Appendix 3.3 DFID/FAO SFLP draft policy brief

BUILDING ADAPTIVE CAPACITY TO CLIMATE CHANGE

The aim of this policy brief is to:

- Identify the pathways through which climate variability and climate change may influence the contribution of fisheries to poverty reduction
- Introduce a framework for analysing vulnerability to climate change
- Provide a global assessment of the impacts on national economies of future climate change on the fisheries sector.
- Review livelihood and institutional responses to past climate variability and change in the fisheries sector, and existing attempts to maintain or enhance fisherfolk's adaptive capacity relative to climate change
- Propose policy actions and initiatives that can help build fisherfolk's adaptive capacity to climate change and reduce their vulnerability

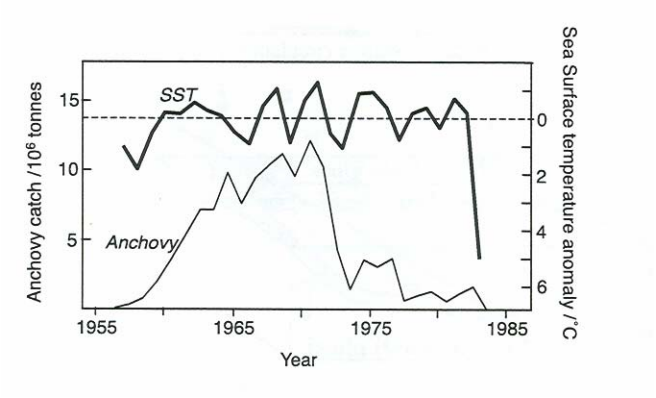
Fisheries, Climate and Poverty Reduction

There is a strong link between fisheries and poverty reduction as they provide vital livelihood opportunities in many developing countries. Fisheries employ over 50 million people worldwide and 98% of these are from developing countries[1]. Fisheries are also important for economic growth. African export earnings are calculated to be over US$2.5million, and fisheries sectors in countries such as Namibia, Uganda, Ghana and Senegal contribute over 6% to their national GDPs. Fish is also an important and cheap source of protein. It forms at least 50% of the essential animal protein and mineral intake for 400 million people from the poorest African and South Asian Countries[2].

There is also an established link between fisheries and climate variability and ongoing challenges in dealing with this variation (Box 1 and 2). For instance a number of fisheries resources fluctuate with changing environmental or climate conditions e.g. upwelling resources, flood-plain fisheries, migrating ocean stocks.

Box 1. Impacts of El Niño Southern Oscillation variation on fisheries

The El Nino Southern Oscillation is a change in the Pacific Ocean atmospheric pressure system, which affects weather and ocean behaviour. In normal years the pressure system results in prevailing offshore winds that blows warm water off the east coast of Latin America allowing cool nutrient water to flow upwards ('upwelling'). This supports a productive pelagic fishery (e.g. anchovies & sardines) off the coasts of Chile and Peru. In El Nino years, changes in pressure weaken the trade winds and upwelling, decreasing productivity of the fishery. Fish catch volumes were reduced by 45% in El Nino year 1998 compared to 2002 catches. Pelagic upwelling fisheries are also important to Chile, Namibia and South Africa.



Source: Barange, M. (2002). Influence of climate variability and change on the structure, dynamics and exploitation of marine ecosystems. In Global Environmental Change (eds R.E. Hester & R.M. Harrison), pp. 57-82. The Royal Society of Chemistry, Cambridge.

[1] ICLARM (1999) Annual Report
[2] World Bank (2004) Saving Fish and Fishers Toward Sustainable and Equitable Governance of the Global Fishing Sector May 2004, Agriculture and Rural Development Department

A framework for understanding vulnerabilities to climate change

There are a number of different pathways through which climate change may influence the contribution of fisheries to poverty reduction. These can be examined on two dimensions: on a spatial scale climate change may result in impacts at the micro and macro levels; and on a temporal dimension impacts will range from climate variability to trends and large scale shifts what are likely to increase in severity and frequency over time.

Impacts on poverty from the micro to the macro level

Micro-scale impacts

- Reduced access to livelihood opportunities and natural capital through:
  - Changes in the productivity or distribution of fisheries resources
  - Impacts on ecosystems important for small-scale fisheries
- Increasing vulnerability of fishing communities due to the impacts of extreme events such as damage to infrastructure and threats to human health.

Macro-scale impacts

- Reducing the contribution of fisheries to the national economy
- Reduction of the availability of fish as a source of dietary protein

Changing impacts over time

Climate change may affect fisheries through changes in climate variability, trends that result in incremental changes, or dramatic shifts. Trends include the shift in distribution of fisheries stocks, or increasing frequency and severity of extreme events such as floods, storms and droughts. Potential dramatic shifts include the loss of coastal habitats[3] due to sea level rise or the change in river flows due to glacial melts. Sea level rise of 1m would result in flooding of the entire Niger Delta in Egypt wiping out towns, fishing and farming communities currently located there (Figure 1).

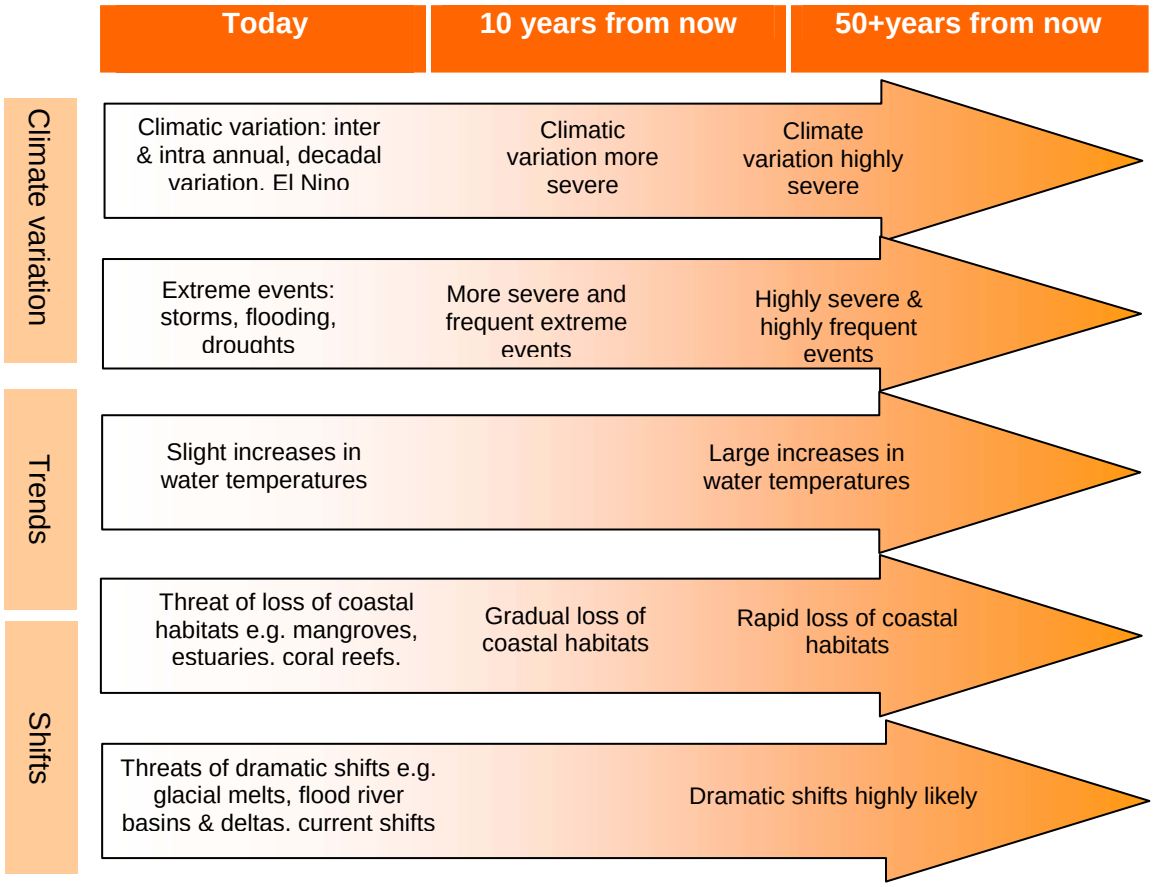
Figure 1 Illustration of the inundation of the Nile Delta with 1m rise in sea level

Source http://www.grid.unep.ch/

All these factors will increase in severity over time (Box 2).

[3] Coastal habitats may be able to shift inland but this will be impeded in areas of high development

Box 2. Different dimensions of climate change



Reduced livelihood opportunities and access to natural capital

There are a number of different pathways through which climate change could affect the productivity or distribution of fishery resources (Table 1). This has implications for livelihood incomes if production decreases. Access to resources may be affected if the distribution changes outside of national or community boundaries, or becomes too expensive to reach.

Table 1 Examples of impact pathways

Level of changes	Climatic changes	Impacts	Potential outcomes for fisheries
Physical	Changes in pH	- Effects on calciferous animals e.g. molluscs, crustacean, corals, echinoderms & some phytoplankton	Potential declines in ***production*** for calcifying marine resources
	Warming upper layers of the ocean	- Warm water species replacing cold water species - Plankton species moving to higher latitudes	Shifts in ***distribution*** north of plankton, invertebrates, fishes birds
		- Timing of phytoplankton blooms changing - Changing zooplankton composition	Potential mismatch between prey (plankton) and predator (fish populations) & declines in ***production***
	Sea level rise	- Loss of coastal habitats e.g. mangroves, coral reefs and breeding habitats	Reduced ***production*** of coastal and related fisheries
Individual species	Higher water temperatures Changes in current	- Changes in sex ratios - Altering time of spawning - Altering time of migrations - Altering time of peak abundance	Can affect the timing and levels of ***productivity*** across marine and fresh-water systems
		- Increased invasive species, diseases and algal blooms	Reduced ***production*** of target species in marine and fresh water systems
		- Affects recruitment success	Affects abundance of juvenile fish and therefore ***production*** in marine and fresh water
Fish populations & Ecosystems	Reduced water flows & increased droughts	- Changes in lake water levels - Changes in dry water flows in rivers	Reduced lake ***productivity*** Reduced river ***productivity***
	Increased frequency of El Nino	- Changes in timing and latitude of up welling	Changes in pelagic fisheries ***distribution***
		- Coral bleaching and die-off	Reduced coral-reef fisheries ***productivity***

* This table is not intended to be comprehensive but to give examples of potential impact pathways that can affect the distribution of production of fisheries systems.

A number of ecosystems important to small-scale fisheries, such as lakes, rivers and coastal fisheries may also experience changes that could reduce livelihood opportunities.

Lake fisheries

Lake fisheries are a particularly important source of livelihoods especially in the African Rift valley and West Africa, including Lake Malawi, Lake Tanganyika, Lake Victoria and Lake Chad. Lake fisheries already experience high levels of climatic variability, affecting water levels or wind speeds and linked to productivity (Box 3). Social systems have developed to manage the variation but the question remains whether these social systems will be able to cope with increasing variability with the ongoing trends of over-exploitation and changing management regimes.

Box 3 Fluctuating Lake Chad fisheries with El Niño patterns

The fish communities of these lakes consist of small, fast growing resilient species. In dry years these lakes produce little or no fish, but the onset of rains leads to recovery of fish catches within a year or two. In wet years, linked to El Niño activity, the lakes are extremely productive supporting livelihoods and supplying a huge food subsidy - Lake Chad provides up to a quarter of dietary protein to surrounding communities in such years. Fishers migrate to the lakes in wet years to capitalise on the ephemeral superabundance facilitated by complex access rights systems implemented by lakeshore farming communities.

River fisheries

River fisheries support millions of people throughout African and Asia. The lower Mekong River (running through China, Vietnam, Lao, Thailand and Cambodia) is home to approximately 60 million people. Important river fisheries in Africa include the Nile River Basin and the Niger River flowing through Guinea, Mali, Niger, Benin and Nigeria.

In the short-term, climate change is anticipated to impact freshwater fisheries through incremental changes in water temperature, nutrient levels and lower dry season water levels. Dry-season flow rates are predicted to decline in South Asia and in most African river basins reducing fish yields. In the longer-term larger changes in river flows are anticipated as glaciers melt, reducing their capacity to sustain regular and controlled water flows.

There is a particular concern for river fisheries in ***downstream impacts*** from adaptations within other sectors. In particular, conflicts exist between agricultural irrigation needs and fish productivity in river systems. Summer flows in the Ganges are predicted to reduce by two thirds with climate change, causing water shortages for 500 million people and 37 per cent of India's irrigated land.

Coastal fisheries

Coastal fisheries include estuarine, wetlands, coral reef and pelagic fisheries and support poor coastal communities around the world. Two-thirds of the world's coral reefs occur in the territorial waters of developing nation, and 30 million of these people depend directly on coral reef fisheries and aquaculture for their livelihoods. The loss of coastal habitats and resources is likely through sea level rise, warming sea temperatures, eutrophication, and invasive species. For example coral bleaching has been associated with warm sea temperatures.

Coastal fishing communities face a double exposure of reduced fisheries resources and increased risks of coastal flooding and storm surges. 50 million people could be at risk by 2080 because of climate change and increasing population densities along the coast[4]. Projections suggest the combined pressures of human population growth and climate change will result in reef loss and a decline in fish availability for per capita consumption of approximately 15% by 2015[5].

[4] Adger et al (2005) Social-Ecological Resilience to Coastal Disasters. Science Vol 309, 12 August 2005

[5] Allison et al (2005) Social-ecological vulnerability of fisheries to climate change.

Increased vulnerability

Sea level rise and increased frequency and severity of storms, flooding and hurricanes or cyclones are expected to increase damage to infrastructure and risks from infectious disease, further reducing the socio-ecological resilience of coastal and river delta fishing communities. Communities in the Pacific are already experiencing the effects of sea level rise and coastal erosion.

Increased frequency of extreme events are likely to result in lost fishing days, damaged and lost fishing gears and boats and damage to the infrastructure, ports, harbours and coastal defences. El Nino related damage in Fiji during 1997/8 resulted in US$ 107 million worth of damage.

The impacts of climate change on fishing communities are on top of other poverty drivers such as HIV/Aids, declining fish stocks, a lack of savings or insurance and a lack of alternative livelihoods. Wider impacts of climate change will reduce their resilience and ability to cope. Climate change is predicted to add health burdens to the poor and potentially decrease water and food security[6]. For example, cases of cholera outbreaks in Bangladesh coastal communities have been found to increase following El Niño flooding events.

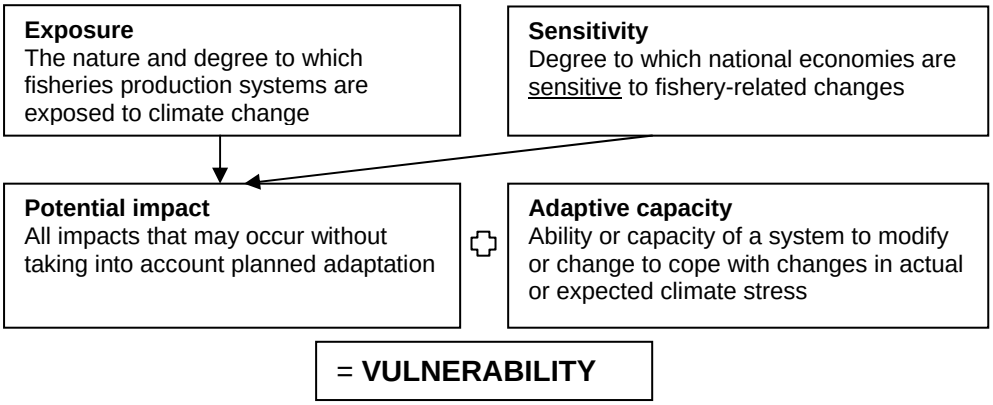
Macro-level impacts on economies and food security

The vulnerability of national economies and food provision to climate impacts on fisheries has been investigated through a global comparison using the definition of vulnerability and methodology given in Box 4. It reveals that African countries are the most vulnerable to the impacts of climate change on fisheries, despite the fact that over 80% of the world's fisher folk are found in South and Southeast Asia (Box 5).

What makes African fisheries so vulnerable? The analysis reveals that semi-arid countries with significant coastal or inland fisheries are vulnerable due to their high catches, exports and high nutritional dependence on fish for protein. These countries include Angola, Congo, Mauritania, Mali, Sierra Leone, Senegal and Niger. Fisheries provide employment for up to 10 million people in Africa and provide a vital source of protein to 200 million people. Protein may be particularly limited in these countries resulting in high dependency on wild caught fish and bushmeat. Other vulnerable nations include Rift valley countries such as Malawi, Uganda and Mozambique and Asian river-dependent fishery nations including Pakistan, Bangladesh and Cambodia. Countries such as Russia, Peru and Columbia are sensitive to climate changes either due to their high catches and reliance on exports and employment from fisheries, but have a high adaptive capacity to deal with potential impacts.

Box 4. Assessing global vulnerability of fisheries systems to climate change

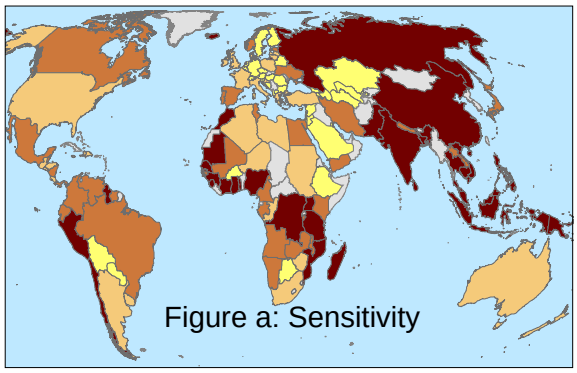
The Intergovernmental Panel on Climate Change defines vulnerability to climate change as a combination of the potential impact (sensitivity plus exposure) and adaptive capacity.

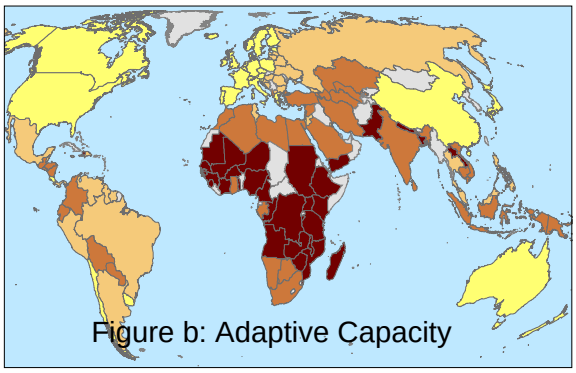


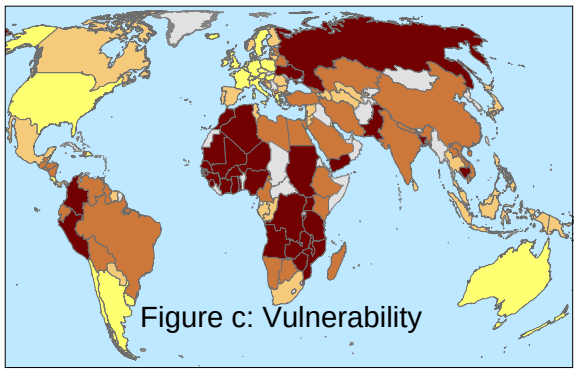
National exposure to climate change was measured as the average predicted surface temperature in 2050. Sensitivity represented the national relative importance of fisheries and was a composite of: number of fisherfolk, poverty (1-per capita GDP), fish export value as a proportion of total export value, size of fisheries employment sector, total catch and contribution of fish to daily protein intake. Adaptive capacity (resilience) was a composite of human development indices and economic performance, including; life expectancy, literacy rates, school attendance, size of economy, political stability and good governance, law, accountability and corruptibility[7].

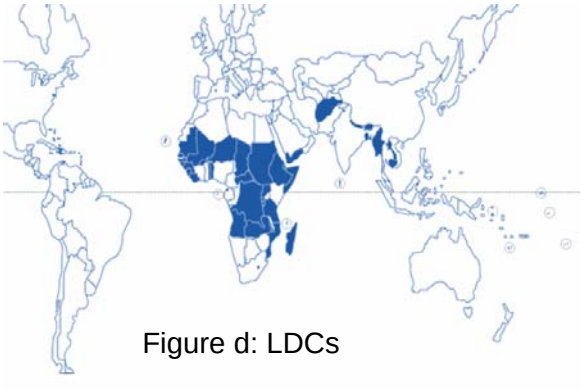
[7] Allison, E H; Adger, W N; Badjeck, M-C; Brown, K; Conway, D; Dulvy, N K; Halls, A; Perry, A & Reynolds, J D (2005) Effects of climate change on the sustainability of capture and enhancement fisheries important to the poor: analysis of the vulnerability and adaptability of fisher folk living in poverty. DFID Fisheries Management Science Programme Project R4778J, UK.

Box 5. Global comparison of vulnerability to climate impacts on fisheries









In the figures above the darker colours represent higher sensitivity (Figure a), lower adaptive capacity (Figure b) and higher vulnerability (Figure c). Many of the most vulnerable countries have already been identified as Least Developed Countries based on other economic and vulnerability criteria (Figure d). West African and Central African fisheries form the bulk of the most vulnerable countries to climate impacts on fisheries.

Livelihood and institutional responses to past climate variability

Livelihood responses

Fishing communities have often developed coping strategies to deal with fluctuating environmental conditions. Observations on Lake Chilwa, in Malawi, have shown that when the lake dries up (approximately every 10 years) resident communities use the lakebed for agricultural land. When they return to fishing, they invest in low-value gear to offset the risk of a sudden drop in water levels[8]. In Northern Nigeria communities surrounding the floodplain fisheries on the Nguru-Gashua wetlands have developed different access rights depending on the water level (Box 6).

Box 6. Northern Nigeria: Variable access rights to deal with a variable climate

The Nguru-Gashua Wetlands in Northern Nigeria are an important source of fisheries resources for surrounding villages. During the flood season there is an open access regime to the river fisheries. When the floods recede village water management councils manage the deep sections of the river. Fishers either pay for the right to use the deep sections or give up part of their catch to the council; outsiders must seek permission. River sectors are fished one at a time until each is exhausted. Floodplain pools are owned by individuals or families, who must also give up some of their catch to the village, which uses the proceeds for community development projects.

Source: Neiland, A. E; Madakan, D; Bene, Christopher, B (2005) Traditional Management Systems, Poverty and Change in the Arid Zone Fisheries of Northern Nigeria. Journal of Agrarian Change 5: 177-148

Institutional responses

Co-management approaches to fisheries can benefit local communities by giving them more control over their resources. However if this is not based on an understanding of livelihood and current coping strategies it can increase communities vulnerabilities to climate variability (Box 7).

Box 7. Lake Malawi: Social systems for fluctuating fisheries

Artisanal fisheries on Lake Malawi focus on highly seasonal fish resources. The Tonga ethnic group originally come from the Northern banks of the lake, but migrate to capitalise on the productive waters in the southern areas of the lake and follow the seasonal patterns of the fish populations. Lake-side communities along the southern banks do not engage in full time fishing to the same extent, but benefit from access payments of migratory fishers and combine part time fishing with a diversified livelihood in farming or non-farming enterprises.

Recent developments in co-management arrangements for fisheries management have been based on lakeside communities, effectively excluding migratory fishers from management decisions. This undermines the use of migration as an adaptation strategy to seasonal variability, and will also negatively affect lakeside communities that are reliant on access fees and job opportunities from migratory fishers.

Source: Allison, E H; Ellis, F; Mathieu, L; Musa, A; Mvula, P M and Tinch, R (2002) Final Technical Report Project R7336: Sustainable Livelihoods from Fluctuating Fisheries, Fisheries Management Science Programme, DFID

It has been increasingly recognised that reducing the vulnerability of fishing communities as a whole is an opportunity to address poverty and enhance adaptive

[8] Pers. Comm. Friday Njaya, Department of Fisheries Malawi

capacity to a range of shocks, including those resulting from climate variability and extreme events (Box 8).

Box 8. Supporting coastal communities in Mozambique
The diversification of livelihoods is being supported for coastal communities in Capo Delgado, Mozambique through tourism developments. Over 300 people have gained employment or training opportunities through a tourism initiative to protect and promote turtle nesting areas along beaches, Moz. Local fishers were selected by community leaders to be employed as turtle monitors and an 'accommodation levy' imposed on tourists is being tested to provide finance for community development projects including healthcare, water wells, schools, roads, small businesses and support for conservation initiatives.

Source: Zoological Society of London (ZSL), 2005. The Cabo Delgado Biodiversity & Tourism

Risk reduction initiatives are another response that is becoming increasingly important within coastal and floodplain communities. Such approaches seek to address vulnerabilities through early warning systems, disaster recovery programmes and enhancing ecological resilience (Box 9). In Sri Lanka the presence of natural barriers such as sand dunes, mangrove forests and coral reefs protected coastlines from the full impact of the Indian Ocean tsunami by dampening the energy of the waves. However throughout Asia deforestation of mangroves for intensive shrimp production has removed this natural barrier and also reduced livelihood options available to local farming and fishing communities, and hence opportunities for economic recovery from the Tsunami.

Box 8. Benefits for fisheries through disaster protection, Vietnam
There are a number of potential synergies between risk reduction and improving coastal habitats. In Vietnam the Red Cross has assisted coastal communities to replant mangrove, improving physical protection from storms. This has reduced the cost of maintaining coastal defences (dykes) and saved lives and property during typhoon seasons. Restoration of the mangroves has also improved fisheries livelihoods through the harvesting of crabs, shrimps and molluscs.

Source: International Federation of Red Cross and Red Crescent Societies 2001. World Disasters Report: Focus on Reducing Risks. Geneva. IFRC.

Uncertainties in climate change impacts

Although there is increasing awareness of the potential risks of climate change on poor fishing communities, uncertainty remains. These include the predicted changes in climate, how this will affect fisheries resources and ecosystems, and how this will interact with social systems at the community and national level.

More detailed predictions of climate change effects on specific fisheries systems are needed to determine the net climate induced changes. This requires increased spatial resolution of both ocean and land temperature forecasts. Regional rainfall forecasts would help planning and management in river basins. The knock-on effect on poverty will require a better understanding of the contribution of fisheries to poverty reduction, and better data on the numbers reliant on small-scale fisheries.

Greater understanding of how fishers cope and adapt to fisheries systems that vary naturally in productivity would assist in developing appropriate adaptation strategies to the additional impacts of climate change. There is also a clear need to assess the relative risk of climate change on fisheries sectors against impacts on other natural resource sectors and other hazards that result in high levels of poverty, e.g. HIV/AIDS, political marginalisation, inequity and poor governance.

Time for Action

Despite the uncertainty of climate change impacts on the contribution of fisheries to poverty alleviation, there are opportunities to reduce the vulnerability of fishing communities to climate variability that will also reduce their poverty.

Fisheries managers

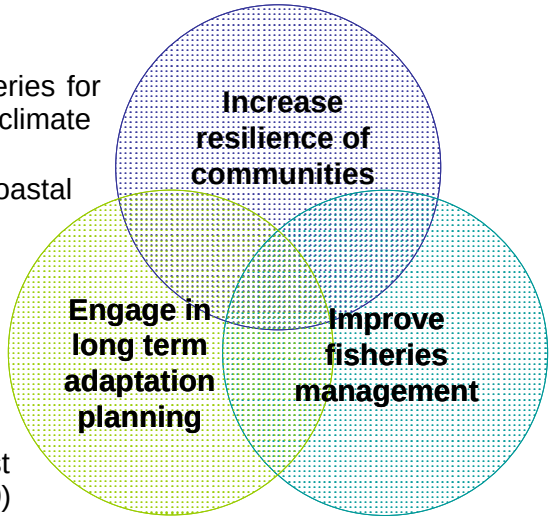
- Build institutions that are able to consider and respond to climate change threats along with other pressures such as over fishing, pollution and changing hydrology
- Link with disaster management and risk reduction planning especially concerning planning coastal or flood defences, understanding levels of vulnerability and enhancing resilience of fishing communities.
- Address issues contributing to the vulnerability of fishing communities and support existing coping and adaptation strategies
- Engage in long-term adaptation planning to address longer-term trends or potential large-scale shifts in resources or ecosystems.

NGOs

- Communicate the importance of fisheries for poverty alleviation and the risks of climate change to policy makers
- Build and support the resilience of coastal and other fisheries communities
- Support risk reduction initiatives within fishing communities

Adaptation planners

- Incorporate fisheries issues within National Adaptation Programmes of Action (NAPAs) for the Least Developed Countries (LDCs) (Box 10)



Box 9 National Adaptation Programmes of Action (NAPAs)

National Adaptation Programmes of Action (NAPAs) are being supported by GEF funding to address the urgent and immediate national needs of least developed countries (LDCs) for adapting to the adverse impacts of climate change.

Guyana has completed a National Climate Change Adaptation Policy and Implementations Plan. This identifies potential climate change threats to fisheries including the impacts of increased flooding and sea level rise on infrastructure, and potential negative impacts on mangroves - a vital habitat supporting the shrimp export market. However adaptation strategies focus on coastal management without specific attention to the fisheries sector. Since coastal erosion is a particular concern in Guyana, adaptation strategies might be planned that are detrimental to the fisheries resources.

Bangladesh has also drafted a NAPA and held a National Stakeholder Consultation Workshop. The adaptation options for fisheries focuses on aquaculture, but does not consider options for mitigating adverse effects of river floods or droughts on river fisheries.

Source: http://www.undp.org/cc/napa.htm