TITLE OF PROJECT	Promoting new knowledge of climate change impacts on fisheries		
PROGRAMME MANAGER / INSTITUTION	Nicholas Dulvy CEFAS		
REPORTING PERIOD	FROM 1st April 2005	TO 31st October 2005	

1 Executive Summary

The project aim was to promote new knowledge on the impact of climate change on the sustainability of capture and enhancement fisheries and people dependant upon them to key policy stakeholders, and relate findings to similar outputs from other renewable natural resource sectors. These main project achievements were:

- a review of climate change impacts and interactions in the context of other renewable natural resource sectors,
- a high-level scientific paper submitted to a peer-reviewed publication,
- identified and targeted key communications stakeholders, channels and media with main project messages,
- produced a flyer summarising R4778J project findings, distributed electronically to 61 people,
- held workshop to disseminate project findings and solicit stakeholder needs and views, attended by 39 people from 22 agencies, 4 stakeholder categories,
- two targeted presentations given to DFID personnel,
- five presentations given to scientific and development organisations, and
- produced a policy brief which will to be disseminated globally to a range of stakeholders through DFID / FAO Sustainable Fisheries Livelihoods Programme.

This project successfully contributed to DFID development goals by developing, producing, synthesising, promoting and packaging new knowledge in the impacts of climate change on fisheries and the people dependent upon them, and related these findings to outputs from similar sectors.

2 Background

The project goal lay within existing FMSP research outputs relating to: the contribution of capture and enhancement fisheries to the livelihoods of the poor; fisheries management tools and strategies that could benefit the poor; and, the means to realise improved management, further developed, disseminated and promoted to relevant stakeholders at all levels.

The project addressed the need for improved management of fishery resources and livelihood protection of poor people in the context of climate change. Climate change has emerged as a key concern for international development organisations, since related changes will have a disproportionate impact in the development world, where the world's poor remain most susceptible to the potential damages and uncertainties inherent in a changing climate. Most of the 36 million fisherfolk will be directly or indirectly affected by human-induced climate change. Despite this, climate change and fisheries has not been considered a priority for donors, aid practitioners and researchers when designing interventions to decrease the vulnerability of the poor to climate change. Up to the completion of FMSP project R4778J; there had not been a systematic global study of the impacts of climate change on fisheries systems. To achieve better impact from projects in the field of climate change mitigation and fisheries, international development organisations require improved information on the likely impacts of climate change, geographical climate change hotspots, and potential mitigation approaches.

DFID, like other international development organisations such as the World Bank, have recognized that climate change is a significant barrier to attaining the Millennium Development Goals and reducing poverty. DFID is currently re-focusing its funding themes to accommodate it. However, improved knowledge and communication of the potential impact of climate change on fisheries and the poor, its geographic range and potential mitigation measures are required to focus the development of future projects.

3 Project Purpose

This seven-month project aimed to promote new knowledge on the impact of climate change on the sustainability of capture and enhancement fisheries and people dependant upon them to key policy stakeholders, and relate findings to similar outputs from other renewable natural resource sectors. This project aimed to use a range of

communication strategies to inform key stakeholders of the outputs of DFID project R4778J, which details the implications of climate change for poor fisherfolk. The project aimed to increase awareness of the impacts of climate change on fisheries dependent livelihoods, its geographical importance, and position within the wider context of climate change, and ensure that key target stakeholders (i.e. donors, researchers, fisheries managers, and risk reduction/aid practitioners) have the relevant information in order to re-prioritise their work to account for these impacts. Uptake of project recommendations beyond the life of the project will embed climate change within future development programme structures.

The project aimed to contribute to changing the behaviour of target communication stakeholders. The short-term nature of this project means that verification can only take the form of questionnaires of current knowledge, attitudes and practices and anticipated uptake of target stakeholders, uptake of communications messages by target channels and stakeholders and correspondence with target institutions.
In addition, the project aimed to increase awareness of the impacts of climate change on fisheries-dependent livelihoods among the general public to engender support among the public and taxpayers for the work of national, regional and international agencies. This re-prioritisation would indirectly target beneficiaries in the long-term by increasing the number and effectiveness of interventions designed to support the adaptive capacity of fishing communities, particularly those in poverty.

4 Outputs

Achievement against Outputs

The following table summarises the findings and achievements against the two outputs of the project (Table 1). These achievements are described in more detail below.

Table 1. Reporting findings and achievements against outputs

Output	Findings	Achievements
1. New knowledge available on climate change impacts on fisheries livelihoods and placed within the wider context of climate change and its effects on other natural resources.	• A number of potential indirect impacts of climate change on fisheries through other NRR sectors • The importance of recognising the interactions between RNRS and the fisheries sector when developing adaptation strategies. The fisheries sector is often 'downstream' of other RNR sectors. • Water is an important link between sectors and adaptation in one sector such as agriculture, water management or forestry can have knock-on effects on rivers and estuarine fisheries.	Report reviewing impacts and interactions in the context of climate change, fisheries and other renewable natural resource sectors produced (Appendix 2.1) Two scientific papers and a workshop summary reports prepared/published (Section 7)
2. Wider awareness of climate change effects on fisheries dependent livelihoods and other	• The role and importance of the fisheries sector for poverty alleviation is often overlooked	Communications stakeholders, channels, media & messages identified (section 2.4, box 3). Wide range of stakeholders

natural resource sectors among policy makers, management initiatives, research organisations and the public	• It is important to place climate change in the context of poverty and other natural resource sectors • Using DFID as a focal point for discussions and the workshop was a powerful way of attracting the interest of stakeholders • It is valuable to have research published before wider dissemination although networks can be built up in preparation • Having a diverse project team increases the opportunities for dissemination • We have identified a range of future research needs and priorities (section 6.3)	identified by the end of the project including: 49 policy makers; 25 researchers; 17 humanitarian agencies and 69 national, international or international fisheries management organisations (Appendix 3.1). Flyer disseminated to 13 policy makers, 22 environmental or climate change researchers, 16 risk reduction agencies and 10 national, regional or international fisheries management organisations (Appendix 3.2) Policy brief prepared for publication through the FAO/DFID Sustainable Fisheries Livelihoods Programme 'New Direction in Fisheries' Policy Series (Appendix 3.3). A total of 3500 policy briefs will be printed in two languages and widely in paper format and also electronically through the FAO website (Appendix 3.3). Information presentations given to DFID Research and DFID Policy Units (Appendix 3.4). Workshop held in September 2004 at DFID (Appendices 3.5-3.7), which attracted 31 stakeholders from four stakeholder categories: researchers, policy makers, and humanitarian agencies and fisheries management institutions. (Section 5, Table 2). Workshop report disseminated to 34 stakeholders and posted on eight websites including; the DFID, FMSP & Wetlands Livelihoods websites (Appendix 3.8). As identified from the workshop uptake questionnaire (Appendix 3.9), the understanding of 73% of participants indicated their understanding of climate change, fisheries and poverty was increased as a result of the workshop. Following the workshop 100% of respondents felt that climate change; fisheries and poverty were important (Figs. 1 & 2). Drafted a press release and identified target journalists (Appendix 3.10). This will be released on publication of the policy brief.

		Additional achievements beyond original project remit Five separate presentations at a range of meetings and conferences in four countries on three continents, e.g. “Climate change and biodiversity in Africa”, (reported on in *Nature* 437(27) p1217), and SFLP programme planning meeting in Ouidah, Benin, September 2005 (Section 7). It is anticipated that the major findings will be incorporated into Chapters 5 and 17 of the latest Intergovernmental Panel on Climate Change.

5.1 Output 1

4.1.1 Interactions with other resource sectors

Within the first two months of the project, a 46-page report was produced. This report reviews the impacts and interactions [of climate change and fisheries] in the context of other renewable natural resource sectors (Appendix 2.1). This report first outlines existing knowledge on the potential impacts of climate change (including sea level rise, hydrology and water resource changes) and then expands to identify lake and river basin scale impacts, identifying potential interactions between other natural resource sectors including aquaculture, agriculture, livestock and forestry sectors. This review provided a key background to the further outputs of the project, drawing attention to the need to take a cross-sector approach when developing poverty alleviation plans. This work provided the key basis for highlighting the importance of considering the downstream effects on fisheries systems of climate change and management of other renewable natural resource sectors. In addition this work and other project outputs feed into and informed Project R8496 "Climate Change Adaptation Synthesis" by Michael Mortimore (Drylands Research).

4.1.2 Scientific papers

Based upon the outputs of R4778J, a scientific paper has been summarised from the global analysis of vulnerability of fisheries systems to climate change. Considerable effort was made to consider other possible methods for calculating vulnerability to ensure the results were robust. The broad thrust of the original findings still stands and the findings are robust to different model variants; however there have been slight changes to the lists of the most sensitive and vulnerable countries. These new analyses prompted a much more detailed and sophisticated interpretation of the original findings. This will be submitted for publication in a high profile scientific journal. This publication will provide a rigorous scientific basis underpinning the policy brief (see below) that will secure both scientific and media interest for the subject of poverty in fisheries and climate change impacts.

The project also contributed to the completion of another paper on, "Rainfall variability in East Africa: implications for natural resources management and livelihoods" by Conway, D., Allison, E.H., Felstead, R. & Goulden, M. in the journal *Philosophical Transactions of the Royal Society, A* (2005, **363**, 49-54).

4.1.3 Achievements beyond original project remit

A project team member (N. Adger) is lead author on Chapter 17 – Assessment of Adaptional practices, options, constraints and capacity of the IPCC report (IVth Assessment, Working Group II – Impacts, Adaptation and Vulnerability). This provides the opportunity for project findings to be incorporated into the latest round of this process.

4.2 Output 2

4.2.1 Communications stakeholders, channels, media & messages identified (Table 2).

4.2.1.1 Communications stakeholders

Throughout the project communications stakeholders were identified. These were initially based on contacts of the project team but gradually expanded through contacts with stakeholders. For example at the beginning of the project 13 policy makers, 22 research institutions, 16 humanitarian agencies and 10 national, regional or international fisheries management organisations were identified. By the end of the project this had increased to 49 policy makers, 25 researchers, 17 Humanitarian agencies and 68 national, regional or international fisheries management organisations.

Table 2. Reporting against the communications matrix

Comm. stakeholders	Research Product / message to be communicated	Current knowledge, attitude, practice of stakeholders	Communication objectives: Desired outcome of communication / promotion	Communication channels and media in which research product will be communicated	Achievements	Approach to monitor and evaluate implementation of communications plan
International Donor Community (A)	*Message:* Climate change will affect fisheries and the poverty of those reliant on fisheries, and therefore needs to be taken into account within donor support and national planning and budgeting *Research products*: • Hot-spot maps • Vulnerability analysis • Vulnerability matrices • Synthesis research	Climate change impacts on fisheries not fully understood or considered a priority in dealing with the impacts of climate change.	- Increased awareness - Target institutions have access to sufficient information and evidence to support for planning in the fisheries sector that takes climate change into consideration	• Policy briefs summarising main messages from research products and advising action required • Presentations to priority stakeholders (e.g. DFID Global Local Team) • Invitation to final workshop • Press releases targeting news and technical media (e.g. The Economist/New Scientist)	Meetings held with DFID Policy and Research Units Flyer distributed to 13 policy makers. Email correspondence with DFID Policy Unit Input and comments to scoping exercise on research needs for climate change adaptation commissioned by DFID Research Unit One-page summary provided through DFID Research Unit for delivery to all DFID policy advisors. Article posted on DFID Internal Intranet. Agreement of SFLP/FAO/DFID programme to publish policy brief through the SFLP policy series Invitations to workshop sent out to 9 policy makers	Dissemination of policy briefs Correspondence Attendance to presentations/ workshop Follow-up questionnaire

					Workshop attendance of 5 Policy makers Follow up questionnaire found 10 stakeholders (from all categories) had increased their knowledge on climate change, poverty and fisheries. 10 Policy makers received workshop report. Press releases prepared and a list of journalists prepared ready for when policy brief is released Policy brief disseminated to over 49 stakeholders at the policy level Poster summarising the linkages between climate change and fisheries used during the dissemination workshop Article on DFID news site	
National, Regional and International Fisheries Management Initiatives (B)	*Message*: Climate change needs to be taken into account within fisheries management plans *Research products* • Hot-spot maps • Vulnerability matrices • Synthesis research	Climate change beginning to be considered as an issue within fisheries management but not sufficiently considered within management plans	- Increased awareness - Target institutions have access to sufficient information and convincing evidence to incorporate climate change mitigation and adaptation measures into fishery management plans	• Flyers distributed • Scientific publications distributed • Key findings sent by email, mail and hosted on websites and list servers	Flyers distributed to 10 national, regional or international fisheries institutions 6 national, regional and international management organisations invited to workshop and one attended[1].	Dissemination of flyers Links hosted on stakeholder websites Uptake in newsletters Correspondence Follow-up

[1] One further invited individual could not attend due to immigration issues in Paris

					Follow up questionnaire found 10 stakeholders (from all categories) had increased their knowledge on climate change, poverty and fisheries. 8 national, regional and international fisheries institutions received workshop outputs Key findings distilled into policy brief sent out to 68 national, regional or international fisheries management organisations. Website links to key findings on STREAM, PASS, DFID, Eldis, ISDR, Wetlands Livelihoods websites. Newsletter article prepared for *Tiempo* Follow up questionnaire found 10 stakeholders (from all categories) had increased their knowledge on climate change, poverty and fisheries. Poster used during the dissemination workshop	questionnaire
Research organisations (Climate change, fisheries, environment and development) (C)	*Message:* Fisheries will also be impacted by climate change in a number of different ways and according to vulnerabilities of different	At present, knowledge is generic, with little regional country or ecosystem specific overview and	- Use of products by target institutions: - Increased awareness of the impacts of climate change on the fisheries sector	• Scientific publications distributed • Availability of research products on FMSP website • Flyer to draw attention	Scientific paper prepared FMSP project R4778J summary and main report, workshop reports, flyer, bibliography, poster, policy	Dissemination of flyer Uptake in newsletters Links hosted on stakeholder websites

	area. Further research is required on climate change and fisheries *Research products:* • Hot-spot maps • Vulnerability analysis • Vulnerability matrices • Literature review • Synthesis research	synthesis	- Target research institutions are aware of what research (on impacts of climate change on fisheries and adaptation tools) has been conducted and what additional research is required.	to available materials • Postings to list servers • Key findings	brief made available on the FMSP website Flyer sent to 22 research stakeholders Website links to key findings on STREAM, One Fish, PASS, DFID, Eldis, ISDR, Wetlands Livelihoods websites 18 research stakeholders invited to workshop 12-research stakeholder attended workshop and increased awareness of climate change and fisheries issues. Follow up questionnaire found 10 stakeholders (from all categories) had increased their knowledge on climate change, poverty and fisheries. 13 research stakeholders received workshop outputs. Poster used during the dissemination workshop	Publication in journals Correspondence Follow-up questionnaire
Disaster or Risk Reduction agencies (D)	*Message:* Fisheries communities also need to be supported to mitigate risks of climate change Research Products: • Hot-spot maps • Vulnerability analysis • Vulnerability matrices • Literature review	High knowledge on vulnerabilities to climate risks, and use of vulnerability mapping etc, but low knowledge on the potential impacts on fisheries and	- Use of products by target institutions - Increased awareness of the impacts of climate change on the fisheries sector	• Flyer distributed by email, mail and hosted on websites to illustrate some of the key findings from research • Presentation to Risk Reduction Network • Invitation to final	Flyer sent to 16 stakeholders 7 stakeholders invited to workshop 2 risk reduction agencies attended workshop and 3 received workshop report. Participants increased	Dissemination of flyer Correspondence Attendance to presentations/ workshop Follow-up

	• Synthesis research	fishing communities		workshop	awareness of climate change and fisheries issues. Follow up questionnaire found 10 stakeholders (from all categories) had increased their knowledge on climate change, poverty and fisheries. Poster used during the dissemination workshop Website links to key findings on STREAM, PASS, DFID, Eldis, ISDR, Wetlands Livelihoods websites	questionnaire
General public (E)	*Message:* Climate change will affect fisheries and other natural resource sectors and poverty levels *Research products*: • Hot-spot maps • Vulnerability matrices • Synthesis research	Impacts of climate change on natural resources and dependent livelihoods not fully understood or not considered	- Increased awareness of the impacts of climate change on fisheries and natural resource dependant livelihoods - Public support for donor commitments, management initiatives, research strategies, vulnerability reduction programmes	• Press releases targeting news and technical media (e.g. The Economist/New Scientist, daily national newspapers)	Press release and list of journalists prepared and ready for release	Reporting in target news and technical media
Target Beneficiaries (J, K)	*Message:* Climate change may have an impact on fisheries livelihoods. There may be activities fishers, fisheries manager and other policy managers can take to assist adaptation. *Research products:* • Synthesis research • Vulnerability matrices & analysis	Possibly low knowledge of climate change impacts although this is likely to be variable (e.g. reportedly high awareness in Bangladesh among the poor)	- Intermediate organizations have appropriate information they can pass on to target beneficiaries - Target beneficiaries have increased awareness of the impacts of climate change and actions they can take to adapt to these	• Recommended actions stated within policy briefs e.g. encourage intermediate organisations to communicate information to lower stakeholders.	Recommendations in policy brief sent to over 150 stakeholders from all categories Questionnaire identified future research priorities covered in policy brief	Dissemination of policy briefs Follow-up questionnaire

4.2.1.2 Communications materials

Different communications channels and media identified including one-to-one meetings; flyers, websites, the dissemination workshop, scientific papers, posters and conferences, and the policy brief. These communications materials are provided in Appendices 3.2, 3.3, 3.5, 3.6, 3.7 and 3.8. Slightly different messages were used within each of these materials as appropriate for the target audience.

4.2.1.3 Dissemination channels

The FMSP website was used to publicise the project and host all project outputs. The website provides a summary of the project and access to the project flyer, the workshop report and presentation, and the policy brief. It also provides access to the summary and full report for project R4778J. The FMSP website mainly targets other research organisations or individuals. Other websites hosted links to the project to widen the range of stakeholders targeted. These included, i) DFID website, targeting policy makers, researchers and managers, ii) the Eldis website, targeting social development experts, institutions and projects; iii) the STREAM website, targeting fisheries management institutions particularly in Asia; iv) the ISDR website, targeting risk reduction agencies and v) the DFID Pass Website targeting internal DFID staff. The outputs for the workshop were also published on DFID's Intranet. See Table 3 and Appendix 3.8 for details on the website and web-links. The main communications products and the number distributed to the different stakeholder groups are summarised in Table 4. This information is provided in more detail, illustrating each individual stakeholder in Appendix 3.1.

4.2.2 Flyer

The aim of the flyer was to make key stakeholders aware of the scope and main findings of the previous project (R4778J). In addition the flyer outlined the aims of the current communication project highlighting key activities, dissemination mechanisms (such as the workshop) and dates and also providing a point of contact for more details (Appendix 3.2).

4.2.3 Policy Brief

The policy brief was based upon the relevant material available through the project, discussed at the workshop and through targeted searches. The policy brief was designed to appeal to a wide range of stakeholders and has a final section within it that covers action points for each stakeholder group. Through the project initiation workshop an opportunity was discovered to publish the policy brief through the DFID/FAO SFLP 'New Directions in Fisheries' Policy Series. This enabled the policy brief to be published through FAO as part of a series dealing with current concerns in fisheries such as HIV/AIDS and governance. It also enabled the brief to be designed and published in a glossy format and sent through FAO's large dissemination network. The project has already identified over 150 stakeholders and FAO's network will add additional stakeholders. The policy brief has been submitted to the FAO/DFID Sustainable Fisheries Management Programmes (SFLP) for editing and publishing as part of the SFLP 'New Direction in Fisheries' Policy Series. This series has an extensive distribution, with 2000 English and 1500 French copies produced for distribution via FAO and DFID contacts.

Table 3. Details of websites that picked up and presented project outputs

Website name	Project outputs hosted and target audience
FMSP	Contains a summary of the project, FMSP 4778J full and summary project report, bibliography, project flyer, workshop outputs and policy brief Targets research institutions http://www.fmsp.org.uk/r8475.htm
DFID	Provides a news article summarising the outcomes of the workshop Targets policy makers, development partners http://www.dfid.gov.uk/news/files/fisheries-climate-change.asp
Eldis	Link to FMSP project webpage Targets social development experts, projects & institutions http://www.eldis.org/climate/index.htm
Stream	Link to project flyer Targets fisheries research and management institutions in Asia http://www.streaminitiative.org/Library/organizations/index.html
UN ISDR (International Strategy for Disaster Reduction)	Promoted the workshop and link to FMSP webpage Targets risk reduction and humanitarian agencies http://www.unisdr.org/meeting-conference-2005.htm
PASS	Provides a summary of the project and workshop Targets internal DFID staff and other donors http://www.passlivelihoods.org.uk/default.asp?project_id=306
DFID intranet	Provides a summary of the project and workshop Targets internal DFID staff http://www.dfid.gov.uk/
Wetlands Livelihoods	Provides a summary of the workshop Targets the development sector and wetland researchers and managers http://www.wetlands.org/WLWG/default.htm
New Agriculturalist online	Internet magazine reporting on agricultural issues in the 21st century http://www.new-agri.co.uk/05-6/focuson/focuson4.html

Table 4. Number of communications products distributed to stakeholder groups

Communications product	Target groups and number of stakeholders group targeted
Flyer	Policy Makers (13)
	Environmental or climate change researchers (22)
	Humanitarian or risk reduction agencies (16)
	National, regional or international fisheries management organisations (10)
Workshop report	Policy Makers (10)
	Environmental or climate change researchers (13)
	Humanitarian or risk reduction agencies (3)
	National, regional or international fisheries management organisations (8)
Policy Brief	Policy Makers (49)
	Environmental or climate change researchers (25)
	Humanitarian or risk reduction agencies (17)
	National, regional or international fisheries management organisations (68)

4.2.4 Information presentations

One-to-one meetings were held with key DFID Policy staff including Jessica Troni (climate change advisor); Tim Bostock (fisheries advisor) and Simon Anderson (research advisor). These were held at the beginning of the project to ensure that these key stakeholders were involved in the development of the project and designing means of disseminating the main messages. From this contact an opportunity arose to comment on a scoping report that had been undertaken for the DFID Research Unit on priorities for research into climate change adaptation (Appendix 3.4). This enabled the project to highlight the lack of research within the fisheries sector and provide suggestions to enhance this area. An opportunity was also provided through Simon Anderson to provide a summary of the main issues surrounding climate change, poverty and fisheries to a meeting of policy advisors within DFID. This was achieved by providing a 1-page summary distributed to each policy advisor (Appendix 3.4). Email communications have been maintained with these target stakeholders, by sending relevant links and information and introductions to other institutions or individuals working in this field.

4.2.5 Dissemination workshop

A workshop entitled, “Climate change and fisheries: impacts & interactions with other natural resource sectors” was held at DFID on 12th September 2005, which attracted 31 stakeholders including academic researchers, policy makers, humanitarian agencies, and fisheries management institutions (Table 5 and Table 6). The workshop was an opportunity to review current knowledge on the impacts of climate change on fisheries important to the poor, initiate multi-disciplinary discussion groups and summarise the key issues for a policy brief. Jessica Troni and Tim Bostock had earlier noted that knowledge of adaptation and coping strategies was beyond the remit of the earlier project (R4778J), and it was stressed that it would be important to gain this knowledge Therefore, we took the opportunity to solicit greater detail and examples of adaptation and coping

mechanisms in response to climate change using the experience of the stakeholders attending the workshop.

Table 5. *Climate change and fisheries: impacts & interactions with other natural resource sectors* workshop participants.

	Participant	Institution
1	Manuel Barange	Global Ocean Ecosystems Dynamics (GLOBEC)
2	Yasmin McDonnell	ActionAid
3	James Tuohy	DFID Research Unit
4	Rachel Berger	Practical Action
5	Hannah Reid	IIED
6	Michael Mortimore	Drylands Research
7	Michael Ounsted	Wetlands International
8	Patricia Davis	Frontier
9	Georg Caspary	OECD
10	Karina Drif	POST
11	Jim Gunson	Hadley Centre
12	Saleemul Huq	IIED
13	Adam Manvell	Dry lands research
14	Catherine Sullivan	CEH
15	Eddie Allison	UEA/FAO
16	Charlotte Howard	MRAG
17	Nick Dulvy	CEFAS
18	Graham Pilling	CEFAS
19	Declan Conway	UEA
20	Allison Perry	UEA
21	Sophie De Clears	UCL
22	Ashley Halls	Aquae Sulis
23	Jessica Troni	DFID
24	Simon Anderson	DFID
25	Emily Corcoran	UNEP-WCMC
26	Joanna House	QUEST
27	John Beddington	MRAG
28	Elizabeth Tyler	University of Oxford
29	Friday Njaya	Fisheries Dept, Malawi
30	Tim Bostock	DFID
31	Suzannah Walmsley	MRAG

Table 6. Invitees and attendees to the workshop by stakeholder group

Potential and actual audience	Stakeholder group
Workshop invitees	Policy makers (9)
	Environmental or climate change researchers (18)
	Humanitarian or risk reduction agencies (7)
	National, regional or international fisheries management organisations (6)
Workshop attendees	Policy Makers (5)
	Environmental or climate change researchers (12)
	Humanitarian or risk reduction agencies (2)
	National, regional or international fisheries management organisations (1)

Presentations were given covering current project findings and work carried out in the previous FMSP R4778J project. This was an opportunity to increase awareness of target stakeholders to the findings of the previous research project and the current promotion project. It was also an opportunity to widen the discussion to research ongoing beyond the project both within other DFID research programmes and other research institutions. To this aim, additional presentations were given by Michael Mortimore (Drylands Research), Manuel Barangue (Globec) and Georg Caspary (OECD), see below.

Project presentations included:

- Interactions of hazard and vulnerability for fisheries. Declan Conway (UEA)
- Climate Change Impacts on Fisheries Production in the Land-Water Interface. Ashley Halls (Aquae Sulis Ltd)
- Current and future coral reef sustainability and food security. Nick Dulvy (CEFAS)
- Global vulnerability and adaptability of poor fisher-folk to climate change. Eddie Allison (UEA)

Additional presentations from individuals outside the project team included:

- Adaptation research in the Renewable Natural Resources Research Strategy (RNRRS) between 1995-2006. Michael Mortimore (Drylands research)
- GLOBEC's views on Fish, Humans and Global change: a not-so-quiet revolution. Manuel Barange (Globec)
- OECD case studies on climate change impacts and adaptation. Georg Caspary (OECD)

The presentations sought from outside the project team covered the impacts of climate change on oceanographic systems, provided by the GLOBEC (Global Ocean Ecosystems Dynamics); climate change issues within all previous RNRRS projects provided by Michael Mortimore (who is undertaking a review of FMSP and other research programmes); and impact and adaptation issues covered by OECD (who have recently completed a review of the links between climate change, natural resource management and economic development plans in developing countries).

Following the presentations working groups were arranged to allow discussion between workshop participants. The working groups covered the following themes:

1. Impact pathways;
2. Relative risk;
3. Interaction across sectors; and
4. Short-term coping and long-term adaptation

Participants then presented the outcomes of their discussions to the workshop. These group sessions were valuable exercises 1) to further increase the awareness of participants of the issues and 2) to gain feedback on arguments for the policy brief and 3) to gain additional knowledge on related work and ideas related to climate change and fisheries. The groups gave some useful feedback on diagrams for use within the policy brief and suggested alterations to make them more accurate or easier to follow. They also provided additional case studies for inclusion, such as ocean acidification and work within coastal areas to support the resilience of fishing communities.

4.2.6 Knowledge, attitudes and practice questionnaire

The success of the workshop was illustrated by the increase in knowledge on climate change and fisheries issues recorded in end of workshop questionnaires. While most of the participants already felt that climate change and fisheries was an important issue before the workshop (Figure 1), most of them had increased their knowledge on the issue by the end of the workshop (Figure 2). A number of participants also expressed positive feedback within their end of workshop questionnaires (Box 1).

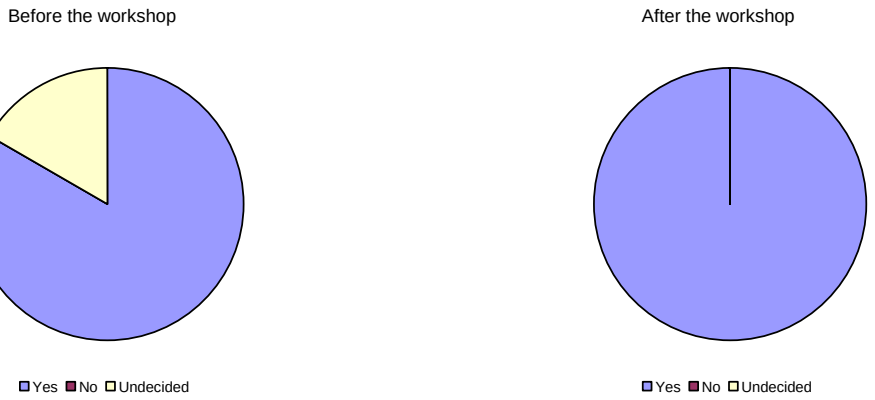

Figure 1. Participants perceived importance of climate change, poverty and fisheries issues before and after the workshop

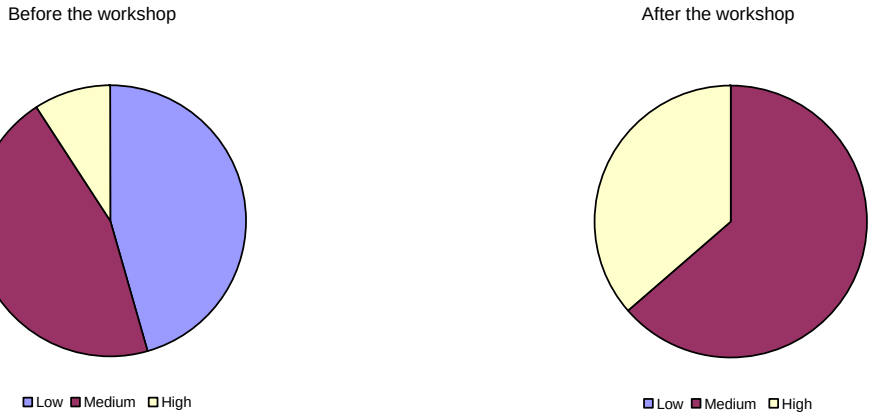

Figure 2. Participants knowledge of climate change, poverty and fisheries issues before and after the workshop

Box 1 Participants comments on workshop

'Useful opportunity to incorporate new perspectives'

'The workshop provided high awareness and understanding of global climate change issues for fisheries'

'Very well organised: I came with limited knowledge on the fisheries aspects of climate change and benefited considerably'

The presentations were very helpful. A paper in the route causes of poverty might have been helpful to address the full breadth of the workshop.

'Very useful, great mix of people'

'Learned a lot more about risk and relative risk and increased appreciation for the scope of this matter'

'Most valuable for opening new horizons, not necessarily about fisheries'

'The workshop helped me find out what research was ongoing and provided very good networking opportunities'.

The end of workshop questionnaire was also a useful opportunity for participants to sum up the issues they felt were most important, areas of future research and related work. These comments were used within the policy brief and illustrate stakeholder buy-in for the main conclusions.

The questionnaires also determined the level of influence stakeholders had over the fisheries and climate change sectors. This is useful information for further targeting of communications messages and the potential to use these stakeholders as intermediaries for passing on key messages. In particular it may be valuable to use the Met Office, NERC and OECD to pass on messages to the climate change sector and use OECD and FAO to communicate to the fisheries sector (Table 7). The majority of participants (92% of respondents to the end of workshop questionnaire) said that they would pass on messages on climate change and fisheries to stakeholders they work with.

Table 7 Stakeholder influence over climate change and fisheries management sectors

Stakeholder	Climate change sector	Fisheries management sector
ZSL	Low	Low
Hadley Centre – Met Office	High	Low
QUEST – NERC	High	Low
UEA – DEV	High	Low
Michael Mortimore	Low	
OECD	High	High
MRAG	Med	Med
Malawi Fisheries Department	High	High
GLOBEC	Med	High
UCL	Med	Med

4.2.7 Press release

Other communications products produced included a press release prepared with a list of journalist's contacts for release on the same day as the policy brief, and a newsletter article for *Tiempo* (Appendix 3.10 & 3.12).

4.2.8 Achievements beyond original project remit

In addition to the project dissemination workshop, the work has been disseminated to the scientific and development community through a number of international meetings and conferences. These include:

1. Presentation of findings at an SFLP Programme planning meeting in Ouidah, Benin, September 2005 (Eddie Allison)
2. Review of IPCC report (IVth Assessment, Working Group II – Impacts, Adaptation and Vulnerability, Chapter 5 – Food Fibre and Forest Products), within which project outputs are incorporated
3. Invited presentation at the "Climate Change and Biodiversity in Africa" conference at Gallagher Estate, near Pretoria, from 17-19 October 2005, as reported in Nature 437(27) p1217 [John Reynolds]
4. Nick Dulvy will present part of project R4778J findings at the Reef Conservation UK annual meeting on Saturday 5th December 2005 as a talk entitled, "Climate change, sustainability and food security in coral reef island nations".
5. Neil Adger is the lead author on Chapter 17 – Assessment of Adaptional practices, options, constraints and capacity of the IPCC report (IVth Assessment, Working Group II – Impacts, Adaptation and Vulnerability). Also Eddie Allison will review chapter 5 "Food fibre and forest products" of the same IPCC report. This will provide opportunity to incorporate the results of project R4778J into this key

publication.

5 Research Activities

5.1 Output 1

5.1.1 Review climate change effect on other NRS

The review aimed to frame the impacts of climate change on fisheries within the wider context of other renewable natural resource sectors, in particular agriculture and forestry, and thereby highlight any important interactions that may exist. The review drew from the work of project R4778J to focus the geographic area of investigation, and used key project outputs and literature to summarise the knowledge from other sectors and synthesise likely impacts and interactions cross-cutting RNRS (Appendix 2.1).

5.1.2 Workshop to review findings of R4778J

A project workshop was held to review the findings for R4778J and pull out the key communications messages. This workshop included almost the full range of project partners including:

- Nick Dulvy (CEFAS)
- Graham Pilling (CEFAS)
- Eddie Allison (UEA/FAO)
- John Reynolds (UEA)
- Alison Perry (UEA)
- Declan Conway (UEA)
- Ashley Halls (Aquae Sulis Ltd)
- Charlotte Howard (MRAG Ltd)
- Anne McClarnon (CEFAS)

5.1.3 Solicit presentations from DFID bilateral programmes

Presentations for the dissemination workshop were sought from individuals outside the project team, to provide a wide background for discussions of the project findings. The presentations covered the impacts of climate change on oceanographic systems, provided by the GLOBEC (Global Ocean Ecosystems Dynamics); climate change issues within all previous RNRRS projects provided by Michael Mortimore undertaking a review of FMSP and other research programmes; and impact and adaptation issues covered by OECD who have recently completed a review of the links between climate change, natural resource management and economic development plans in developing countries. The additional presentations sought from outside the project team included:

- Adaptation research in the Renewable Natural Resources Research Strategy (RNRRS) between 1995-2006. Michael Mortimore (Drylands research)
- GLOBEC's views on Fish, Humans and Global change: a not-so-quiet revolution. Manuel Barange (Globec)
- OECD case studies on climate change impacts and adaptation. Georg Caspary (OECD)

5.1.4 Interpret global hotspot analysis

The vulnerability analysis performed during project R4778J was revisited. The original analysis presented in R4778J was considered to be incomplete as other possible methods of calculating vulnerability, and other combinations of variable had not been explored. Consequently the team had little sense of how robust the findings were to various plausible permutations.

5.1.5 Conduct sensitivity analysis

The team explore three main issues: (1) whether there was any redundancy among component variables, e.g. number of fishers, versus proportion of fishers and per capita GDP versus total GDP; (2) the effect of weighting the components of vulnerability and (3) the effect of averaging versus multiplying components of vulnerability. We searched for redundancy by cross-correlation of component variables and Principle Components Analysis and found little redundancy in component variables. We did however choose to drop per capita GDP from the sensitivity score. This changed the definition of this index from the "sensitivity of poor fishers" to simply the "fisheries sensitivity of each nation". This was preferred, as it does not assume an *a priori* link between poverty and fisheries, which originally raised criticism from commentators that the analysis was tautological. We explored the consequences of the other two issues by pair wise correlation of vulnerability scores and the relative ranking of most vulnerable countries. The correlations between pair wise combinations were always high (Pearson's $r > 0.95$) and the country rankings were relatively unchanged. We choose the most parsimonious method of calculating vulnerability, which was to average sensitivity, exposure and adaptive capacity. We chose not to consider weightings as this makes interpretation and the 'unpacking' of any composite index difficult. This suggests that the findings are robust to the method of calculating vulnerability. In addition we found that the original data required appropriate transformation prior to normalisation to ensure the vulnerability scores were also normal. This allowed the final vulnerability scores to be categorised into "high", "moderate", "low" and "very low" using quartiles.

5.1.6 Drafting and peer-review of scientific outputs

Based upon the results of the sensitivity analyses, a scientific paper has been drafted and we anticipate that this manuscript will be further revised by team members and will eventually be circulated for informal comments before submission.

5.2 Output 2

5.2.1 Identification of communication stakeholders, channels & media

A communications plan was drafted by the communications advisor (Charlotte Howard), and the project team leaders (Nick Dulvy and Graham Pilling) at the start of the project. This drew on knowledge of stakeholders from the previous project (FMSP project R4778J) and previous research into climate change and poverty linkages. The draft communications plan was presented at the project-planning workshop to all the project partners and comments were received on additional communications stakeholders, media and channels (See presentation in Appendix 3.6). The list of questions that guided the process included:

1. *Communications objectives:* What do we want to achieve and how can communications support this?
2. *Scope:* What is the scope of our communications objectives?
3. *Messages:* What are our communications messages? Can we make them concise, relevant and targeted?
4. *Opportunities and constraints:* How can we get around the constraints? What opportunities are there to get our messages across?
5. *Communication channels:* What are the most appropriate channels to use?
6. *Dissemination workshop:* Who should be invited? What do we want to achieve?
7. *Monitoring:* What is the best way to monitor?

The project-planning workshop was also an opportunity to present the outputs from the previous research programme (R4778J), present new research into the interactions between climate change impacts on natural resource sectors and determine key communications messages (Box 3).

5.2.2 Stakeholder correspondence initiated, dissemination workshop invitations sent

Correspondence was initiated with stakeholders by sending out the project flyer to all the stakeholders identified at the project-planning workshop. The flyer was sent out electronically by email, and a number of responses were received expressing an interest in the topic or in attending the workshop. The workshop was also advertised on the STREAM and ISDR websites. Invitations were sent out to a variety of stakeholders (See Appendix 3.5 for a copy of the invitation). As it was considered important to cover the oceanographic aspects of climate change a representative from GLOBEC was invited and also asked to make a presentation. A representative was invited from the Met Office to provide background to the climate change science, and a representative from the NERC Quest programme to represent the issue of ocean acidifications as a result of climate change. Representatives of risk reduction and humanitarian organisations were invited through contacts with the risk reduction network and the NGO 'Up in Smoke' campaign. Research stakeholders were invited through contacts of CEFAS, UEA and MRAG and these included research organisations focusing on environmental or biodiversity issues (e.g. UNEP, ZSL, University of Oxford), climate change and development issues (e.g. IIED), and project partners. Policy makers focused on DFID, OECD, World Fish and World Bank fisheries and climate change policy advisors.

The budget allowed for two international participants to attend and invitations were sent to the Mekong River Commission, Lake Victoria Fisheries Organisation, Malawi Fisheries Department and the Pan African Institute for Development Central Africa (PAID). A representative from Malawi and PAID were available to attend and accommodation and travel arrangements were made. However due to immigration controls the PAID representative was unable to make it to the workshop. Interest was also expressed by World Fish, the World Bank and IUCN, although they were unable to attend the workshop due to other commitments (Box 2).

5.2.3 Internet /www channels identified and targeted

A web page was set up on the FMSP site providing a summary of the project and access to the project outputs. This website was updated following the dissemination workshop, and the workshop report and policy brief is available for download. Links were also placed on the following webpage (see Table 3) and illustrations of these are available in Appendix 3.8. In addition a list of alternative web sites was identified as possible communication channels (Table 8).

Box 2 Examples of responses to workshop invitations

1) World Fish

Hi Charlotte – just to let you know that we are looking at how we could send someone to this meeting. However it clashes with our Board meeting so that may be tricky. Will try to let you know shortly.

Regards Patrick Dugan

2) World Bank

Dear Charlotte,

Many thanks for the invitation.

I have spoken on the matter with Frank Sperling this afternoon and we both have a strong interest in the subject matter. Unfortunately, the Bank's fisheries staff all have prior travel commitments at the time of the workshop and will be unable to participate.

However, I would be very grateful if we could be copied the papers and report of the workshop with a view to our future engagement in any initiatives which may emarge.

With best regards,

Kieran Kelleher

Senior Fisheries Specialist

Agriculture and Rural Development Department The World Bank,

3) IUCN

Dear Charlotte and Graham,

Thanks very much for all your efforts with this (please thank Keeley too). Unfortunately I will not be able to attend the workshop as the visa processing time is longer than anticipated and two weeks will not be enough time.

I do hope that we keep in touch and that we receive the outputs from your workshop. Once the work plan for the climate change and reef resilience component of our Global Marine Program is finalised, we will forward them on.

I look forward to developing collaborative links with your group.

All the best,

Ameer

Ameer A. Abdulla

Global Marine Program

IUCN-The World Conservation Union

5.2.4 Communication messages identified and CP revised

As discussed above (2.1) the initial project workshop was the first opportunity to revise the communications plan. Following the workshop, the communications plan was further refined following consultations with DFID Policy advisors and a review of potential web pages, newsletters or conferences. Through email correspondence initiated by sending out the project flyer and workshop invitations, additional stakeholders were identified and added to the communications plan. A revised communications plan was provided in the first quarterly report. The main changes were:

- Identification of new stakeholders e.g. GLOBEC
- Publication of the policy brief through the FAO/DFID SFLP 'New Directions in Fisheries' Policy Series
- Identification of potential dissemination channels (Table 8)
- Identification of key meetings or conferences that could be used as dissemination opportunities. These include:
    - Fish For All Workshop: Nigeria, 21st–25th August (http://www.fishforall.org/) [To be attended by Eddie Allison]
    - Montreal COP meeting and associated Workshops: 28 November to 9 December 2005, Quebec
    - Climate Change and Biodiversity in Africa: 17-19 October, 2005 South African National Biodiversity Institute, Cape Town [To be attended by John Reynolds]
    - Establishing an evidence-based framework for managing biodiversity in a period of rapid climate change: 28-29th July 2005, Institute of Biology, London [To be attended by Nick Dulvy]
- Identification of key communication messages. These are described in Box 3 below.

Table 8. Potential web sites suitable for project output dissemination

Title	Web address (URL)
Science dev.net	http://www.scidev.net/
ID 21	http://www.id21.org/
Water KAR Newsletter	http://www.dfid-kar-water.net/home.shtml
Tyndall project sheet	http://www.tyndall.ac.uk/publications/fact_sheets/fact_sheets.shtml
UEA/DEV Climate Website	http://www.uea.ac.uk/dev/climate/
NAGA Newsletter, World Fish	http://www.worldfishcenter.org/Naga/nagainfo.htm
SAMUDRA Newsletter	http://www.icsf.net/jsp/english/pubPages/yemaya/index.jsp#show
Montreal COP meeting and associated Workshops	http://unfccc.int/meetings/cop_11/items/3394.php
CEFAS Newsletter	http://www.cefas.co.uk/news/insight.htm
Tiempo (IIED Newsletter)	http://www.cru.uea.ac.uk/tiempo/
Resilience Alliance	http://www.resalliance.org/ev_en.php
Eldis – Linking Climate Adaptation	http://community.eldis.org/webx?14@39.bVdeaa7bchB.0@.ee9fe17
Climate-L	http://www.iisd.org/climate/
Institute for Sustainable Development news lists, magazines & alerting service	http://www.iisd.org/
GLOBEC newsletter	http://www.pml.ac.uk/globec/products/newsletter/news11_1.pdf
DFID website	http://www.dfid.gov.uk/news/files/fisheries-climate-change.asp

Box 3 Identified communications messages

1. **Fisheries communities are among the most vulnerable to the future impacts of climate change.** An analysis of the vulnerability and adaptability of fisherfolk living in poverty has found there are [eight] key reasons that heighten their vulnerability: high levels of poverty and little capacity to recover from shocks; over-exploited resources; lack of alternatives; 'down-stream' impacts; high levels of migrants with a lack access to services; dependence on sensitive ecosystems (e.g. coral reefs, lake & river systems); and exposure of fishing infrastructure to climate related damage.
2. **Fisheries in Africa [and Asia] are the most vulnerable to increasing climate variation and climate change.** A worldwide comparison of climate risks, levels of dependence on fisheries and adaptive capacity has revealed that the top ten vulnerable countries are Angola, Russian Federation, Democratic Republic of the Congo, Mali, Mauritania, Senegal, Sierra Leone, Peru, Niger & Morocco. For example West African countries are among the most vulnerable owing to high risk of CC, high predicted temperature changes, worlds poorest countries and high relative dependence on fisheries. There is a stark contrast between China, which has a large number of people involved in fisheries but has high economic growth and a diverse economy compared to Mauritania with a small fisheries dependent economy.
3. **There are direct impacts of climate change on fisheries but also indirect impacts through the adaptation of other natural resources sectors. A review of all sectors has found that water is a key link causing adaptations in one sector to have repercussions for other NR sectors.** For example in the Mekong region flood defences have increased sedimentation in rivers reducing fish productivity downstream. In addition in Africa the predicted increase in drought conditions will increase the need for irrigation, negatively affect fisheries downstream that rely on a certain level of water to sustain production and growth.
4. **A number of ecosystems supporting developing country fisheries are particularly sensitive to climate change and can result in double/multiple exposures for fisheries-dependent communities.** Reviews of coral reef, African lake and flood plain fisheries found that these systems are often already heavily exploited and in many cases climate change will further reduce productivity and some of the protective elements of these ecosystems lowering resilience. For example a study of coral reef ecosystems has found that sustainable fishery yields are an order of magnitude lower than previous estimates and projections suggest yields will be substantially reduced by population growth and climate change impacts on reefs (e.g. coral bleaching, disease, pest outbreaks). Small islands are particularly vulnerable and will experience a double exposure in terms of the loss of fish productivity and loss of the protective nature of reefs to storm surges and sea level rise.
5. **Fisheries co-management systems are not always designed to deal effectively with variability due to climatic factors.** A case study of the linkages between climate change and vulnerability for fisherfolk in the African Great Lakes found that co-management systems are linking communities with territorial area and basing fisheries management on control of effort. This is not always appropriate where climatic variability causes large fluctuations in production from year to year, and results in movement of fish stocks. For example for Lake Chilwa in Malawi there is a relatively high population of migrants who are well adapted to climate variations and move around the lake targeting fish populations. A much larger proportion of their income comes from fishing compared to residents around the lakeside and the move towards 'Beach Management Committees [BVCs]' has negative effects due to a lack of representation on management committees and a move towards territoriality.
6. **Knowledge on climate change and fisheries is growing but there are specific knowledge gaps that prevent us from answering key policy questions.** An initial literature review into knowledge on climate change and fisheries has found a lack of knowledge on the economic implications; an understanding of the role of climate variation and longer term climate change; possible options for adaptation or reducing vulnerability in the fisheries sector; options for adaptive fisheries management; vulnerability of the poor dependent on coral reef systems, inland fisheries and climate sensitive coastal small-scale fisheries.

5.2.5 KAP / uptake questionnaire devised

A knowledge, attitudes and practice questionnaire was devised to give to the workshop participants (see Appendix 3.1). The aim of the questionnaire was to determine the current level of knowledge of participants, their attitude towards the importance of climate change, poverty and fisheries and their practice in terms of addressing the issue.

5.2.6 Policy brief / flyers produced and distributed

At the beginning of the project a project flyer was prepared providing an overview to the project and its objectives. It advertised the dissemination workshop and provided a useful summary of information and a means to begin discussions with key stakeholders (Appendix 3.2). Following the dissemination workshop a policy brief was drafted drawing on material from project R4778J, workshop presentations, stakeholder views expressed in the uptake questionnaires and other published material that was located during the project. This was then sent to FAO for the final edit and publication into their 'New Directions in Fisheries' policy brief format (Appendix 3.3). Other communications materials produced during the project lifetime included a response to a scoping exercise commissioned by the Research division of DFID, a one-page summary sheet for policy advisors within DFID, Poster, and newsletter articles (see Appendices 3.4 & 3.12).

5.2.7 Seminar presentation to two key stakeholders

Rather than seminar presentations, informal presentations were given to representatives from the DFID Policy and DFID research units: Jessica Troni (DFID climate change advisor), Tim Bostock (DFID Senior fisheries advisor) and Simon Anderson (DFID Research Manager). These informal presentations gave an overview of the key communications messages as identified during the initial project workshop. They were also a chance to determine the level of interest within DFID to address the issues and provide an opportunity for their input and buy-in to the project. The discussions enabled the DFID advisors to provide ideas on how to communicate the messages and additional communications stakeholders that should be targeted. One of the opportunities identified by Simon Anderson was the response to the scoping exercise on adaptation research, and 1-page summary for policy advisors. Tim Bostock suggested the development of a key-sheet and including the outputs of the workshop on the DFID webpage. Jessica Troni provided detailed comments and guidance on the workshop agenda.

The opportunity was taken to consult these two stakeholders (Jessica Troni & Tim Bostock) for their views on the structure and aims of the dissemination workshop. An initial agenda drawn together focused on adaptation options for addressing climate change impacts on fisheries in developing countries. However following discussions with DFID, it was considered too early to be covering adaptation and it was agreed that the workshop should focus on reviewing current understanding of impacts and the importance of these impacts in relation to other stresses that contribute to poverty. (The final agenda for the workshop is provided in the workshop report in Appendix 3.5).

Contact was made Risk Reduction group and 'Up in Smoke NGO group' to conduct seminars but we found that the groups did not meet frequently enough or with sufficient participation to make our proposed activity worthwhile. Instead arrangements were made to use the network to distribute key outputs such as the workshop report and policy brief. Contact was also made with the Wetlands Livelihoods working group who have expressed an interest to hold an additional workshop on the issue focusing on poverty impacts, but this is more likely to take place next year as their members are widely dispersed globally and arrangements need to be made whether this can take place in the UK or one of their regional centres.

5.2.8 Findings presented to stakeholders at dissemination workshop

The findings of the FMSP research were presented to stakeholders at the dissemination workshop, along with the additional presentations solicited from relevant institutions. While originally we envisaged presenting the findings of the earlier project (R4778J), it was soon realised there were great opportunity to elicit the experience of the stakeholders to the benefit of the project outputs especially the communication material. Jessica Troni and Tim Bostock had earlier noted that knowledge of adaptation and coping strategies was beyond the remit of the earlier project (R4778J), and it was stressed that it would be important to gain this knowledge Therefore, we took the opportunity to solicit greater detail and examples of adaptation and coping mechanisms in response to climate change using the experience of the stakeholders attending the workshop. The presentations from project members included:

- Interactions of hazard and vulnerability for fisheries. Declan Conway (UEA)
- Climate Change Impacts on Fisheries Production in the Land-Water Interface. Ashley Halls (Aquae Sulis Ltd)
- Current and future coral reef sustainability and food security. Nick Dulvy (CEFAS)
- Global vulnerability and adaptability of poor fisher-folk to climate change. Eddie Allison (UEA)

Although there was other project material that could have been presented (a review of impact pathways, case studies on lakes and river ecosystems), it was considered valuable to allow sufficient time for questions, and discussions within breakout groups. The working groups were a chance for participants to consolidate the information that had been presented and determine priorities for future research.

5.2.9 KAP / uptake questionnaire distributed and returned

The knowledge, attitudes and practice questionnaire was distributed to all workshop participants and returned either at the end of the workshop or by email. Eleven of the participants returned their questionnaires. The results of these questionnaires were reported in Section 5. The results were also used to inform the policy brief. Participants provided feedback on the workshop, information on related work and future research priorities.

5.2.10 Press release to news and print media

A press release has been prepared to coincide with the release of the policy brief (see Appendix 3.10). A list of journalists and their contacts has also been drawn up in preparation. The greatest media exposure and widest dissemination is planned to occur outside of the project lifespan. The press release will be released to coincide with the publication of the policy brief and main scientific paper, without pre-empting embargo policies.

6 Contribution of Outputs

6.1 Contribution to FMSP's Purpose and Outputs

The purpose OVI's addressed by the current project are shown below, followed by our combined response:

FMSP Purpose OVIs - Benefits for poor people generated by application of new knowledge to fisheries management systems.

By 2005, evidence of application of FMSP research products to benefit target communities[2] in target countries[2] by achieving:

[2] Target communities: At least two of:

- Poor people
- Institutions supplying services to the poor

Capture Fisheries: For at least one EFZ, coastal or inland capture fishery, one or more of the following:

OVI 1: Less variable capture fisheries production, and yield stabilised at sustainable level to support sustainable livelihoods

OVI2: Improved fisheries employment (numbers, income, quality)

OVI3: Improved access by poor people to fisheries knowledge generated by the Programme

FMSP Output OVI - Existing FMSP research outputs relating to: the contribution of capture and enhancement fisheries to the livelihoods of the poor; fisheries management tools and strategies that could benefit the poor; and, the means to realise improved management, further developed, disseminated and promoted to relevant stakeholders at all levels.

Contribution of current project to FMSP OVI's - The current project has contributed directly to the delivery of both FMSP purpose and output OVI's. The project has developed and promoted the findings of R4778J both directly and indirectly to key development stakeholders. Through uptake of project outputs by these key regional and international stakeholders, appropriate focussing and incorporation of climate change and fisheries within future regional and international development programmes should generate benefits for poor people (purpose OVI's). Furthermore, identification of the links between RNRS and the potential impact of development programmes in other RNRS on fisheries important to poor people will help limit downstream reduction and fluctuation in fisheries yield and reduced employment opportunities. A key achievement of this project which will considerable enhance the attainment of FMSP goals as measurable through the OVIs is the development of a strong commitment from the FAO//DFID SFLP to disseminate project findings through their "New Directions in Fisheries" policy brief series. This will give the project findings greater credibility and wider impact and dissemination.

6.2 Impact of the project

Project purpose OVI - By end month 7, policy awareness of climate change threats to fisheries dependent livelihoods, its geographical importance and position within the wider context of climate change increased for four stakeholder categories. Outside the life of the project, practice revised in accordance with project recommendations by at least one key stakeholder.

The project has successfully identified the importance of climate change to fisheries dependent livelihoods, analysed the geographic distribution of threats (through vulnerability mapping), and identified the positive and negative links between fisheries and other renewable natural resource sectors. We disseminated directly to 31 stakeholders from 4 stakeholder groups through the project dissemination workshop and demonstrated a 73% increase in stakeholder understanding of the impacts of climate change on poor fishers. The workshop report was distributed to 34 stakeholders and posted on FMSP, Wetlands Livelihoods and OneFish websites. A large number of stakeholders have been reached through other dissemination channels. The total or anticipated number of stakeholders reached is shown in parentheses for each channel: websites (uptake by 9 websites, number of hits unknown), flyer (61 stakeholders comprising 13 policy makers, 22 environmental or climate change researchers, 16 risk reduction agencies and 10 national, regional or international fisheries management organisations), policy brief (158 identified comprising 49 policy makers, 25 environmental

- Employers of the poor
- Policy makers

2. Target countries: S Asia (Bangladesh & West Bengal) and SE Asia (Cambodia, Laos and Vietnam) for inland fisheries, and East Africa (Kenya and Tanzania), Indian Ocean SIDS and S. Asia (Orissa and Andhra Pradesh) for marine fisheries.

or climate change researchers, 17 risk reduction agencies and 68 national, regional or international fisheries management organisations. Note that the first print run will total 3500 of 2000 English and 1500 French copies), scientific presentations (> 200 stakeholders), scientific publications (1 with two more anticipated), and popular press and print media (1 mention in the scientific journal *Nature*). The project is also in a good position to influence DFID through direct lobbying of DFID personnel within DFID Research and DFID Policy units and influence the IPCC IVth assessment report. The project has therefore fulfilled the OVI set within the project timeframe. Outside the life of this short project, it is anticipated that increased media exposure will occur upon publication of the main scientific paper and on release of the FAO/DFID SFLP policy brief. There is already evidence of uptake of main communication findings:

1. by FAO/DFID SFLP "New direction in fisheries"
2. by 8 websites (excluding FMSP website)
3. key findings reported in *Nature* 437:1217, 27/10/05.

Potential future uptake has been evidenced by considerable interest in and responses to invitations to the dissemination workshop and other project email communication, e. g. see Box 2. The Wetlands and Livelihoods working group has indicated that they would be interested to hold a follow up workshop to consider further the poverty dimension of climate change impacts on fisheries. Interest from DFID policy unit has been apparent through continued correspondent on related issues in the news or recent research. Some of the literature identified through the research and preparation of the policy brief has been picked up with the IFFET initiative to record and make available publications on the economic impacts of climate change (available through the one-fish site, http://www.onefish.org/global/index.jsp). This bibliography now includes the R4778J report, workshop report and in the future should include the policy brief.

6.3 Further work

Following the publication of the scientific paper and the policy brief there is considerable opportunity to continue disseminating the key findings. Some of the communications stakeholders have expressed an interest in taking the discussions forward, for example the Wetlands and Livelihoods Working Group has expressed the interest in holding a discussion group to highlight the poverty impact of climate change effects on fisheries to donors. In addition the project has been invited to present at the IIFET 2006 Conference on Rebuilding Fisheries in an Uncertain Environment. Other opportunities are likely to exist such as the annual workshop held by the fisheries sector of the Canadian climate impacts and adaptation research network (http://www.fishclimate.ca/).

A number of future research areas have been identified throughout this work; these are outlined below and given tentative ranking:

Climate change research

1. Develop better measures and indices of exposure to climate change, particularly incorporating marine-relevant climate change parameters such as sea level rise, sea surface temperatures, storm frequency and intensity, upwellings frequency and intensity
2. Develop more detailed regional-scale climate prediction is needed, particularly of rainfall patterns to allow identification of downstream effects
3. Increase understanding of net climate impacts across natural resource sectors and develop medium-term weather and climate predictions that correspond to fisheries management planning horizons
4. Understand the effect of glacial melt profiles on river hydrology and net fisheries productivity

Fisheries research

1. Understand the direct and indirect impacts of climate change on fisheries ecology, productivity and resilience on different spatial and temporal scales

Understand how ecosystem change and variation interacts with social systems and adaptive capacity – is social resilience a function of ecological resilience?
2. Improved fisheries data on catches for subsistence and small scale fisheries
3. Provide detailed analyses of direct and indirect economic and social contributions of fisheries
4. Poverty indicators and an understanding of livelihoods within fishing communities

Vulnerability and adaptation research and actions

1. Pilot a programme to include the fisheries sector within National Adaptation Programmes of Action (NAPAs) for the Least Developed Countries (LDCs)
2. Set up joint initiatives and early-warning networks between fisheries management and disaster management especially concerning planning coastal or flood defences, and drought responses.
3. Identify variation in socio-ecological resilience and livelihoods along gradient of natural resource use, in order to identify generic constraints and adaptation/coping strategies
4. Identify the net consequences of different natural resource states and management strategies for downstream fisheries, e.g. water abstraction on fish yield
5. Identify 'win-win' adaptation options that will benefit more than one natural sector across resource sectors, such as re-forestation of watersheds
6. Understand the reliance of people and livelihoods on natural resources and ecosystem services in terms of both routine use and in response to hazards and natural disasters
7. Compare vulnerability at a variety of scales, to identify relevant scale for intervention or assistance
8. Determine the relative importance of climate change at a local scale, this requires an understanding of people's perception of risks as well as an objective measure of risk
9. Improve ability to communicate climate change risks to the poor by understanding perception of risk
10. Review current strategies to deal with climate variation and trends at a local level to provide lessons for adaptation strategies
11. Extend the range of countries covered by existing adaptive capacity indices. This is of particular importance for small island developing states, which are known to be highly vulnerable yet this has to date not been quantified

7 Publications and other communications materials

7.1 Peer-reviewed publications (published)

Conway, D., E. Allison, R. Felstead & M. Goulden (2005) Rainfall variability and change in East Africa: Implications for natural resources management and livelihoods. Philosophical Transactions of the Royal Society A, 363: 49-54

7.2 Peer-reviewed publications (in press or submitted)

Allison, E.H., Perry, A., Adger, W.N., Badjeck, M.-C., Brown, K., Conway, D., Halls, A., Pilling, G., Reynolds, J.D., & Dulvy, N.K. Global vulnerability of fisheries to climate change. Due for submission by March 2006

7.3 Non peer-reviewed publications and reports and communications materials

A review of effect of climate change on Renewable Natural Resource Sectors and their interactions with the fisheries sector (Appendix 2.1)

Project flyer (Appendix 3.2)

DFID / FAO SFLP Policy Brief (Appendix 3.3)

Summary and response of scoping exercise on researching climate change adaptation (Appendix 3.4)

Workshop report (Appendix 3.5)

Poster (Appendix 3.7)

Press Release (Appendix 3.10)

Tiempo newsletter articles (Appendix 3.12)

Project web site (http://p15166578.pureserver.info/fmsp/r8475.htm; Appendix 3.8)

7.4 Verbal presentations & project dissemination and other workshops

Marie-Caroline Badjeck gave a presentation on the global vulnerability analysis at the Peruvian Institute for Marine Science (Instituto del Mar del Perú, IMARPE) on 24th May 2005

Eddie Allison gave an invited talk to a NERC/ESRC audience as part of their interdisciplinary seminar series in London (April 2005)

Eddie Allison presented project findings at an SFLP Programme planning meeting in Ouidah, Benin in September 2005

John Reynolds gave an invited presentation at the "Climate Change and Biodiversity in Africa" conference at Gallagher Estate, near Pretoria, from 17-19 October 2005

Nick Dulvy will present part of project R4778J findings at the Reef Conservation UK annual meeting on Saturday 5th December 2005 as a talk entitled, "Climate change, sustainability and food security in coral reef island nations".

8 Project Logframe

Narrative summary	Objectively verifiable indicators	Means of verification	Important assumptions
Goal			
Existing FMSP research outputs relating to: the contribution of <u>capture</u> and <u>enhancement</u> fisheries to the livelihoods of the poor; fisheries management tools and strategies that could benefit the poor; and, the means to realise improved management, further developed, disseminated and promoted to relevant stakeholders at all levels	1. By 31 March 2006, at least three fisheries information products developed to inform management research and influence policy (in target countries, international knowledge systems and DFID) 2. Project and programme level monitoring systems provide further benchmarking baseline data, record the take-up and adoption of FMSP products, and contribute to fisheries information products by 31 March 2006	• Programme Management review • Project FTRs • Programme highlights • Publications and other communications materials • Quarterly and annual reports • FMSP project database • FMSP Website • Requests for policy brief received • Uptake of research products by target institutions monitored and reported in Annual Report • National statistics and publications • International networks, databases and publications	Policy makers remain receptive to information on fisheries management Government policies continue to support pro-poor approaches Target beneficiaries remain receptive to mitigation approaches proposed
Purpose			
New knowledge on the impact of climate change on fisheries and the people dependant upon them further developed and promoted, and related to similar outputs from other sectors	**By end month 7, policy awareness of climate change threats to fisheries dependent livelihoods, its geographical importance and position within the wider context of climate change increased for four stakeholder categories. Outside the life of the project, practice revised in accordance with project recommendations by at least one key stakeholder**	**Poverty reduction strategies, policy statements, research and development programmes** **Future programme focus developed by DFID global/local team**	**Research results taken up by stakeholders**
Outputs			
1. New knowledge available on climate change impacts on fisheries livelihoods and placed within the wider context of climate change and its effects on other natural resource sectors	**By end month 2, review of the wider context of climate change completed. Workshop held to review current knowledge on climate change impacts on fisher livelihoods and identify knowledge gaps** **By end of month 7, at least one scientific paper submitted**	**Quarterly project reporting and final report** **Journal correspondence**	**Quality and scope of data sufficient to allow synthesis** **Quality of previous project findings sufficient for publication**
2. Wider awareness of climate change effects on fisheries dependent livelihoods and other natural resource sectors among policy makers, management initiatives, research organisations and public	**By end of month 2, communications stakeholders, channels, media and messages identified** **By end of month 7, all communication products (flyers, policy briefs, press releases) completed and delivered**	**Revised communications plan and final report** **Project correspondence and**	**Project is successful in diffusing information among target groups** **Stakeholders**

	By end of month 7, all communication messages delivered to five stakeholder groups through: **- natural resources workshop: international donor community, disaster/ risk reduction agencies, other natural resource sectors, and** **- targeted presentations to at least two stakeholders (DFID Global Environmental Assets team, Risk Reduction Network)** **By end of month 7 policy briefs delivered to at least two key stakeholders**	**uptake questionnaires** **Uptake of communication messages by print and news media, future DFID programme logical frameworks revised**	**respond to workshop invitations and can participate**
Activities	Budget and milestones		
Output 1	£12,859		
1.1 Review effects of climate change on other DFID Natural Resource sectors	By end of month 2		**Knowledge sufficient to allow synthesis**
1.2 Project workshop reviewing findings of project R4778J	By end of month 2		**All partners are available to meet**
1.3 Presentations solicited from other DFID bilateral research programmes	By end of month 2		**DFID bilateral research programmes have undertaken relevant research**
1.4 Global hotspot analysis interpreted	By end of month 5		**Depends on quality of previous project findings**
1.5 Sensitivity analyses conducted	By end of month 5		**Depends on quality of previous project findings**
1.6 Scientific publication and visual presentations drafted and peer-reviewed	By end of month 7		**Scientific products suitable for publication**
Output 2	£22,120		
2.1 Communications stakeholders, channels and media identified	By end of month 2		
2.2 Correspondence with stakeholders initiated, and stakeholders invited to dissemination workshop and to give presentations	By end of month 2		**Dependent on willingness and capacity to respond**

2.3 Internet / WWW channels identified and targeted	By end of month 2	
2.4 Communications messages identified and communication plan revised	By end of month 2	
2.5 Develop uptake questionnaire to identify current knowledge, attitudes and practices of stakeholders, and anticipated future activities in light of current project findings	By end of month 4	**Assumes responses reflect long-term commitment to change**
2.6 Policy brief and flyers produced and disseminated	By end of month 7	
2.7 Seminar presentations of findings to priority stakeholders (DFID Global Environmental Assets team, Risk Reduction Network)	By end of month 7	**Willingness to respond to offer of a presentation**
2.8 Findings presented to stakeholders at dissemination workshop. Presentations given by other natural resource sectors.	By end of month 6	**Relevant stakeholders, in particular DFID Central Research Department and Global Environmental Assets team, are reached and receptive to messages**
2.9 Uptake questionnaire distributed and returned at workshop	By end of month 6	**Questionnaires completed by stakeholders and their response reflects longer-term change in attitudes and practices**
2.10 Press release to news media	By end of month 7	**Uptake by news media**

9 Keywords

Adaptation, climate change, fisheries, poverty alleviation

10 List of appendices