

CLIMATE CHANGE AND FISH RESOURCES

Information sources

Addendum to the MRC Technical Workshop on Application of Modelling Tools for Climate Change Impact and Vulnerability Assessment, Bangkok, 8 – 9 September 2009

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Brief: The threat to fisheries and aquaculture from climate change

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WorldFish CENTER
POLICY BRIEF

The threat to fisheries and aquaculture from climate change

Key messages

- Significance of fisheries and aquaculture. Fish provides essential nutrition and income to an ever-growing number of people around the world, especially where other food and employment resources are limited. Many fishes and aquacultures are poor and ill-prepared to adapt to change, making them vulnerable to impacts on fish resources.
- Nature of the climate change threat. Fisheries and aquaculture are threatened by changes in temperature and, in freshwater ecosystems, precipitation. Storms may become more frequent and extreme, impinging habitat, stocks, infrastructure and livelihoods.
- The need to adapt to climate change. Greater climate variability and uncertainty complicates the task of identifying impact pathways and areas of vulnerability, requiring research to detect and pursue coping strategies and improve the adaptability of fishes and aquacultures.
- Strategies for coping with climate change. Fish can provide opportunities to adapt to climate change by, for example, integrating aquaculture and agriculture, which can help farmers cope with drought while boosting profits and household nutrition. Fisheries management must move from seeking to maximize yield to increasing adaptive capacity.

The significance of fisheries and aquaculture

Population growth is accompanied by increasing demand for food fish, with direct human consumption of fish reaching an estimated 103 million tons in 2005. Fish is the main source of animal protein for a billion people worldwide. As well as providing a valuable protein complement to the starchy diet common among the global poor, fish is an important source of essential vitamins and fatty acids.

Some 200 million people and their dependants worldwide, most of them in developing countries, live by fishing and aquaculture. Fish provides an important source of cash income for many poor households and is a widely traded food commodity. In addition to stimulating local market economies fish can be an important source of foreign exchange.

Fishing is frequently integral to mixed livelihood strategies, in which people take advantage of seasonal stock availability or resort to fishing when other forms of food production and income generation fall short. Fishing often is related to extreme





Fisheries and Aquaculture in a Changing Climate

Climate change impacts such as more frequent and severe floods and droughts will affect the food and water security of many people. The impact of climate change on aquatic ecosystems, fisheries and aquaculture, however, is not as well known. This policy brief is a joint partnership between several agencies, highlights this issue to ensure that decision makers and climate change negotiators consider aquatic ecosystems, fisheries and aquaculture at the UNFCCC COP-15 in Copenhagen, December 2009.

The buildup of carbon dioxide and other greenhouse gases in the atmosphere [1] is changing several of the features of the Earth's climate, oceans, coasts and freshwater ecosystems that affect fisheries and aquaculture – air and sea surface temperatures, rainfall, sea level, acidity of the ocean, wind patterns, and the intensity of tropical cyclones.

Climate change is modifying the distribution and productivity of marine and freshwater species and is already affecting biological processes and altering food webs. The consequences for sustainability of aquatic ecosystems, fisheries and aquaculture, and the people that depend on them, are uncertain.

Fishes, fish farmers and coastal inhabitants will bear the full force of these impacts through less stable livelihoods, changes in the availability and quality of fish for food, and rising risks to their health, safety and homes. Many fishery-dependent communities already live a precarious and vulnerable existence because of poverty, lack of social services and essential infrastructure. The fragility of these communities is further undermined by overexploited fishery resources and degraded ecosystems. The implications of climate change for food security and livelihoods in small island states and many developing countries are profound.



Brief: Fisheries and aquaculture in a changing climate

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Brief: Climate change: research to meet the challenges facing fisheries and aquaculture

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ISSUES BRIEF | 1701

Fisheries and aquaculture can provide solutions to cope with climate change

KEY MESSAGES:

- Significance of fisheries and aquaculture. Fish provides nutritious food, fishing and fish farming generate income and employment to millions of poor people, and fish and fishery products contribute to poverty reduction and national economic growth in many developing nations.
- Nature of the climate change threat. Global warming affects aquatic ecosystems and their fishery productivity. Fisheries and aquaculture are also threatened by the secondary effects of warming: changes in ocean currents, precipitation that affects lake levels and river flows, and increasing storminess and sea level floods and droughts. This makes living near water and catching or farming fish more hazardous than it already is.
- The need to adapt to climate change. Greater climate variability and uncertainty complicate the task of governing fisheries and expanding aquaculture sustainably. Fish can provide opportunities to adapt to climate change. For example, integrating aquaculture and agriculture, which can help farmers cope with drought while boosting profits and household nutrition. Fisheries management must move from seeking to maximize yield to increasing adaptive capacity. Research is needed to find innovative ways to further improve the existing adaptability of fishes and aquaculturists.

Climate change has moved to front and center of the world's environmental agenda, and rightly so. Because fisheries production depends so heavily on climate, this brief shows how WorldFish is working with partners to help nations deal with impending change.

A major new study by the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment concludes that:

- In the low latitudes of the tropics, many wet areas will get wetter and dry areas, drier, aggravating drought and food shortages.
- Weather events will become more extreme, creating more variability in water supplies that drive agricultural and hydrological systems.
- Rising water temperatures may reduce the spawning of food supplies that fish in upper water layers depend on, and increased carbon dioxide in the atmosphere will increase the acidity of water bodies, adversely affecting shellfish and coral reefs.
- Coastal areas and islands will be especially hard hit by rising sea levels and more intense oceanic storms such as typhoons or hurricanes.

While many of these changes will severely undermine fisheries, some will deliver benefits. For example, with tight technological and farming systems, farmers can use flooded and saline areas no longer suitable for crops to cultivate fish. They can also use freshwater reservoirs and ponds used for fish culture, to moderate the swings between drought and



Climate Change: Research to Meet the Challenges Facing Fisheries and Aquaculture

KEY MESSAGES

- Climate change poses new challenges to the sustainability of fisheries and aquaculture systems, with serious implications for the 820 million people who depend on them for their livelihoods and the nearly 2 billion people for whom fish is an important source of animal protein.
- To help meet these challenges, climate change research at the WorldFish Center aims to work with partners to:
 1. focus climate change responses where they are most needed by assessing and mapping the vulnerability of fishery- and aquaculture-dependent people and regions to the impacts of climate change;
 2. reduce people's vulnerability to these impacts by identifying appropriate adaptation strategies;
 3. contribute to climate change mitigation by identifying ways to reduce greenhouse gas emissions and aquaculture carbon aquatic production systems; and
 4. build local, national and regional capacity to implement adaptation and mitigation strategies for fisheries and aquaculture by streamlining policy processes.

THE CLIMATE CHANGE CHALLENGE

The Intergovernmental Panel on Climate Change predicts that atmospheric temperatures will rise by 1.5-6.0°C globally by 2100 (IPCC 2007). This warming will be accompanied by rising sea temperatures, changing sea levels, increasing ocean acidification, altered rainfall patterns and sea level rise, and higher incidence of extreme weather events.

The productivity, distribution and seasonality of fisheries, and the quality and availability of the habitats that support them, are sensitive to these climate change effects. In addition, many fishery-dependent communities and aquaculture operations are in regions highly exposed to climate change. Governments and policymakers now recognize that the climate change impacts on coastal and riparian environments, and on the

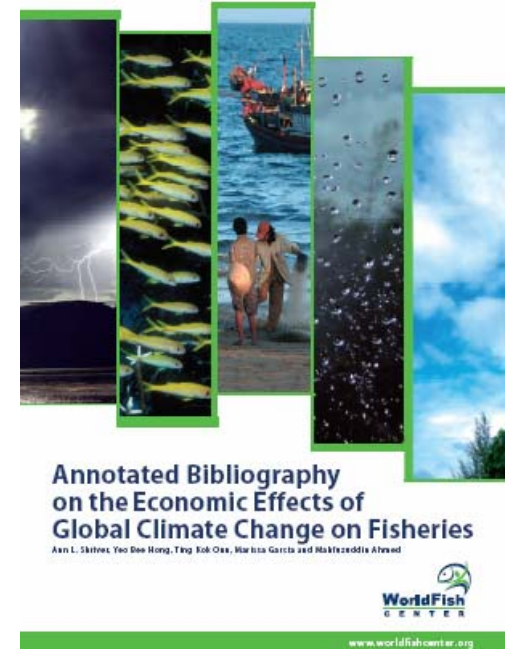
Brief: Fisheries and aquaculture can provide solutions to cope with climate change

www.worldfishcenter.org/resource_centre/CC-ThreatToFisheries1701.pdf

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Report: Annotated bibliography on the economic effects of global climate change on fisheries

www.worldfishcentre.org/resource_centre/WF_GLocalClimate_FA.pdf



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Enhancing the resilience of inland fisheries and aquaculture systems to climate change

Edward H. Allison¹, Heidi L. Anderson, Anna Olson

WorldFish Center
PO Box 106, CGPO, 13670
Ponape, Micronesia

¹Corresponding Author: E.Allison@worldfishcenter.org

Abstract

Some of the most important inland fisheries in the World are found in semi-arid regions. Production systems and livelihoods in arid and semi-arid areas are at risk from future climate variability and change; their fisheries are no exception. This paper reviews the importance of fisheries to livelihoods in 'aridlands & drylands', with a focus on communities in Africa. We examine the threats posed by climate change to the traditional 'livelihood' of fishing, farming and livestock herding. Although both livelihood strategies and local institutions are highly adapted to cope with, and benefit from, climate-related variability, resilience in the wider governance and socio-economic environment means that the overall adaptive capacity of these regions is low and the future for the fisheries are vulnerable to projected climate change. In order to maintain the important nutritional, economic, cultural and social benefits of fisheries in the face of climate change, planned adaptation at scales from the local to the regional (transnational) is required. We use the concept of resilience in linked socio-ecological systems to examine how such responses may be developed and promoted. Key strategies include facilitating people's geographical and occupational mobility, improving recreational water and tourism planning, and promoting forms of aquaculture that help build resilience of farming systems to seasonal and systemic stressors.

Key words: vulnerability, adaptation, fisheries, livelihoods, Lake Chad, Malawi

1. Introduction: the contribution of fisheries to development and their vulnerability to climate change

The majority of the world's 200 million inland fishers (fishers and other stakeholders and their dependents) live in areas that are highly exposed to human-induced climate change, and depend for a major part of their livelihood on resources whose distribution and productivity are known to be influenced by climate variation (Allison et al., 2013). While the climate-resilience of major inland fisheries of drylands and semi-arid regions remains, such

Article: Enhancing the resilience of inland fisheries and aquaculture systems to climate change.

<http://www.icrisat.org/Journal/SpecialProject/sp15.pdf>

Others resources (WorldFish contributions)

Article: A place at the table? (Fisheries, food security and climate change)

www.nature.com/climate/2009/0906/full/climate.2009.52.html



Commentary
Published online 25 May 2009 | DOI: 10.1038/nclimate.2009.52

A place at the table?
 The fishery is a hard sell

As the biological science of food security and livelihoods, fisheries must be included in ongoing discussions of how the world's most vulnerable can adapt to climate change.

It is not enough to focus on the world's most vulnerable and how they have lost out on existing production opportunities, primarily through overfishing and climate change. Instead, fisheries and aquaculture resources have been used by the rapidly increasing number of people who are dependent on them. And the high seas are the last best hope for the world's most vulnerable. Fisheries and aquaculture are the only food systems that can be produced in the most vulnerable regions. In the world's most vulnerable regions, fisheries and aquaculture are the only food systems that can be produced in the most vulnerable regions. In the world's most vulnerable regions, fisheries and aquaculture are the only food systems that can be produced in the most vulnerable regions.

Increasing ocean productivity

Currently, one-third of the world's fishery catch is used to produce fish products for aquaculture. This is the most productive and profitable sector in aquaculture and a major driver of the industry's growth. It is also the most productive and profitable sector in aquaculture and a major driver of the industry's growth. It is also the most productive and profitable sector in aquaculture and a major driver of the industry's growth.

Double jeopardy

Sea level rise and sea level rise are the two most significant threats to the world's most vulnerable. Sea level rise and sea level rise are the two most significant threats to the world's most vulnerable. Sea level rise and sea level rise are the two most significant threats to the world's most vulnerable.

Figure 1: Coastal vulnerability

The vulnerability of coastal communities to the impacts of climate change is a function of the level of exposure to the hazard, the sensitivity of the community to the hazard, and the adaptive capacity of the community. The vulnerability of coastal communities to the impacts of climate change is a function of the level of exposure to the hazard, the sensitivity of the community to the hazard, and the adaptive capacity of the community.

Vulnerability of national economies to the impacts of climate change on fisheries

Edward H. Allison^{1,2}, Alison L. Perry^{3,4}, Maria Carolina Balboa^{1,4}, W. Neil Adger⁵, Katrina Brown^{1,4}, Declan Conway^{1,4}, Ashley S. Hill⁶, Graham M. Hill⁷, John D. Reynolds⁸, Neil L. Andrew⁹ & Nicholas K. Dalrymple^{2,4}

¹The WorldFish Center, CPO Box 500, Penang, Malaysia; ²School of Development Studies, University of East Anglia, Norwich, NR4 7TJ, UK; ³School of Biological Sciences, University of East Anglia, Norwich, NR4 7TJ, UK; ⁴Centre for Marine Technology, University of Bremen, 28359 Bremen, Germany; ⁵Global Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, UK; ⁶Mekong River Commission, c/o Inland Fisheries Research and Development Institute, P.O. Box 582, Phnom Penh, Cambodia; ⁷Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, Suffolk, NR33 0HT, UK; ⁸Department of Biological Sciences, Simon Fraser University, Burnaby, BC V5A 1S5 Canada

Abstract
 Anthropogenic global warming has significantly influenced physical and biological processes at global and regional scales. The observed and anticipated changes in global climate present significant opportunities and challenges for societies and economies. We compare the vulnerability of 112 national economies to potential climate change impacts on their capture fisheries using an indicator-based approach. Countries in Central and Western Africa (e.g. Malawi, Guinea, Senegal, and Uganda), Peru and Colombia in north-western South America, and four tropical Asian countries (Bangladesh, Cambodia, Pakistan, and Yemen) were identified as most vulnerable. This vulnerability was due to the combined effect of projected warming, the relative importance of fisheries to national economies and diets, and limited societal capacity to adapt to potential impacts and opportunities. Many vulnerable countries were also among the world's least developed countries whose inhabitants are among the world's poorest and whose diet is reliant on fish, which provides 27% of dietary protein compared to 13% in least vulnerable countries. These countries also produce 20% of the world's fish exports and are in greatest need of adaptation planning to maintain or enhance the contribution that fisheries can make to poverty reduction. Although the precise impact and direction of climate-driven change for particular fish stocks and fisheries are uncertain, our analysis suggests they are likely to lead to either increased economic hardship or missed opportunities for development in countries that depend upon fisheries but lack the opportunity to adapt.

Correspondence
 Nicholas K. Dalrymple, Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, Suffolk, NR33 0HT, UK. Department of Biological Sciences, Simon Fraser University, Burnaby, BC V5A 1S5 Canada. Tel: (+1) 778-782-402 Fax: (+1) 778-782-586 Email: nick.dalrymple@ec.gc.ca

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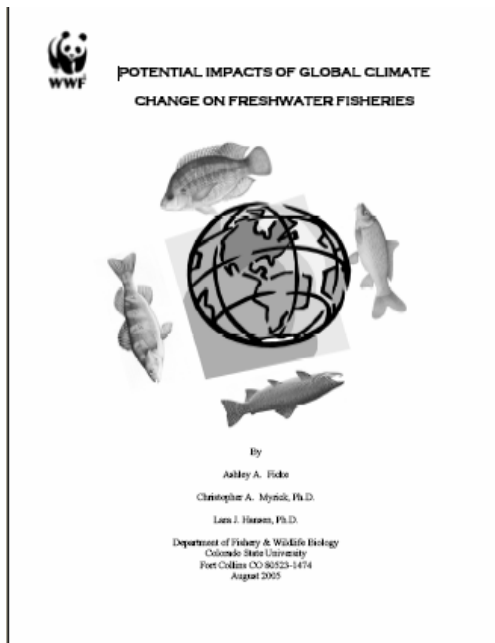
Article: Vulnerability of national economies to the impacts of climate change on fisheries

www3.interscience.wiley.com/journal/121681399/abstract?

Others resources

Report: FAO Expert Group on fisheries and climate change

<ftp://ftp.fao.org/docrep/fao/010/i0203e/i0203e00.pdf>



Report: Potential impacts of global climate change on freshwater fisheries

<http://assets.panda.org/downloads/fwfishreport902nov05.pdf>