

# **The impact of global environmental change on fisheries in the Caribbean – outlining research needs**

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## **1.0 Summary**

Fisheries data are inherently imprecise, resulting in high levels of uncertainty in resource predictions. A number of global environmental changes (GECs) are expected to impact negatively fisheries development and management in the Caribbean region, and will introduce further uncertainty into fisheries evaluations. To overcome the challenges, fisheries administrations will need to: revise their policies, legislation and management plans; expand their information databases to include data on environmental and habitat conditions, and social and economic data; develop resource assessment approaches that take into account environmental factors (fisheries prediction/performance models); identify those resources, habitats, and resource users that will be most vulnerable to anticipated changes (vulnerability assessments); solicit greater stakeholder participation in research and planning, and develop socially acceptable adaptive management strategies (adaptation planning). The current human and institutional capacity of national fisheries administrations is inadequate to achieve these aims, and this problem will need to be addressed in the near future.

## **2.0 Introduction**

In April 2002, a regional consultation was held to review and discuss the adaptation of fisheries and fishing communities to the impacts of climate change in the CARICOM region (Anon., 2002). The salient issues were identified, and the agreed approaches are to be pursued through the CRFM, working in collaboration with MACC and other interested organizations and institutions. This brief takes into account the conclusions of Anon. (2002), and provides some further thoughts on identified technical needs.

**3.0 Capacity Building:** The constraint of capacity is not a new issue to fisheries managers in the Caribbean. Building on the achievements of CFRAMP and ICRAFD and recognizing the continuing constraints facing fisheries managers in the Caribbean, Anon. (2002) recommended

that capacity needs for addressing issues related to GEC be dealt with as part of a current mainstream activity of the CRFM to develop a comprehensive capacity building strategy which is sustainable in the long term. This strategy should be developed, based on an assessment of the present capacity levels of all stakeholders, and the capacities that are required to facilitate holistic development and management planning. The CRFM should collaborate with MACC (Mainstreaming Adaptation to Climate Change), CCCC (Caribbean Climate Change Centre), and other relevant organizations and institutions to ensure that GEC issues are incorporated into the planning process and into the implementation of agreed capacity building programmes.

It will be necessary to consider capacity enhancement needs at several levels: i) institutional systems (e.g. policy planning, legislation; statistical recording and reporting systems, management systems, national fishery advisory mechanisms); ii) human capacity (short-term and long-term); iii) stakeholder participation (strengthened and operational fisher folk organizations), and; iv) established collaborative network among national and regional institutions to optimize use of specialized expertise and experience (development of CRFM network).

#### **4.0 Assessment of impacts on fisheries resources, critical habitats, and human livelihoods (vulnerability assessments)**

At present, climate change models do not provide predictions at scales useful for local and regional adaptation planning in the Caribbean region. The development of more local climate change models is therefore an essential step in determining the timing and extent of anticipated changes and for informing and refining vulnerability assessments.

##### **4.1 The impact on fisheries resources**

A number of anticipated GECs will affect the biology and ecology of marine resources in the Caribbean region. These include: increase in sea surface temperature (SST), sea level rise, increased frequency of ENSO events, increased frequency and intensity of storms and hurricanes, changes in rainfall patterns, and changes in sea current systems.

Countries will need to monitor and measure changes in environmental conditions, and will need to estimate the relationships between each key environmental variable and resource biology and ecology. For instance, the distribution and abundance of certain tropical large pelagic species are known to change during years of ENSO events. Such changes notably reduce fisheries yields in the years concerned. Increased frequency of ENSO events can therefore significantly negatively

impact the efficiency of the associated industries and the standard of living in the fishing communities involved.

Temporal and spatial differences in environment-resource relationships will permit identification and categorisation of vulnerable areas. Fisheries independent surveys are desirable to enhance interpretations of the commercial fisheries data. This type of research is specialised, and will be pursued in collaboration with universities and other research institutions and organizations.

Some environmental data are already collected routinely by non-fisheries agencies. Arrangements are needed to accommodate data acquisition from these sources, for incorporation into national fisheries databases. Together with results generated by specific technical studies, commercial fisheries and other similar data will contribute to further development and refinement of ecosystem-based resource assessment approaches and other types of fisheries evaluations, to take into account the effects of GEC on resource abundance, distribution, and recruitment, and hence industry yields.

#### 4.2 The impact on critical habitats

Mangroves, seagrass beds, coral reefs and wetlands support complex ecosystems in inshore and coastal areas. Many of the anticipated GECs seriously threaten the health and long-term survival of these ecosystems, and the human communities dependent on them. Regular monitoring of coral reefs has commenced in a few areas, but this effort needs to be expanded and consolidated. In particular, countries should measure changes and recovery times in species composition and abundance in response to SST changes, storm activities, physical changes in coastline and beaches, and changes in rainfall patterns. If not yet available, countries will need to develop baseline references on the characteristics and dynamics of beaches and landing sites, and to accumulate data on changes and recovery times following storm activities.

Sea level rise, increased storm activity and changes in rainfall patterns will also have implications for the continued development of the aquaculture industry. Vulnerability assessments are required to determine the tolerance of cultured species to changes in water conditions such as temperature and salinity. This information will also inform planning, and selection or relocation of aquaculture sites.

#### 4.3 The impact on human livelihoods

For the fisheries likely to be negatively affected by GECs, it will be important to quantify:

- i) the current social and economic conditions of the industry, including contribution to food security, poverty alleviation, employment, revenue, and foreign exchange.
- ii) the current dependence of fishing communities on the resources, and the abilities of these communities to seek alternative livelihoods.
- iii) (i) and (ii) will yield data for determining degrees of vulnerability, potential losses to the industry, and capacity for adaptation of the harvesting sector.

## **5.0 Adaptation planning**

Given the pervasive impact of GECs, consultative mechanisms are needed to ensure success of proposed adaptations. National legislation, policies and fisheries management plans will have to be reviewed, to incorporate consideration of new directions regarding conservation, industry and management practices. The establishment and strengthened activities of National Fisheries Advisory Mechanisms (NFAMs) will play a vital role in coordinating collaboration among the relevant agencies (government and NGO) at the national level, and developing an inter-sectoral network for data sharing and the development of complementary approaches (e.g. fisheries management plans should complement coastal zone management plans and vice versa). Additionally, the NFAM can be an effective tool in promoting direct involvement of fisher folk organizations and local fishing communities in GEC social and economic research and in developing practical adaptation strategies that are socially acceptable.

### **5.1 Adapting approaches to assessment and conservation of resources and habitats**

5.1.1. *The Precautionary approach* – FAO advocates application of the precautionary approach in situations of scientific uncertainty and where there is evidence of resource depletion and environmental degradation. In view of the added uncertainty GEC effects will impose on fisheries evaluations, countries need to develop precautionary approaches to management. This will probably involve application of management restrictions at levels somewhat lower than the usual fisheries management reference points. Successful resource conservation is intimately linked to successful habitat conservation practices: the latter will also need to be developed and pursued within the context of GEC, and this may require revisions of policies, legislation, and resource/habitat management plans.

5.1.2 *Risk assessment* – Given that fisheries data are usually imprecise, risk assessments are often carried out, to determine the risk and hence, the consequences of incorrect management

decisions being taken. Risk assessments can take into account the additional uncertainty introduced by GECs, and should form an essential component of the resource evaluation process.

5.1.3. *Ecosystem-based approaches to resource assessment* – Fishery assessment has evolved over the years, from single species assessment models to multi-species assessments and ecosystem-based approaches. Some fisheries models also try to incorporate environmental data, and bio-economic models are becoming more popular. These efforts have tried to quantify and relate two or more of the important factors influencing resource dynamics and the sustainability of the fishery. Ecosystem-based models, such as ECOPATH, ECOSIM and ECOSPACE attempt to model the energy flows within the living community of a specified ecosystem. Such ecosystem-based models should be further developed to account for environmental effects; it will be necessary to develop one or more of these types of models to facilitate fisheries monitoring and decision-making in the Caribbean region.

## 5.2 Adapting coastal fishing communities and the industry

### 5.2.1 *Stakeholder awareness and education*

Clearly, it is essential to educate stakeholders of the anticipated GECs, the likely impact on human livelihoods and hence the necessity for strategic action to mitigate the negative effects. Hopefully, this will encourage stakeholders to respond more positively to planned research and to participate fully in consultative planning sessions.

### 5.2.2. *Research*

The following studies will inform the development of adaptation strategies (Anon., 2002):

- i) Conduct cost-benefit analyses of implementation of proposed adaptation measures;
- ii) Estimate the economic implications of inaction;
- iii) Incorporate risk analyses into studies noted in (i) and (ii).

Additionally, fisher folk organizations will need to be strengthened, as indicated in section 3.0, not only to accommodate their effective participation in the NFAM and adaptation planning, but also as vehicles for support and delivery of re-training programmes where necessary.

## **6.0 References**

Anonymous (2002). Report of the Consultation on Adaptation of Fisheries and Fishing Communities to the Impacts of Climate Change in the CARICOM Region. In Prep..