



Food and Agriculture Organization
of the United Nations

Global strategies and knowledge on climate change and fisheries and aquaculture

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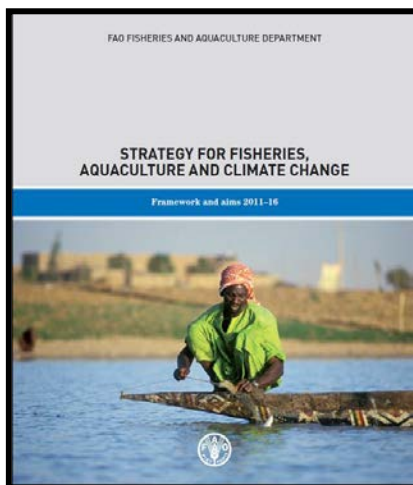
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Key Publications

***Global Strategies and Knowledge on Climate Change and Fisheries
and Aquaculture***

Fisheries and Aquaculture Department Climate Change Strategic Framework



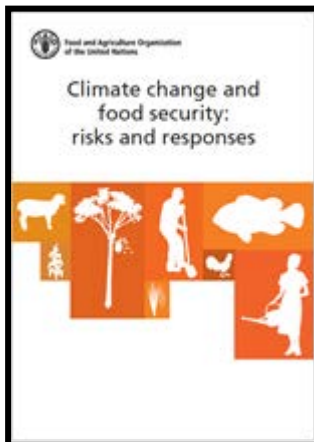
The aim of this document is to provide the medium-term (2011–16) strategic framework defining the perspectives and objectives of the FAO Fisheries and Aquaculture Department with respect to climate change issues and development responses, and its coherence and operational effectiveness with respect to more localized delivery through regional and subregional offices. The goal of the program is to enable people, communities and States to meet their social and development objectives effectively while responding to the additional challenges imposed by climate change on fisheries and aquaculture. The purpose of the program is to support Member States and partners in mitigating, and adapting effectively to, the impacts of climate change for fisheries, aquaculture and aquatic ecosystems, through policy development, knowledge development and exchange, normative outputs, practical demonstrations, and capacity building.

FAO. 2012. *Strategy for Fisheries, Aquaculture and Climate Change*. Rome.

The PDF publication can be downloaded from the following url:

<http://www.fao.org/3/a-at500e.pdf>

Global overview of Climate Change implications for food security



By adopting the sustainable development goals, the world has committed to ending hunger, achieving food security and improving nutrition by 2030. But climate change is already undermining the livelihoods and food security of the most vulnerable populations. Ensuring food security and good nutrition in the face of climate change is among the most daunting challenges facing humankind.

The report *Climate change and food security: risks and responses* brings together evidence from the Intergovernmental Panel on Climate Change (IPCC), updated by the latest evidence and scientific findings as well as by results from experience on the ground, on the impacts of climate change on food security and nutrition. It shows how a cascade of impacts from ecosystems to livelihoods interacts with a series of vulnerabilities, undermining food security and nutrition, especially of the most vulnerable populations. The report presents ways to adapt, to reduce vulnerabilities and to build resilience to climate change. It shows the importance of

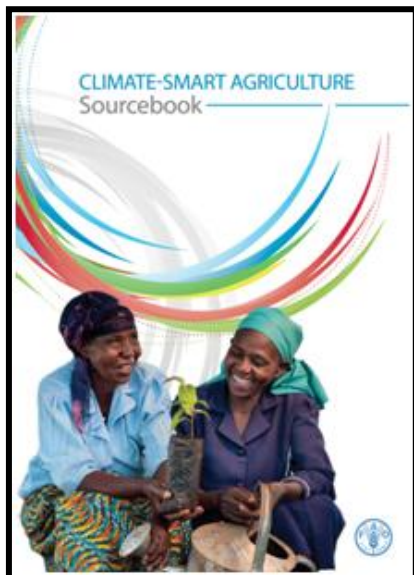
acting now to address climate change, to ensure food security and good nutrition for all, now and in the future.

FAO. 2016. *Climate change and food security: risks and responses*. Rome.

The PDF publication can be downloaded from the following url:

<http://www.fao.org/3/a-i5188e.pdf>

Fisheries and Aquaculture in the Climate-smart Agriculture Sourcebook



There has been a rapid uptake of the term Climate-Smart Agriculture (CSA) by the international community, national entities and local institutions, in the past years. However, implementing this approach is challenging, partly due to a lack of tools and experience. Climate-smart interventions are highly location-specific and knowledge-intensive. Considerable efforts are required to develop the knowledge and capacities to make CSA a reality. The purpose of the sourcebook is to further elaborate the concept of CSA and demonstrate its potential, as well as its limitations. This sourcebook is a reference tool for planners, practitioners and policy makers working in agriculture, forestry and fisheries at national and subnational levels, dealing with the effects of climate change.

FAO. 2013. *Climate-smart Agriculture Sourcebook*. Rome.

The PDF publication can be downloaded from the following url:
<http://www.fao.org/docrep/018/i3325e/i3325e00.htm>



***Understanding Vulnerability Climate Change in Fisheries and
Aquaculture***

Vulnerability assessment methodologies and their relevance to fisheries and aquaculture



From relatively limited and narrow uses two decades ago, the concept of vulnerability has emerged as a key dimension of the development debate. Be it in relation to climate change, disasters, globalization and economic development, and social–ecological system changes more generally, vulnerability is a complex and multifaceted concept that has attracted the attention of scholars and development practitioners from all disciplines. The many interpretations of vulnerability and its many scales (e.g. individual, community, ecosystem, countries, continents) and fields of application have led to a wide array of propositions regarding ways and means by which vulnerability could be studied, characterized, understood, and acted upon. This multiplication of approaches and methodologies of assessment has enabled new insights into the causes and consequences of vulnerability, but has also caused some confusion among practitioners and led to the voicing of a need for clarification and guidance on how best to approach the study of vulnerability. This publication provides an overview of vulnerability assessment concepts and methodologies. It sheds

light on the different vulnerability assessment methodologies that have been developed, and on how these are conditioned by the disciplinary traditions from which they have emerged. It also analyses how these methodologies have been applied in the context of fisheries and aquaculture, with illustrative examples of their application. A series of practical steps to assess vulnerability in the fisheries and aquaculture sector is proposed in order to support climate change specialists working with communities dependent on fisheries and aquaculture, as well as fisheries and aquaculture practitioners wishing to incorporate adaptation planning into the sector's management and development.

Brugère, C & De Young, C. 2015. *Assessing climate change vulnerability in fisheries and aquaculture: Available methodologies and their relevance for the sector*. FAO Fisheries and Aquaculture Technical Paper No. 597. Rome, FAO.

The PDF publication can be downloaded from the following url:
<http://www.fao.org/3/a-i5109e.pdf>

Global overview of Climate Change implications for fisheries and aquaculture, from impacts to adaptation and mitigation



An overview of the current scientific knowledge available on climate change implications for fisheries and aquaculture is provided through three technical papers that were presented and discussed during the Expert Workshop on Climate Change Implications for Fisheries and Aquaculture (Rome, 7–9 April 2008). A summary of the workshop outcomes as well as key messages on impacts of climate change on aquatic ecosystems and on fisheries- and aquaculture-based livelihoods are provided in the introduction of this Technical Paper. The first paper reviews the physical and ecological impacts of climate change relevant to marine and inland capture fisheries and aquaculture. The paper begins with a review of the physical impacts of climate change on marine and freshwater systems and then connects these changes with observed effects on fish production processes. It also outlines a series of scenarios of climate change impacts on fish production and ecosystems through case studies in different regions and ecosystems. The second paper tackles the consequences of climate change impacts

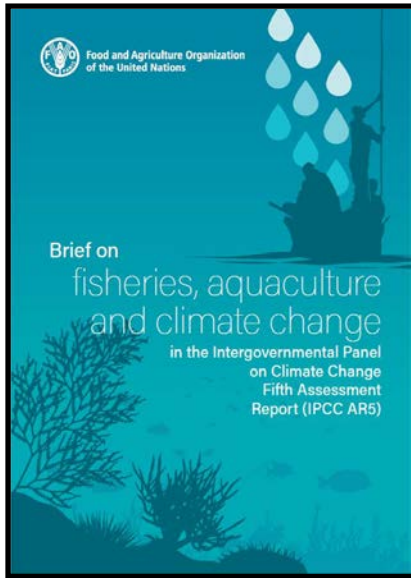
on fisheries and their dependent communities. It analyses the exposure, sensitivity and vulnerability of fisheries to climate change and presents examples of adaptive mechanisms currently used in the sector. The contribution of fisheries to greenhouse gas emissions is addressed and examples of mitigation strategies are given. The role of public policy and institutions in promoting climate change adaptation and mitigation is also explored. Finally, the third paper addresses the impacts of climate change on aquaculture. It provides an overview of the current food fish and aquaculture production and a synthesis of existing studies on climate change effects on aquaculture and fisheries. The paper focuses on the direct and indirect impacts of climate change on aquaculture, in terms of biodiversity, fish disease and fishmeal. Contribution of aquaculture to climate change is addressed (carbon emission and carbon sequestration), as well as possible adaptation and mitigation measures that could be implemented.

Cochrane, K., De Young, C., Soto, D. & Bahri, T., eds. 2009. *Climate change implications for fisheries and aquaculture: overview of current scientific knowledge*. FAO Fisheries and Aquaculture Technical Paper No. 530. Rome, FAO.

The PDF publication can be downloaded from the following url:

<http://www.fao.org/docrep/012/i0994e/i0994e00.htm>



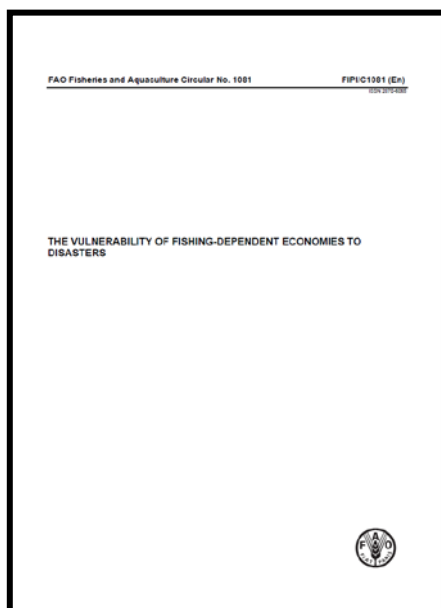


The FAO Fisheries and Aquaculture Department has prepared this Brief on Fisheries, Aquaculture and Climate Change in the AR5 to provide an entry point to the vast AR5 content specifically for those interested in the fisheries and aquaculture sector and its dependent communities who are directly and indirectly affected by climate change and variability. This brief synthesizes the Intergovernmental Panel on Climate Change Fifth Assessment Report's (AR5) important knowledge on how climate change is already manifesting itself through the aquatic systems, what the future changes may be and their predicted impacts on food and livelihood security, marine and inland fisheries and aquaculture systems, and overviews AR5's information on implications of climate change and variability for capture fisheries, aquaculture and dependent communities in eight regions: Africa, Asia, Australasia, Central and South America, Europe, North America, Small Island States and Polar Regions. In this context, adaptation options suggested by the AR5 will be outlined for each. It concludes with a review of knowledge gaps from the fisheries and aquaculture perspective that could benefit from further IPCC efforts.

FAO. 2016. *Brief on Fisheries, Aquaculture and Climate Change in the Intergovernmental Panel on Climate Change Fifth Assessment Report (IPCC AR5)*. Rome.

The PDF publication can be downloaded from the following url:
<http://www.fao.org/3/a-i5871e.pdf>

The vulnerability of fishing-dependent economies to disasters



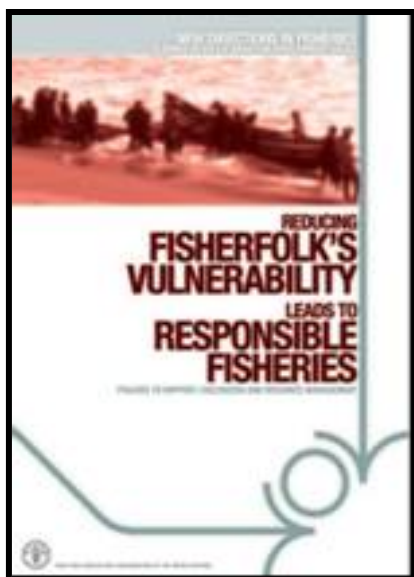
This circular examines the vulnerability of fishing-dependent communities to natural disasters. The objective was to identify countries that are particularly vulnerable to disasters but also those that are less resilient. Fisheries and fishing-dependent people are often located in places that are at particularly high risk of extreme events such as flooding, cyclones, and tsunamis, while inland fisheries can be significantly affected by droughts and floods. In addition to the tragic loss of life, disasters can have direct impacts on livelihoods such as destruction of gear, infrastructure and productive assets, such as boats, landing sites, and post-harvesting facilities. Indirect impacts can also be important through disruption to markets and through reducing harvesting capacity and access to markets, food supply and employment, thereby affecting both local livelihoods and the overall economy. The circular concludes that the fishery sectors of African and Southeast Asian countries are most vulnerable to disasters, according to both frequency and mortality exposure indicators, fishery-dependence, and capacity to adapt. Recommendations are made with respect to strengthening understanding of vulnerability measurement.

Badjeck, M.-C., Perry, A., Renn, S., Brown, D. & Poulain, F. 2013. *The vulnerability of fishing-dependent economies to disasters*. FAO Fisheries and Aquaculture Circular No. 1081. Rome, FAO.

The PDF publication can be downloaded from the following url:
<http://www.fao.org/docrep/018/i3328e/i3328e00.htm>

Supporting Adaptation in Fisheries and Aquaculture

Policy brief to reduce fisherfolk's vulnerability



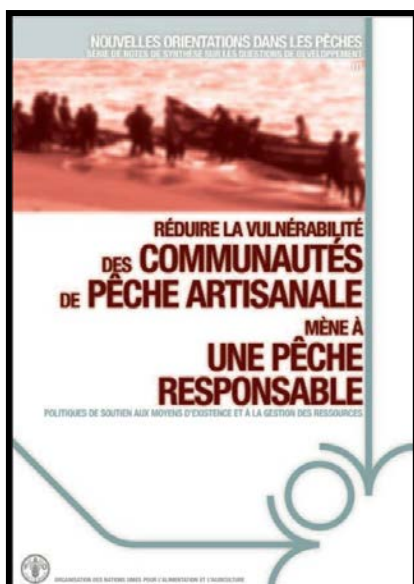
The aim of this policy brief is to 1) Highlight the different ways in which small scale fisheries currently contribute to poverty alleviation and food security, with a focus on West Africa. Propose that decreasing people's vulnerability and marginalization are key ways of reducing poverty among fishing-dependent people without putting additional pressure on fully- or over- exploited fishery resources; 2) Show that diminishing fisherfolk's vulnerability and marginalization will increase their incentives and capacity to participate in resource management; 3) Emphasize that reducing fisherfolk's vulnerability and supporting their social inclusion will help to enhance the flow of benefits from fisheries and increase the sector's contribution to pro-poor economic growth at local, national and regional levels; and 4) Outline response strategies and recommendations for national governments, donor and international organizations, and policy-makers in fisheries.

FAO. 2006. *Reducing fisherfolk's vulnerability leads to responsible fisheries. Policies to support livelihoods and resource management.* New Directions in Fisheries – A Series of Policy Briefs on Development Issues No. 01. Rome.

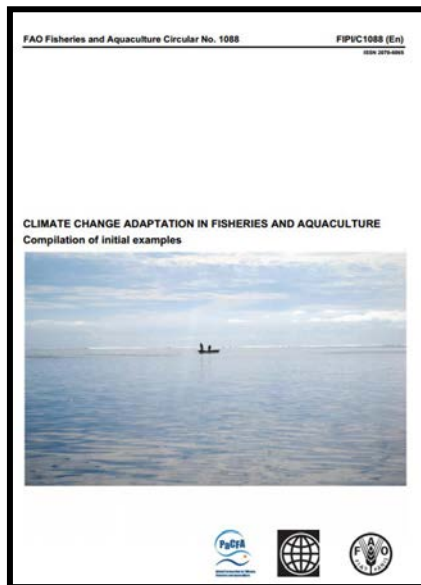
The PDF publication can be downloaded from the following url:

<http://www.fao.org/3/a-a0228e.pdf> (English)

<http://www.fao.org/3/a-a0228f.pdf> (French)



Fisheries and aquaculture climate change adaptation examples



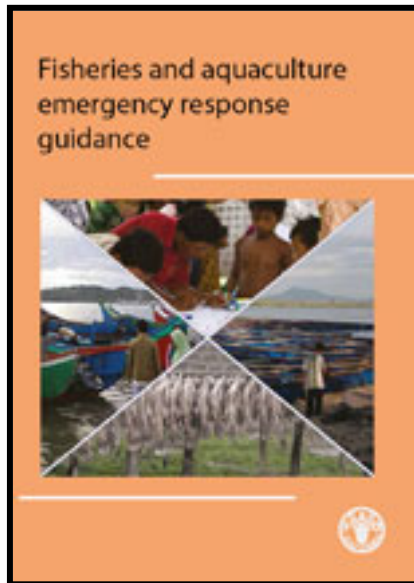
This circular contains a selection of current and recent climate change adaptation activities and measures in the fisheries and aquaculture sector. These examples provide an overview of the types of adaptation activities and programmes rather than a comprehensive review of adaptation activities addressing fisheries and/or aquaculture. Some of the highlighted activities are specifically targeted at addressing climate change impacts in fisheries or aquaculture, and others address related areas (e.g. coastal management and capacity building activities) that also have benefits for fisheries or aquaculture. In addition to specific examples, the publication provides an overview of climate change impacts on global fisheries and aquaculture and potential adaptation and mitigation strategies. Descriptions for 26 current or recent activities and programmes focused specifically on or benefiting fisheries and/or aquaculture (and other sectors if relevant), primarily in developing countries, highlight the diversity of potential adaptation actions at the local to regional scales. This circular is intended to provide a starting point for planners, policy-makers and practitioners who are involved in sectors related to fisheries and aquaculture around the globe.

Shelton, C. 2014. *Climate Change Adaptation in Fisheries and Aquaculture*. FAO Fisheries and Aquaculture Circular C1088. Roma, FAO.

The PDF publication can be downloaded from the following url:

<http://www.fao.org/docrep/019/i3569e/i3569e.pdf>

The Fisheries and aquaculture emergency response guidance



The Fisheries and Aquaculture Emergency Response Guidance (the Guidance) aims to help to save the lives and livelihoods of people in the fisheries and aquaculture sector who have been affected by disasters and humanitarian emergencies. It aims to do this by improving the quality of the design, implementation and assessment of interventions in fisheries and aquaculture in the wake of disasters. It draws on best practice and experience in responding to disasters that have affected fisheries and aquaculture and in supporting people working in the sector to rebuild their livelihoods.

Cattermoul, B., Brown, D. & Poulain, F., eds. 2014. *Fisheries and Aquaculture Emergency Response Guidance*. Rome, FAO.

The PDF publication can be downloaded from the following url:
<http://www.fao.org/3/a-i3432e/index.html>

Fisheries operations. Best practices to improve safety at sea in the fisheries sector



Article 6, paragraph 6.17, of the Code of Conduct for Responsible Fisheries recognizes that “States should ensure that fishing facilities and equipment, as well as all fishing activities, allow for safe, healthy and fair working conditions and meet internationally agreed standards adopted by relevant international organizations”. Consequently, following directions from the Food and Agriculture Organization (FAO) Committee on Fisheries, the three principle relevant international organizations, FAO, the International Labour Organization (ILO) and the International Maritime Organization (IMO), have cooperated in the development of mandatory and voluntary instruments, as well as guidelines for their implementation. Such cooperation was crucial in the revision of Parts A and B of the FAO/ILO/IMO Code of Safety for Fishermen and Fishing Vessels, as well as the in the development of the Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels and in the development of:

- Safety Recommendations for Decked Fishing Vessels of Less than 12 metres in Length and Undecked Fishing Vessels;
- Implementation Guidelines on Part B of the Code, the Voluntary Guidelines and the Safety Recommendations; and
- Revision of the Document for Guidance on Training and Certification of Fishing Vessel Personnel.

FAO. 2015. *Fisheries operations. Best practices to improve safety at sea in the fisheries sector.* FAO Technical Guidelines for Responsible Fisheries. No. 1, Suppl. 3. Rome.

The PDF publication can be downloaded from the following url:

<http://www.fao.org/3/a-i4740e/index.html>

Review of the current state of world capture fisheries insurance



Capture fisheries in marine and inland areas involve risks. Vessel insurance of marine capture fisheries vessels is available in many countries, but this is not the case for vessels and equipment used in inland capture fisheries.

The FAO Fisheries and Aquaculture Department decided to carry out the world review in recognition of the opportunities fisheries insurance services can offer to the sustainable development of capture fisheries in the developing countries. The review covers the following regions and countries: Asia (China, Japan, India), Africa (Mauritania, Morocco, Namibia, South Africa), Europe, the Russian Federation, the United States of America, South America (Peru, Chile) and Oceania (New Zealand, Australia).

This world review revealed that in Europe, North America, Oceania and South America, large composite private sector insurance companies often dominate the fisheries insurance market, whereas in Asia, public sector insurance companies are the ones playing a major role. Many international insurers have linkages with the London markets where the Institute Fishing

Vessel Clauses are promulgated, and these clauses are widely used throughout the industry. The “all risks” type of policies are most common, but the “named perils” policies are also frequently used, depending on the coverage desired by the individual fishing vessel owner and the costs of the policy coverage offered by insurers.

Van Anrooy, R., Ahmad, I.U., Hart, T., Hotta, M., Ping, Y., Yang, W., Shipton, T., Benoit, C., Ruchismita, R., Upare, S. & Siar, S.V. 2009. *Review of the current state of world capture fisheries insurance*. FAO Fisheries and Aquaculture Technical Paper. No. 510. Rome, FAO.

The PDF publication can be downloaded from the following url:

<http://www.fao.org/docrep/011/i0744e/i0744e00.htm>

Fisheries in the Drylands of sub-Saharan Africa



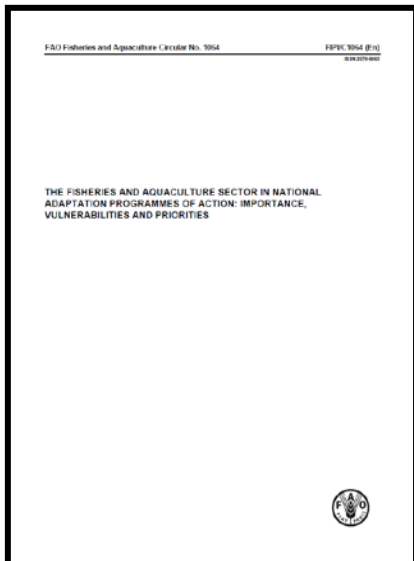
The focus of this review has been on both documenting the general resilience of many fish resources to climatic variability and its underestimation in livelihood importance, including in protracted crisis situations, but also on enhancing the potential supply of fish from dryland areas by better use of the available water bodies, and in particular from small reservoirs.

Kolding, J., Zwieter, P., Marttin, F. & Poulain, F. 2016. *Fisheries in the drylands of sub-Saharan Africa – “Fish come with the rains”. Building resilience for fisheries-dependent livelihoods to enhance food security and nutrition in the drylands*. FAO Fisheries and Aquaculture Circular No. 1118. Rome, FAO.

The PDF publication can be downloaded from the following url:
<http://www.fao.org/publications/card/en/c/c8776b54-a37d-496e-b10e-e07ad2239069/>

Regional and National Climate Change Priorities

Review of fisheries and aquaculture in National Adaptation Programs of Action



The main purpose of this review is to support least-developed countries (LDC), development partners and donors in planning and implementing climate change adaptation actions for the fisheries and aquaculture sector. In particular, it is aimed at the LDCs eligible for support from the Least Developed Countries Fund (LDCF) (operated by the Global Environment Facility [GEF]), the GEF and its Agencies and the United Nations Framework Convention on Climate Change (UNFCCC) LDC Expert Group (LEG). This desk study analyses the existing national adaptation programmes of action (NAPAs) of LDCs to identify why and in what ways the sector has been identified as needing priority adaptation action and how this prioritization has transferred into actual projects through the LDCF. The report: familiarizes fisheries and aquaculture decision-makers in LDCs with the NAPA process and the means for NAPA implementation; reviews country priorities vis-à-vis the fisheries and aquaculture sector; and provides those in the climate change arena with an understanding of the particular needs and vulnerabilities of the sector. The ultimate goal of the circular is to promote the

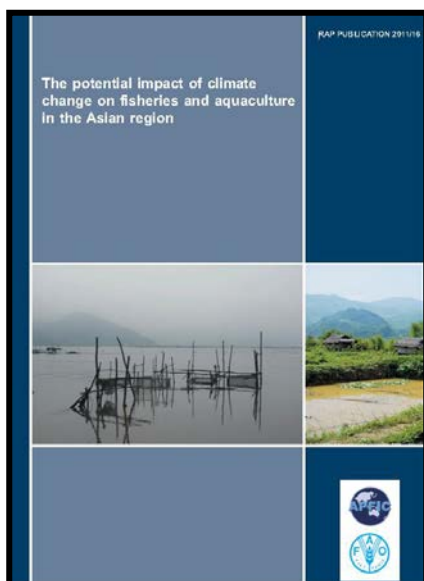
inclusion of a traditionally under-represented but potentially highly vulnerable sector in the planning and implementation of climate change adaptation strategies.

Vadacchino, L., De Young, C. & Brown, D. *The fisheries and aquaculture sector in national adaptation programmes of action: importance, vulnerabilities and priorities*. FAO Fisheries and Aquaculture Circular No. 1064. Rome, FAO.

The PDF publication can be downloaded from the following url:
<http://www.fao.org/docrep/014/i2173e/i2173e.pdf>



Potential impacts of climate change on fisheries and aquaculture in the Asian region



The impacts of climate change are likely to be far from uniform and it is expected that the Asian region will face very specific and locally variable challenges. Certain trends and impacts may be more pronounced in Asia (e.g. temperature increases are likely to be above the global norm in many parts of the region; a number of important river basins in Asia are threatened by further water stress; people in the region are likely to be disproportionately impacted by flooding; biodiversity loss will be greater in the tropics). Understanding the challenges and opportunities that climate change will pose to the fisheries sector in the Asian region will be crucial if governments hope to minimize negative impacts and buffer the impacts of climate change on some of the most vulnerable sections of society that are dependent on this sector. This document examines the significance of climate change for the fisheries sector in Asia and reviews what steps could be taken to minimize negative impacts as well as capitalize on potential opportunities. Drawing from the available literature some conclusions are drawn regarding the: impact of climate change on Asia; implications of this to the fisheries sector in Asia;

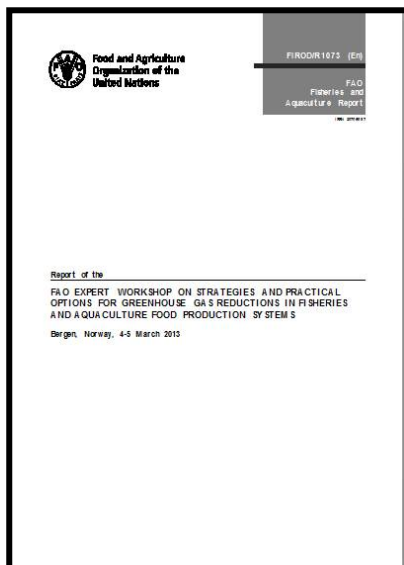
– significance of these findings to policy makers; and kind of action that should be taken to respond to potential challenges and opportunities

Sriskanathan, G. & Funge-Smith, S. 2011. *The potential impact of climate change on fisheries and aquaculture in the Asian region*. RAP PUBLICATION 2011/16. Bangkok, FAO.

The PDF publication can be downloaded from the following url:
<http://www.fao.org/3/a-ba0083e.pdf>

Greenhouse gas emissions and mitigation potentials

Fisheries and aquaculture greenhouse gas mitigation potentials



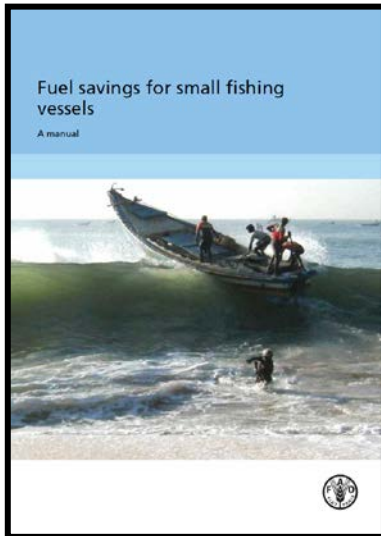
This document contains the report of the Expert Workshop on Strategies and Practical Options for Greenhouse Gas Reductions in Fisheries and Aquaculture Food Production Systems, held in Bergen, Norway, 4-5 March 2013. The workshop was convened by the Director-General of the Food and Agriculture Organization of the United Nations, following a recommendation by the 29th session of the Committee on Fisheries (COFI) that FAO should provide Members with information on possible fishing industry contributions to climate change, and on ways to reduce the sector's reliance on, and consumption of, fossil fuels, respecting the principles embodied within the United Nations Framework Convention on Climate Change (UNFCCC). Financial and in-kind support for the Expert Workshop was provided by the Government of Norway, the FAO Regular Programme, Seafish, and other contributing participants.

FAO. 2015. Report of the Expert Workshop on Strategies and Practical Options for Greenhouse Gas Reductions in Fisheries and Aquaculture Food Production Systems. Bergen, Norway, 4-5 March 2013. FAO Fisheries and Aquaculture Report No. R1073. Rome, FAO.

The PDF publication can be downloaded from the following url:

<http://www.fao.org/3/a-i4697e.pdf>

A manual on fuel savings for small fishing vessels



The recent sharp increase in the price of fuel has had a major impact on the economics of operating fishing vessels. Fishing boat owners and operators struggle to meet this challenge and ask what measures can be taken to reduce the heavy burden of increased fuel cost. Litres of fuel required per tonne of fish landed varies widely depending on the fish species and fishing method used. Fuel saving methods have to be tailored to each fishing method and fishery. This manual aims to provide practical advice to fishing boat owners and crews, boatbuilders and boat designers and fisheries administrators on ways to reduce fuel costs. It focuses on small fishing boats measuring up to 16 m (50 ft) in length and operating at speeds of less than 10 knots. This covers the majority of the world's fishing boats. It also serves as a guide for those involved with fuel savings for small vessels used in support of aquaculture activities. The manual provides information to boat designers and boat builders on hull shape for low resistance and the selection of efficient propellers. The first chapters of this manual deal with fuel saving measures that can be taken on existing boats without incurring major investment costs. The most effective measures include reducing boat service speed, keeping the hull and propeller free from underwater fouling and maintaining the boat engine. It also suggests that changing fishing methods can save fuel. The final chapters of this manual provide information regarding the fuel savings that are possible by changing from a 2-stroke outboard engine to a diesel engine, installing a diesel engine, and using sail. Selecting economic engine power on the basis of the waterline length and the weight of the boat is discussed. Advice is given on the choice of gear reduction ratio and of propeller related to service speed, service power and propeller rpm. Data are provided to assist with the design of a new fuel-efficient boat and the selection of an optimum propeller. The information contained in this manual is accompanied by many illustrations to make the main points more easily understood. Detailed background information is provided in the appendices. The appendices also contain blank tables that may be used to calculate potential fuel savings, cost of engine operation, the weight of a boat and the diameter and pitch of a propeller.

Gulbrandsen, O. 2012. *Fuel savings for small fishing vessels – a manual*. Rome, FAO.

The PDF publication can be downloaded from the following url:

<http://www.fao.org/docrep/017/i2461e/i2461e00.htm>



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***Building resilience to climate change and variability including
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