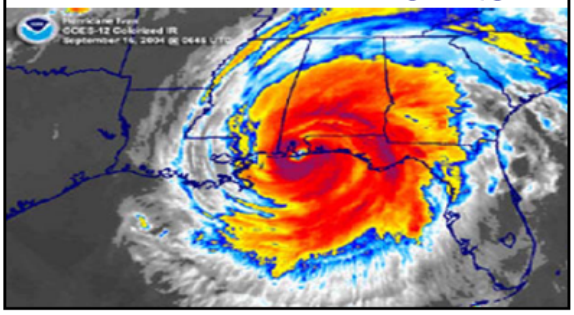
Should Caribbean Fisheries Sector Be Concerned?

The hurricane threat

- Increase in *peak wind intensities* projected →10%.
  - More hurricanes reaching category 3 status and above, than in prior decades → 8 category five systems 2000-2007, compared with 23 between 1928 and 2000.
  - Increase in maximum wind speeds and increments of sea-level rise → amplify storm surge effects, coastal erosion → infrastructure, e.g. wharves, jetties at high risk.

Name	Year	Winds, mph (km/hr)
Isabel	'03	266 (165)
Ivan	'04	266 (165)
Emily	'05	290 (180)
Katrina	'05	282 (175)
Rita	'05	290 (180)
Wilma	'05	298 (185)
Dean	'07	266 (165)
Felix	'07	266 (165)

Hurricanes reaching high intensity over a shorter time →e.g. Gustav (2008) and Wilma (2005) → tropical depression to category 4 and 5 status, respectively, in < 24 hours → reduces time for securing boats, gear.



Vulnerability of Caribbean Small-Scale Fisheries

- Vulnerability → (a) the degree of exposure to threat (b) sensitivity and (c) capacity of the sector to cope with threat. In the Caribbean, exposure/sensitivity of the small-scale fisheries sector is *high*, adaptive capacity *low:*
  - High probability of habitat and ecosystem damage → stress on corals, mangroves and seagrasses; role of ocean warming in algal blooms and various diseases.
  - Fisher folk tend to reside in vulnerable, low-lying coastal areas → exposes assets (e.g. boats, homes) to climate-related events, e.g. storm surge, SLR.
  - Some resilience to climate variability in past BUT lacks consistent government support, access to capital, insurance, etc. Also weak fisher folk organizations, low bargaining power → compromise adaptive capacity.

How May the Caribbean Fisheries Sector Respond?

- Elimination of *source* of the problem practically unachievable → *adaptation* the only option.
- Practical measures →*build resilience*, *exploit opportunities, minimize dislocation of* fishers.
- Measures should (i) reflect the *status of the science* (ii) be *flexible* (iii) exploit the knowledge base of fishers (iv) cost-effective, socially/culturally sensitive.
- Adaptation a *process* → new initiatives may be required BUT sector can begin by strengthening existing management process and *mainstreaming* 'adaptation thinking' into these arrangements.
- Existing platform can provide basis for sound adaptation practice (legislation, FACs, CFRM, etc).

How May the Caribbean Fisheries Sector Respond?

- The strategy should be guided by pragmatism → emphasis on activities over which countries have some control and which, if implemented, will have a positive impact.
- While the region can do little to reverse the trend of GHG emissions, actions can be taken to improve the resilience:

Δ Enforcement of existing marine pollution control protocols and abatement of contamination from land-based sources;

Δ Expansion of habitat protection and restoration

Δ Control of practices such as overharvesting and the use of inappropriate harvesting methods.

How May the Caribbean Fisheries Sector Respond?

- Targeting of unexploited species BUT may require innovative marketing programmes, education and outreach.

Δ (i) would diversify options for maintaining livelihood (ii) alleviate pressure on exploited stocks → contribution to resilience .

Δ Agencies such as CFRM and OECS Fisheries Unit can play lead roles, in collaboration with other stakeholders.

- Exploring alternative employment opportunities?

Δ Could help compensate for loss of revenues and livelihood support →collaboration of Government, fishing community.

Δ Organizations such as fisheries cooperatives could play a significant role → creation/sourcing of opportunities & 'retooling' of fishers with new skills.

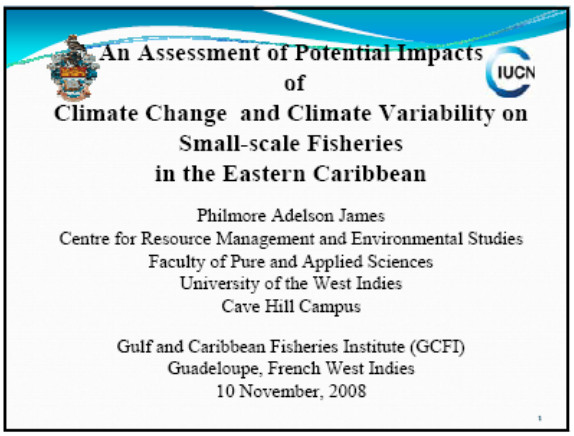
How May the Caribbean Fisheries Sector Respond?

- Although adaptation will help, global anthropogenic greenhouse gas emissions must be abated and stabilized urgently.
- It is a concern that stakeholders in the fisheries sector have not engaged in the global debate with the same vigour as interest groups in other sectors.
- Fisheries constituency must invest in its own self-interest and join the global lobby for steep emission reductions and swift implementation of agreed protocols.
- The international community is currently negotiating a successor to the Kyoto Protocol, to be concluded at the 15th COP to the UNFCCC – Copenhagen, 2009.
- Stakeholders should seek to have an effective voice at the remaining preparatory meetings and at the final decision-making forum.
- Should access existing adaptation facilities e.g. the *Climate Change Adaptation Fund* → assistance for vulnerable communities once certain conditions of eligibility are met.

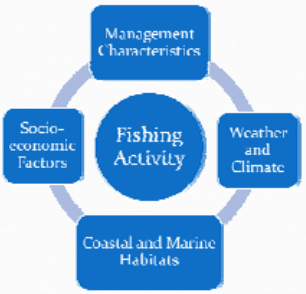
How May the Caribbean Fisheries Sector Respond?

- Robust, region-specific research
- How will changing temperature, wind and circulation regimes affect the spatial and temporal abundance and migration patterns of commercially important species?
- What is the state of knowledge of population dynamics of non-exploited species? What are the *harvesting thresholds?*
- Is there be a market for non-traditional species? What would be required to ensure sustainability of the species and the market?
- Response of predators & prey under different scenarios
- Even partial answers would provide guidance for action → optimizing catch effort; structuring of bilateral and other agreements; identification of needed behavioural changes; stakeholder training and awareness.

Appendix 4: Research presentation by P. James



Background



- Climate change is real
- Much 'talk' about impacts of climate change
- Easier to identify impacts of climate change on natural environment than on fishing activities.

3

Introduction

- Documented perceived changes in fishers' work environment based on observations
- Assessed the potential impacts of climate change and/or climate variability on small-scale fisheries in the Eastern Caribbean
- Study sites: Antigua and Barbuda, Barbados, St. Kitts and Nevis
- Finding answers to key questions as much as posing additional researchable questions

4

Key Research Questions

- What do fishers consider to be the features of climate change and/or climate variability?
- What do fishers perceive as the likely impacts of climate change and/or climate variability on small-scale fisheries (selected sites in the EC) ?
- Does scientific evidence support or refute the findings?
- How can fisher folk cope with changes resulting from likely climate change impacts?
- What are the potentials for future related research?

5

Research Approach

- Literature review
- Informal interviews: focused on fishers and their groups
- Results
- Analysis and interpretation
- Key learning, suggestions

6

A Summary of the Impacts of Climate Change on Fisheries and the Oceans

- Impacts fisheries (freshwater, saltwater) aquaculture
- Changes in fish abundance, fishery areas, species mix
- Subsistence/small scale fishermen are more vulnerable in some cases due to restricted mobility, fewer options
- Climate change impacts may contribute to overfishing, natural variation, pollution, UV-B and loss of wetlands and nurseries
- Inherent uncertainties in fisheries worldwide are expected to be exacerbated by a changing climate
- Globally, economic and food supply impacts should vary, but may increase the population at risk to hunger and other symptoms of poverty

7

A Summary of the Impacts of Climate Change on Fisheries and the Oceans (cont'd)

- Increased coral bleaching as a result of a 2°C increase in average global atmospheric temperature by 2050
- Sea-level change will occur with regional variations, impacts including loss of coastal wetlands
- Changes in coastal pollutants will occur with changes in precipitation and runoff eventually affect fisheries.
- Changes in circulation and vertical mixing influence nutrient availability, primary productivity, fish yields
- Reduced yields of desirable fish species will occur if primary productivity decreases

Sources: (Everett, 2007; APO, 2008; Crocker, 2008; IPCC, 2007b; IPCC, 2007a; Yohe, et al., 2007)

8

General Perceptions: Climate Change and Fisheries

- Fair understanding of climate change
- A decline in marine life and habitats around the islands
- Fish landings perceived to be declining
- Economics of fishing show an increase in operating cost

9

Perceptions of Fishers: Fact or Fiction?

- Increased sea surface temperatures causing decreased fish catch
- More rains could mean more fish. Less rains?
- More frequent and stronger storms mean less fishing days and possible damage to habitats, vessels and infrastructure
- Stronger currents and unpredictable winter swells mean more disruption in fishing activities.
- Migratory sea birds are decreasing
- Sea level rise is not seen as a threat to fishing activity

10

Facing the Facts: Coping with Changes

- Development of appropriate livelihood alternatives
- Socio-ecological factors critical to the management of fisheries
- Treat fishing activity as a business
- Do nothing: Live with the conditions

11

Research criteria/approaches

- Demand driven by fishers, participatory
- Generates results in short to medium term
- Low cost and cost effective methods used
- Strategic, wide communication of results
- Incorporates institutional learning (FFOs)
- Adaptive management built in the design

Potential topics for future research

1. What are fisher-relevant indicators of climate change?
2. Fisher-observed seasonal, local current etc. variations
3. Influence of local habitat changes on 'indicator' fisheries
4. What determines change in migratory patterns of fishes?
5. Behaviour, etc. pattern changes of 'indicator' sea birds
6. Climate change impacts on marine invasive species
7. Climate change impacts on occurrence of ciguatera
8. Does sea level rise matter when it comes to fisheries?
9. Changes in sea water colour linkage to climate change
10. How to communicate climate change issues to fishers?
11. How to include fisher climate issues in policies plans?
12. What market, tech., livelihood changes to prepare for?

13

Conclusions

- Climate change is a reality
- Fisheries within the Eastern Caribbean will continue to be influenced by climate change
- Fishers have recognised that they can and will cope using different strategies
- It is difficult to predict the nature and extent of the impacts
- Future research focused on key ecosystem and their linkages with climate change could be the answer
- Results and implications of research must reach primary stakeholders. FISHERS MUST KNOW.

14

Appendix 5: Fishers Forum photographs

The following photographs were taken during the forum by Kemraj Parsram, PhD researcher at CERMES.

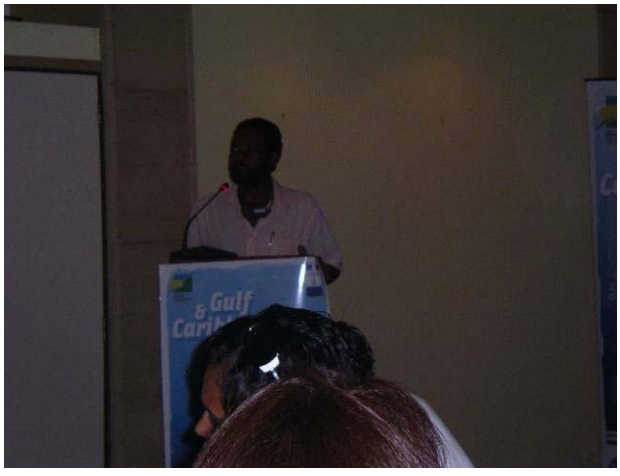
Patrick McConney introduced the Fishers Forum

An attentive audience stayed late to participate

Leonard Nurse spoke on climate models, change

Global and regional climatic trends were shown

Anderson Kinch shared his perspective as a fisher

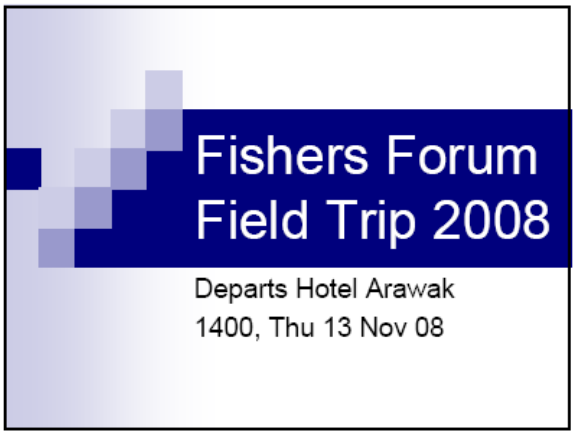


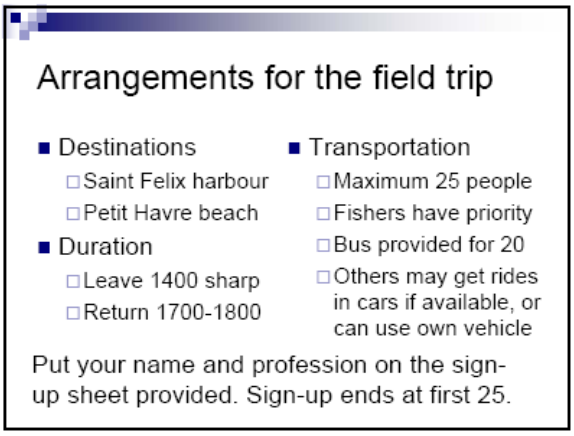
Mitchell Lay led the discussion on action required

Jaime Medina, a fisher leader from Mexico, spoke

Dwight Neal, Friends of Nature (an NGO) in Belize

Appendix 6: Forum field trip presentation






Petit Havre


See you there!