

Fisheries: what's not measured can't be managed

Validated RNRRS Output.

Basic tools to collect and record information on fisheries, designed specifically for developing countries, can now be downloaded from the internet. Previously, assessing fisheries was expensive, time-consuming and needed to be done by experts. This left 70% of the world's fisheries badly managed and seriously threatened. Now, using these tools and with a little training, fisheries managers can work out what is happening in a fishery. Using this information, they can then develop plans that take into account not only the physical resources, but the social, economic and environmental aspects as well. Fisheries managers, fishers and community groups in the Seychelles, Indian Ocean, Kenya, Vietnam, India and the Caribbean have already proven these tools' value. FAO is championing their use in the Atlantic and hundreds of copies of the software have been downloaded all over the world.

Project Ref: **FMSP05:**

Topic: **7. Spreading the Word: Knowledge Management & Dissemination**

Lead Organisation: **MRAG Ltd, UK**

Source: **Fish Management Science Programme**

Document Contents:

[Description](#), [Validation](#), [Current Situation](#), [Current Promotion](#), [Impacts On Poverty](#), [Environmental Impact](#), [Annex](#),

Description

Research into Use

NR International
Park House
Bradbourne Lane
Aylesford
Kent
ME20 6SN
UK

Geographical regions included:

[Africa](#), [Asia](#), [Caribbean](#),

Target Audiences for this content:

[Fishers](#),

FMSP05**A. Description of the research output(s)****1. Working title**

How to assess and manage a fishery – A collection of tools and guides for fish stock assessment and developing management plans.

Short title: **How to assess and manage a fishery.**

2. Name of relevant RNRRS Programme(s) commissioning supporting research and also indicate other funding sources, if applicable.

Fisheries Management Science Programme

3. Provide relevant R numbers (and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities. As with the question above, this is primarily to allow for the legacy of the RNRRS to be acknowledged during the RIUP activities.

R no	Institutional partners	Current contact persons
R8468: Capacity building in the use of FMSP stock assessment tools and management guidelines	SCALES Inc; Marine Resources Assessment Group (MRAG); Caribbean Regional Fisheries Mechanism (CRFM); Field Studies Council, UK; Centre for Environment Education, India Andhra Pradesh Department of Fisheries India West Bengal Department of Fisheries, India Orissa Department of Fisheries, India	Dr Dan Hoggarth; & Dr Chris Mees
R8360: Synthesis and uptake promotion of FMSP stock assessment tools and guidelines	SCALES Inc; Marine Resources Assessment Group (MRAG); Central Marine Fisheries Research Institute, India; Food & Agriculture Organisation, Rome (FAO); College of Fisheries, Mangalore	Dr Dan Hoggarth; & Dr Chris Mees

R7041: Software for estimating potential yield under uncertainty	Marine Resources Assessment Group (MRAG)	Dr Chris Mees
R5050CB: Computer Aids in fish stock assessment - Field development	Marine Resources Assessment Group (MRAG); Faculty of Fisheries, Kasetsart University Thailand; Department of Fisheries, Turks & Caicos Islands	Dr Chris Mees
R4517: Development of Computer Aids for Fish Stock Assessment and Management Policy	Marine Resources Assessment Group (MRAG)	Dr Chris Mees

The following projects also contributed to the development of this output. Institutional partners and contacts persons are listed at www.fmisp.org.uk

R8292; R8285; R8210; R7947; R7835; R7834; R7522; R7521; R7335; R7043; R7042; R7040; R6494; R6465; R6437; R6436; R6178; R5958; R5953; R5484; R5030; R4823; R4778G

4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? (max. 400 words). This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database.

The fisheries sector directly supports 200 million people and feeds up to 2.6 billion. Fisheries can play a significant role in alleviating poverty, and in achieving the Millennium Development Goals (MDGs). However, over 70% of world fisheries are fully exploited, overexploited, depleted or recovering; under utilised resources are often not accessible to poorer fishers; and, fisheries management is inadequate. There is an urgent need for better management to contribute to achieving the MDGs. This was recognised in the commitment made to achieve sustainable fisheries and to reverse the impacts of over-fishing at the World Summit on Sustainable Development in Johannesburg in 2002.

Fisheries are diverse, complex and difficult to manage for the benefits of society. They are frequently common pool (open access) resources, and being a natural production system rely on variable and vulnerable processes that cannot be, or are difficult to control. Social and economic (livelihood) aspirations for a fishery often compete with biological reality and the need for resource sustainability. It is in the absence of management that fish stocks become over-exploited. It is important therefore to develop management approaches that take explicit account of the biological limitations of the resource whilst recognising livelihood needs.

This cluster of outputs includes a number of tools for **fisheries stock assessment** and a paired set of user-friendly **guidelines** for their use in **fishery management**: 'A Guide to fisheries stock assessment using the FMSP tools'; and, 'How to manage a fishery, A simple guide to writing a fishery management plan'. Individual tools and guidelines may be applied to most **inland, coastal and marine fishery** situations, and the guidelines

show how to select and apply appropriate tools for different circumstances. These Outputs directly address the internationally recognised demand for better fisheries management and enable the development of a management plan that recognises biological constraints and livelihood goals.

The **fisheries management and stock assessment guidelines** (2005) are based on stock assessment tools developed since 1993 from over 20 FMSP projects and incorporate best practice for **participatory** and **adaptive co-management approaches**. A framework guide to using fisheries stock assessment tools (2004, FAO Fisheries Technical Paper 487) underpins the guidelines. Individual tools (**software, assessment models, methods and approaches**) include **Length Frequency Data Analysis (LFDA)**, **Catch and Effort Data Analysis (CEDA)**, analytical **Yield Software**, and methods for participatory fisheries stock assessment (**ParFish**). The framework guide synthesises outputs relating to single or **multi-species fisheries** assessments, empirical and Bayesian modelling approaches, life history parameter estimation and age or length based growth assessments.

Fisheries stock assessment can be complex requiring trained scientists and often expensive data collection programmes. These tools have been designed specifically for developing country situations where capacity and resources are limited. The tools enable scientists to provide advice to managers and policy makers on the status of fish stocks and options for managing them. To implement that advice, managers must understand it and set it within the context of social and economic goals for the livelihood benefits of fishing dependant communities. The guidelines are designed to help scientists and managers work together to achieve **fishery development** and management aims, leading to better fisheries **governance**.

5. What is the type of output(s) being described here?

Please tick one or more of the following options.

Product	Technology	Service	Process or Methodology	Policy	Other Please specify
	X		X	X	Software

6. What is the main commodity (ies) upon which the output(s) focussed? Could this output be applied to other commodities, if so, please comment

Fisheries – inland (lakes, rivers, floodplains, reservoirs etc); coastal; and, high seas.

The stock assessment tools and guidelines to their use are specific to fisheries. The guide to writing a management plan could be adapted and developed as guide to managing other natural resources, but in its present form it is specific to fisheries.

7. What production system(s) does/could the output(s) focus upon?

Please tick one or more of the following options.

Leave blank if not applicable

Semi-Arid	High potential	Hillsides	Forest-Agriculture	Peri-urban	Land water	Tropical moist forest	Cross-cutting

X

8. What farming system(s) does the output(s) focus upon?

Please tick one or more of the following options (see Annex B for definitions).

Leave blank if not applicable

Smallholder rainfed humid	Irrigated	Wetland rice based	Smallholder rainfed highland	Smallholder rainfed dry/cold	Dualistic	Coastal artisanal fishing	Inland fisheries	Deep sea fisheries
		X				X	X	X

9. How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? (max. 300 words).

This Output focuses on bridging the gap between assessing wild caught fisheries to provide management advice, and the implementation of that advice – How to Manage a Fishery. All other Outputs related to capture fisheries (and some related to aquaculture) and their post harvest treatment contribute directly to better management of fisheries, and local circumstances will dictate which combinations of Outputs will be most appropriate. A fisheries management plan can be developed utilising this Output, identifying social, economic, and governance goals in addition to biological and ecological goals. Clustering this Output with others will contribute to and enable the achievement of social and economic goals important to achieving the MDGs, whilst ensuring sustainability of the resources upon which those other goals depend. In the context of wider management policies for integrated management of coastal zones, or floodplains, for example, this Output can usefully be integrated with many outputs from other sectors including agriculture, forestry and livestock.

Research Outputs from national, regional and international research initiatives will also contribute to achieving better fisheries management. For example, local research activities such as those of the Kenya Marine Fisheries Research Institute will contribute to the local context of a fishery management plan. Outputs from the regional South West Indian Ocean Fisheries Project (SWIOFP) or international research conducted by FAO or the WorldFish Centre can also contribute in the implementation of better management practices to achieve desired goals. Other regional projects and Programmes that could be linked to include the Lake Victoria Fisheries Office, the Western Indian Ocean Marine Science Association (WIOMSA) and in West Africa, the Sustainable Fisheries Livelihoods Project (SFLP).

Please specify what other outputs your output(s) could be clustered. At this point you should make reference to the circulated list of RNRRS outputs for which proformas are currently being prepared.

Directly relevant

FMSP outputs
Simple empirical models for lake and river fishery assessments
Improving policy for fisheries management; maximising potential for economic growth and poverty reduction
Vulnerability of fisheries to climate variation and options for response

Participatory fisheries monitoring: transparency, sustainability and empowerment
Fisheries stock assessment and management – A collection of tools and guides for assessing fisheries and developing management plans
Managing fisheries with limited data: technical and participatory approaches
Adaptive co-management: Supporting co-managed fisheries
Control of Foreign Fishing to provide economic benefits to developing coastal states
Tools for managing floodplain fisheries
Fisheries Enhancement Decision Support Tools: EnhanceFish
Fish aggregating devices (FADs) for enhancing coastal artisanal fisheries
NRSP
Participatory action plan development
Institutional arrangements for CPR use
Integrated floodplain management
Institutional arrangements for coastal zone management
Trade off analysis for coastal zone conservation and development
MPA guidelines
AFGRP
Sustainable coastal production

Also potentially relevant. As suggested in the text above, wherever integrated management approaches are adopted there is potential to add value to fisheries management planning and implementation by clustering with agriculture, forestry,, livestock etc outputs. Therefore this list is not exhaustive

CPP Outputs
Data management
CPHP
Market information tools
Inventory credit schemes
Decision tools for institutional change in public and private sectors
NRSP
Scaling up process / Scaling up through communication
AFGRP
Integrated aquatic production for rural livelihoods
Promoting networks for market quality
Developing market information systems within the aquatic foods supply chain.
PHFRP
Post Harvest Livelihoods Assessment Tool (PHLAT)
A guide to the analysis of fish marketing systems using a combination of sub-sector Analysis and the sustainable livelihoods approach
Informal Fish Loss Assessment Method (IFLAM)
Trainer's guide to controlling blowfly infestation of traditionally processed fish

Validation

B. Validation of the research output(s)

10. **How** were the output(s) validated and **who** validated them?

Please provide brief description of method(s) used and consider application, replication, adaptation and/or adoption in the context of any partner organisation and user groups involved. In addressing the “who” component detail which group(s) did the validation e.g. end users, intermediary organisation, government department, aid organisation, private company etc... This section should also be used to detail, if applicable, to which social group, gender, income category the validation was applied and any increases in productivity observed during validation (max. 500 words).

FMSP projects were designed to contribute in a sequence to achieving developmental impact. Within this Output cluster, early projects were aimed at developing stock assessment tools and management guidelines that addressed identified demand. Validation of the tools was achieved by testing and adapting them with developing country partners (usually fisheries departments or research organisations) against a range of fisheries and through peer review of project Outputs. To bring the tools together a framework guide to their use was developed and published as an FAO Fisheries Technical Paper, validated and adapted through peer review by scientists at FAO, WorldFish Centre and from New Zealand. In order to promote widespread adoption of the validated tools a number of regional training courses were implemented targeting stock assessment scientists, researchers and trainers. To bridge the gap between assessment and management, necessary to deliver developmental impact, a paired set of guides was developed to help stock assessment scientists and policy makers / managers work together (see Q 4). The guides were developed together with scientists and policy makers / managers from Asia and the Caribbean at a workshop and subsequently compiled with the assistance of communication experts from the Field Studies Council. The guides were designed to be easy to read and user friendly, and this aspect and their usability was validated and adapted at a subsequent workshop. Peer review by scientists at FAO validated the technical content.

Fisheries must be assessed and managed at the level of the stock. Resource boundaries usually do not correspond with human boundaries. As a consequence, this Output cluster aims to create an enabling environment for better management, and targets intermediary organisations nationally and regionally. End users (fishers) should be involved in both assessment and management, but this must be coordinated at the level of the stock. Impacts on productivity follow better management and would not be expected to be observed during validation (see Q 23). Where effective fisheries management is achieved, however, the potential benefits of sustainable fisheries production are obvious (see Q 22 and Q 24).

11. **Where and when** have the output(s) been validated?

Please indicate the places(s) and country(ies), any particular social group targeted and also indicate in which production system and farming system, using the options provided in questions 7 and 8 respectively, above (max

300 words).

Stock assessment tools included in this Output cluster were developed and validated through over 20 projects in a number of countries throughout the world, and they are designed to be globally applicable. They are applicable to most fisheries including small scale artisanal fisheries. Focusing on some of the key tools only, CEDA and LFDA were validated in Thailand for a sardine fishery and Turks and Caicos for lobster and conch fisheries in 1995. Yield software was validated for an Indian Ocean demersal fishery in Mauritius and the British Indian Ocean Territory (BIOT) between 1997 and 2000. ParFish was validated in coastal multispecies fisheries in Tanzania and crab fisheries in Andhra Pradesh, India in 2004/5. Other tools and guidelines included within the Framework guide to FMSP stock assessment tools were validated, amongst others, in Bangladesh, Cambodia, Laos, and Tonga between 1995 and 2005. Guidelines relating to age or length based fishery assessments were validated for demersal fisheries in Mauritius, Seychelles and BIOT. Regional Training courses were held in Nairobi for East Africa (2004), HoChi Minh City for south East Asia (2005), Mangalore and Dhaka for south Asia (2005). The paired set of stock assessment and management guides were developed in Visakapathnam, Andhra Pradesh and validated in Kolkatta, west Bengal, India together with partners from the Caribbean (2005). Technical validation was achieved with inputs of renowned international fisheries scientists from a number of research and development institutions throughout the world, including FAO and WorldFish Centre (previously ICLARM). Promotion of the finalised pair of guidebooks at the Caribbean Regional Fisheries Mechanism's 2nd Annual Science Conference in March 2006 has also led to the books being endorsed by CRFM for wider use in the region. Further consideration by CRFM's Ad-Hoc Methods Working Group at its second meeting in May 2006 also resulted in the guidebooks being recommended for use by member countries.

This Output relates to the land water interface production system and is relevant to coastal artisanal fisheries, inland fisheries and deep sea fisheries.

Current Situation

C. *Current situation*

12. *How and by whom are the outputs currently being used? Please give a brief description (max. 250 words).*

Fishery managers develop plans indicating how (management measures) and why (goals) they will manage a fishery. Stock assessments provide indicators of the status of the fishery relative to target or limit reference points set for the fishery. They enable monitoring of the implementation of the plan. Stock assessment tools have been used by fishery scientists and researchers to derive various indicators (and intermediary parameters required in the assessment process). LFDA has been used to determine the growth and mortality rates of fish, CEDA to estimate abundance, and Yield software to establish reference points for management. Guidelines on length or age based assessments of fisheries have been employed to improve the accuracy of fishery assessments. A number of the tools, including details of multi-species fisheries assessments have been used for training purposes both within Universities and by national research and extension organisations. The results of fishery assessments have been employed by managers to provide management advice to policy makers and to set

management targets. ParFish and other guidelines for co-management of fisheries have been employed directly with fishers and intermediary organisations to facilitate co-management approaches. The management guidelines have been employed by fishery managers to develop a management decision support tool and to inform the development of fishery management plans.

13. **Where** are the outputs currently being used? As with Question 11 please indicate place(s) and countries where the outputs are being used (**max. 250 words**).

FMSP tools are in widespread use (See also Q 21). Some current uses:

Africa / Indian Ocean

The CEDA, Yield and Parfish software and the guidelines on length / age based and multi-species fisheries are all in use to inform fisheries assessments for the Seychelles demersal, trap and holothurian fisheries. Management plans are being developed and the Guide 'How to manage a fishery' has been used.

In the British Indian Ocean Territory (BIOT), the CEDA, LFDA and Yield software have been used to establish management reference points and to monitor indicators of the status of the demersal fishery. Management planning has been informed by the management guide.

The guide 'How to manage a fishery' was used by the Lake Victoria Fisheries Office (LVFO) to develop a fisheries decision support tool. CEDA is being used by Fisheries Department, Kisumu, Kenya on data from sampled beach landing sites on Lake Victoria.

Asia

FMSP stock assessment software tools and training materials have been used to train students at Cantho University, and Ho Chi Minh City, Vietnam. The tools have 'frequently' been applied in fishery assessments (particularly growth parameter assessments) for fish species from the Mekong Delta, and for marine fisheries. Specific fisheries where they have been used include the freshwater Wallago attu (a high value species), mudskipper (commercially important marine species) and the pangasid catfishes of the Mekong.

In India, the Central Marine fisheries Research Institute (CMFRI) uses LFDA and CEDA in stock assessments published in their annual reports (e.g. see 2002-03) and within the Central Institute for fisheries Education (CIFE) for training purposes. The West Bengal Department of fisheries has provided follow-on training for 125 of its staff members, and has initiated data collection for assessment of the 'Hilsa' fishery using CEDA and LFDA.

Elsewhere

FMSP tools have been used in fisheries assessments at Annual Scientific Meetings of the Caribbean Regional Fisheries Mechanism for the eastern Caribbean wahoo (CEDA), and southern Caribbean king mackerel (LFDA and Yield). Management advice for these fisheries has been provided (Managers guides) and CRFM are promoting the paired 'Managers' and 'Stock Assessment' guidebooks regionally.

14. What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading (max 250 words).

Some FMSP stock assessment tools have been available for some time and are in widespread and increasing use. The guide 'How to Manage a Fishery' was completed in 2005, but its use has already spread beyond India and the Caribbean where it was tested, to Lake Victoria, Seychelles and BIOT. FAO have indicated that they intend to promote the use of the Framework Guide and Managers guide to the Western Central Atlantic Fisheries Commission (WECAFC).

As indicated in Q13, use is global, and uptake has not been confined solely to those organisations directly involved in developing and validating the tools. How quickly use was established varies, and relates to local capacity (see 15). Where capacity exists, use was immediate (e.g. Seychelles, CMFRI in India, Cantho University, University of Nairobi). Use is spreading, e.g. to the National Museums of Kenya; and in the Caribbean, where the CRFM has recommended the managers guides to its member countries for developing management plans. Since these are mostly updated every 3 years, the scale of use should spread rapidly. In others countries where capacity is less or other constraints exist, changes have nevertheless been made to use the tools e.g. following training in 2003, both the Kenya Fisheries Department and KMFRI changed data collection procedures to enable future use in stock assessment. The same is true in West Bengal.

Up to 1998 when formal annual reporting on the CEDA/LFDA projects ended, these software tools had been disseminated to, or downloaded from the FMSP website by people in 44 organisations in Latin America and the Caribbean, 31 in Africa, 21 in Bangladesh and India, 22 in SE Asia and 15 in the Indian Ocean. Download data is unavailable from 1998 - 2005, but between 21/08/05 - 15/09/06 286 individuals downloaded copies of LFDA, 249 CEDA, 229 Yield Software, and 226 ParFish from the new FMSP website. 112 people downloaded the Managers guidelines from the FAO OneFish website since April 2006.

15. In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you see as the key facts of success? (max 350 words).

FMSP stock assessment tools are designed to enable stock assessments to be undertaken in capacity limited situations typical of developing countries. However, there is still a need for trained scientists who can understand the use and application of the tools. The analysis undertaken for this Proforma reveals that adoption and sustained use of these outputs has been greatest where there is a stable organisational environment with a sufficient number of existing scientists trained to at least degree or MSc level able to use the tools. Highly trained experts have been able to adopt and use the tools in a number of ways, for example in India the CMFRI and CIFE have both used them in stock assessments and in developing training courses of their own based on the tools. In Vietnam, Cantho University, and in Kenya, University of Nairobi have also developed training materials and used the tools. Within Fisheries Departments, continued exposure to the tools from external sources following initial training has been a key factor leading to successful use. Those locations where the tools were validated in particular benefited. In India, local agencies CMFRI and CIFE were involved in the development of the stock assessment and managers guides, and now provide follow up training in their use. In Seychelles, the bilateral British Seychelles Fisheries Commission has increased scientists exposure to the tools and demonstrated their application, resulting in increasing local uptake. Continued training and practical assistance

during use of the tools and guides has been a critical factor for success. Indeed FAO have indicated that 'training and (help with) application have been important'.

Current Promotion

D. Current promotion/uptake pathways

16. Where is promotion currently taking place? Please indicate for each country specified detail what promotion is taking place, by whom and indicate the scale of current promotion (max 200 words).

Tools and Guides from this Output are promoted globally via a number of websites including the FMSP website (www.fmosp.org.uk Projects database, see project R8468, publications), FAO OneFish (www.onefish.org/id/301916), FAO TECA and shortly the FAO World Ocean Atlas website, and the DFID R4D website.

Three thousand hard copies of the FAO FTP 487 will be disseminated globally. Copies of the stock assessment and managers guides have already been disseminated in India and the Caribbean and will be distributed globally.

In India, CMFRI and CIFE have developed training courses based on the FMSP tools and are actively promoting them, most recently in October 2006. The Mangalore College of Fisheries now includes coverage of the FMSP Tools and the Management Guidelines in its Fisheries Science masters programme. Similarly, in South East Asia, the tools are being promoted by the educational and training institutes which have incorporated training of the tools within their syllabuses: Cantho University, Vietnam, and Prea Leap Agricultural School and the Royal University of Phnom Penh, Cambodia.

Seychelles Fishing Authority have become local champions for FMSP stock assessment tools recommending that for the GEF South West Indian Ocean Fisheries Project (SWIOFP) assessments are standardised and that FMSP tools are adopted. KMFRI, where the project is headquartered, also share this view and will both promote the Outputs and seek capacity building for them, which could be provided through RiUP. Current membership of SWIOFP includes Kenya (HQ), Tanzania, Mozambique, South Africa; Madagascar, Comoros, Seychelles, Mauritius and la Reunion.

In Africa, MRAG who previously managed the FMSP, have promoted the Managers Guide in the Lake Victoria Fisheries Organisation (LVFO), and through the British Seychelles Fisheries Commission continue to promote the tools and guides from this Output. The tools are also being promoted by the University of Nairobi, through their inclusion on the MSc course in Hydrobiology, which a number of Fisheries Department staff complete each year.

In the Caribbean, the paired 'Managers' and 'Stock Assessment' guidebooks are now being promoted by CRFM.

MRAG have also promoted the tools for adoption through the forthcoming FAO / WorldFish Centre Small Scale Fisheries Project but this project has not yet reached the stage of implementation.

17. What are the current barriers preventing or slowing the adoption of the output(s)? Cover here institutional issues, those relating to policy, marketing, infrastructure, social exclusion etc. (max 200 words).

Most fisheries are open access resources and there is frequently considerable political pressure to maintain this arrangement rather than to manage them. A lack of political will to assess and manage fisheries can be manifest in the human and financial resources allocated to these tasks. Lack of infrastructure can be an issue, such as insufficiently powerful computers required to undertake stock assessments using the tools or even simple laboratory facilities. Even where capacity exists to gather information on fisheries, a lack of understanding of the necessary types of information required to undertake a meaningful stock assessment can mean that existing data are inadequate. Changing to a new regime requires overcoming sometimes longstanding and well embedded systems that are delivering little value for money, although there is evidence that this is already changing in Kenya and the Maldives. Frequent movement of trained staff either to other departments or sections within government, or to higher education has also been significant in reducing the benefits of the FMSP stock assessment training courses (for example, amongst the East Africa stock assessment training course participants, for one-third of the institutions, trained staff had left for further study). Even where stock assessment tools have been well adopted, a lack of sufficiently well trained staff to enable the move from assessment to management was cited as a constraint.

In implementing management actions, it is important that fishers understand and participate in management decisions, and the tools and guides promote this approach. However, overcoming resistance to management remains an issue. A lack of suitable alternative livelihood options, for example to enable fishers to cope if fishing effort must be reduced, can also be a major constraint.

18. What changes are needed to remove/reduce these barriers to adoption? This section could be used to identify perceived capacity related issues (max 200 words).

In order to foster a better common understanding of the benefits of well managed fisheries and the costs of not managing them, there is a need for raising both public and fisher awareness and to sensitise policy makers to the issues. There is also a need for better communication between policy, scientists and fishers with all actively participating in assessment and management of fisheries. An integrated approach to management of resources to provide multiple livelihood opportunities encompassing other natural resource (NR) and non NR sectors is also necessary (e.g. Integrated coastal zone or floodplain management). The RiUP offers a significant opportunity to enable such an integrated approach.

Increased political support can lead to increased human and financial resource allocation which will be advantageous. Better use of existing resources however should be prioritised. Dedicated staff are required that retain an institutional memory of the fisheries and issues, and that can build on and implement knowledge acquired through relevant training. Furthermore, training must be followed up with even low level but regular external support until stock assessment tools and management processes are embedded. Existing information gathering systems must be examined and adapted to provide resource assessment and policy relevant data, and effective means of sharing it must be identified.

In the context of this Output clear demand was expressed for specific support and capacity building related to

developing operational management plans in order to move from assessment to implementing practical management action (e.g. Bangladesh, Seychelles and Kenya).

19. What lessons have you learnt about the best ways to get the outputs used by the largest number of poor people? (max 300 words).

These Outputs are primarily targeted at intermediary organisations and policy. They aim to create an enabling environment that through their implementation will deliver benefits to the poor. Whilst they have not been designed to be used directly by poor fishers, it is important that fishers participate in management decisions and receive feedback from assessments. The best way to achieve this is through engaging fishers and policy makers in dialogue from the start. Thus mechanisms for communication linking policy makers, scientists and resource users are the key to both successful implementation of these Outputs and to engaging the poor in the process. Some of the Outputs in this cluster (e.g. ParFish) directly address this issue, but for all outputs, the Guide 'How to Manage a Fishery' emphasises the need for participation. Combining these outputs with others such as the adaptive learning approach has also proved to be an effective way of increasing participation.

Impacts On Poverty

E. Impacts on poverty to date

20. Where have impact studies on poverty in relation to this output or cluster of outputs taken place? This should include any formal poverty impact studies (and it is appreciated that these will not be commonplace) and any less formal studies including any poverty mapping-type or monitoring work which allow for some analysis on impact on poverty to be made. Details of any cost-benefit analyses may also be detailed at this point. Please list studies here.

There have been a number of impact studies for the FMSP that have included individual tools in the cluster of projects that contribute to this Output:

Arthur, R.I., E. Fisher, R. Mwaipopo, X. Irz, and C. Thirtle, (2005). Fisheries Management Science Programme: An overview of developmental impact to 2005, Final Technical Report., MRAG Ltd. (www.fmosp.org.uk Search Project Database, Project R4778C; http://www.fmosp.org.uk/Documents/r4778c/R4778C_FTR.pdf;

Halls, A. S. & Arthur, R. (2006). Assessment of the Impact of the FMSP: A summary of the assessment of impact from the perspectives of key fisheries institutions and researchers. Report to the DFID, London, MRAG Ltd. http://www.fmosp.org.uk/Documents/r4778c/R4778C_Rep1.pdf;

Fisheries Management Science Programme: assessing developmental impact, Policy Brief, March 2006, http://www.fmosp.org.uk/Documents/r4778c/R4778C_Brief.pdf

Arthur, R., A. Halls and C. Mees, 2006, Impact of fisheries management science: Experience from DFID's Fisheries Management Science Programme. *Paper 235 IIFET Conference Proceedings*, IIFET, Portsmouth, July

2006. (Abstract appended)

The following paper is not an impact assessment per se, but outlines lessons learnt on delivering FMSP research that can lead to impact.

Mees, C. and R. Arthur, 2006, Fisheries Management Research And The MDGs: Past Experience And Future Vision *Paper 236 IIFET Conference Proceedings*, IIFET, Portsmouth, July 2006. (Abstract appended)

FMSP annual reports also provide some information on impacts, and since 2004 a specific impact assessment questionnaire was sent to project leaders in addition to other annual reporting requirements. Responses to those questionnaires have been incorporated into annual reports and into the above impact studies.

LTS International (2005) Evaluation of DFID renewable Natural Resources Research strategy, DFID London, See Annex 10 Chapter 2: <http://www.dfid.gov.uk/research/renewable-natural-resources.asp>

In Vietnam, Cantho University have reported one unpublished study showing the impact of use of the software in a shrimp fishery in the Mekong delta, and that use of the software has helped the fisheries to be better managed, leading to a positive impact on poor fishers by increasing their share of catches.

FMSP also conducted demand assessments:

Mees and O'Neill, 2002, Informing the FMSP strategy for interventions for the period 2002-2005: An analysis of research demand, FMSP activities, knowledge gaps and priorities for future research – Defining a new logical framework

21. *Based on the evidence in the studies listed above, for each country detail how the poor have benefited from the application and/or adoption of the output(s) (max. 500 words):*

- *What positive impacts on livelihoods have been recorded and over what time period have these impacts been observed? These impacts should be recorded against the capital assets (human, social, natural, physical and, financial) of the livelihoods framework;*
- *For whom i.e. which type of person (gender, poverty group (see glossary for definitions) has there been a positive impact;*
- *Indicate the number of people who have realised a positive impact on their livelihood;*
- *Using whatever appropriate indicator was used detail what was the average percentage increase recorded*

These outputs aim to create an enabling environment, delivering livelihood benefits through the interventions of intermediary organisations and changes in policy and management of fisheries. This is necessary for fisheries because of the scale at which management decision-making is so often required and the common pool nature of the resource systems, attributes that distinguish fisheries management from either agriculture or aquaculture. Developing the transforming structures and processes, for example increasing the capacity of government and/or community-based agencies and institutions to manage their resources is typically the most effective means of delivering benefits to the poor. The effect on the livelihoods assets and vulnerability of the poor is therefore less direct than for focussed research where the outputs are delivered directly, for example the promotion of new seed

varieties. There is also a time-lag between implementation of better management and developmental impact. This can be related to the life history of a particular fish - the longer it takes to grow, the longer the time-lag before the effects of management will be observed. In such cases examining the impact pathway from design of the products, through adoption and use to ultimate impact can be a useful way of seeing how the outputs are contributing to improved livelihoods.

Dissemination and uptake of the software packages and guidelines has been quite successful with several hundred copies of the software packages downloaded and in use in developing countries worldwide (see Q 14). Application of the software packages has informed management in a number of cases. In the case of the Mexican Pacific shrimp fishery (the most important export earner and a livelihoods component for an estimated 288,000 fishers), the analysis showed that the fishery was overfished. This was acknowledged as extremely important and the results formed the basis for the design of management measures to allow stock recovery and improve the status of the fishery. The packages have also been used to assist management of the Costa Rica prawn fishery, the Turks and Caicos lobster and conch fisheries (considered stable fisheries), the Lake Tanganyika kapenta fishery (a fishery involving some 20,000 fishers), the Mexican lobster fishery, the Caribbean wahoo and king mackerel fisheries, and the spiny lobster fishery around Tristan de Cunha. The packages are routinely used by the Namibian and Keralan fisheries departments amongst others and have been used in the development of training materials in both Kenya and India. The software has also been of use in developed country fisheries including Falkland Island rays, Scottish squid, Mediterranean anchovy and the Hong Kong inshore fishery. Use of the outputs has been beneficial. Halls and Arthur (2006) note the 'very significant impact (of the FMSP) on the capacity of both institutions and individual researchers to achieve or contribute to developmental impact' and it is especially here that these outputs are important. This was cited not only by national fisheries organisations, but also by international bodies such as FAO and WorldFish Centre specifically for these Outputs. Another FMSP Proforma looks specifically at capacity building in stock assessment.

It is difficult to assess the livelihoods benefits of using the outputs but better management of the resource base is almost certain to have some positive impact. In Seychelles holothurian fishers were positive about participation in management, and lobster fishers have more faith in current participatory resource assessments than previous 'research surveys'. The precautionary catch quotas that were set for the Namibian orange roughy using these outputs almost certainly reduced the chance of overexploitation in the initial years of this developing fishery and have contributed to the maintenance of a sustainable fishery that should provide job security for those involved. Finally, in Tanzania the Department of Fisheries report that catches have increased due to better management as a result of the use of these outputs.

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? (max 300 words)

This could include direct benefits from the application of the technology or policy action with local governments or

multinational agencies to create environmentally sound policies or programmes. Any supporting and appropriate evidence can be provided in the form of an annex.

Better management of fisheries will result in sustainable fish production and increased biodiversity. There will be more and larger fish. It will prevent the negative environmental impacts associated with not managing a fishery such as over-fishing, loss of biodiversity, extinctions and stock collapse, and loss of habitat. Wider beneficial environmental impacts related to preventing habitat destruction associated with inappropriate fishing methods will also occur. Depending on the management mechanisms adopted, habitat restoration may occur, or there may be river reserves (sanctuaries) or marine protected areas that can have both positive environmental impacts and fisheries benefits. Integrated management approaches can also bring wider environmental benefits such as mangrove forest restoration and management also providing more nursery habitat for many reef associated species.

Application of the guide 'How to Manage a Fishery' should deliver whatever are the goals and objectives selected by stakeholders for their fishery. Where environmental goals are prioritised, these should be achieved (in the long term). Where socio-economic goals are prioritised these should also be achieved, but within the natural constraints imposed by the environment, and not at its expense.

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? (max 100 words)

It is not anticipated that better fisheries management would result in any negative environmental impacts.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? (max 200 words)

The FMSP has undertaken an evaluation of the impacts of climate change on fisheries associated livelihoods, which is the subject of a separate proforma. Climate change is anticipated to have effects on fisheries associated with particular habitat systems, such as floodplains or coral reefs, and on fish migrations (e.g anchovies) associated with ocean currents that may be affected by changes in cyclical climatic events such as El Nino. Adaptive responses of communities to variable conditions and the need to build adaptive capacity to climate change are described more fully in that Proforma. Better management of fisheries is a key element of building adaptive capacity. It will help build resilience into the system and help to limit the detrimental effects of climate change. Integrated management responses must be developed linking fishing departments and policy makers with risk reduction planners and disaster control agencies. These Outputs applied together will thus increase the capacity of poor people to cope with the effects of climate change, and increase their resilience. They will not, however, reduce the risks of natural disasters.

Annex

Annex 1. ABSTRACTS

Arthur, R., A. Halls and C. Mees, 2006, Impact of fisheries management science: Experience from DFID's Fisheries Management Science Programme. *Paper 235 IIFET Conference Proceedings*, IIFET, Portsmouth, July 2006.

A central objective for UK Department for International Development (DFID) funded research on renewable natural resource systems has been that the research commissioned results in significant positive developmental impacts. This paper describes the outcomes of activities employed by the DFID funded Fisheries Management Science Programme to assess the developmental impact of fisheries management research achieved by projects commissioned under the Programme during the last 11 years. Fisheries pose a particular challenge for the attribution of impacts. A variety of approaches to impact assessment are required, as the systems are characteristically complex, dynamic and heterogeneous. Typically fishery systems operate across multiple scales, involving a wide range of stakeholders with different, and sometimes conflicting, objectives. Fisheries management, usually faced with multiple uncertainties about the system and its dynamics, has to occur at a scale that accounts for both the biophysical scale of the resource and the scale at which there exists the capacity and capability to manage. The paper will illustrate some of the impacts that have been achieved and highlight some of the lessons learned regarding uptake, adoption and impact assessment that should be of interest to researchers and those funding developmental research.

Mees, C. and R. Arthur, 2006, Fisheries Management Research And The MDGs: Past Experience And Future Vision Paper 236 IIFET Conference Proceedings, IIFET, Portsmouth, July 2006.

This paper examines the eleven year Department for International Development funded Fisheries Management Science Programme as a model to explore how fisheries management science can contribute to achieving the Millennium Development Goals. It describes how the Programme strategy was able to adapt to a changing policy environment and local needs and demands for research in order to achieve these goals. It describes a research portfolio that addresses a number of themes contributing to achieving ecologically and economically sustainable fisheries that can support and maintain fisheries associated livelihoods. These themes include policy information required to support fisheries; the information systems needed to involve fishers, particularly the poor, in the co-management of fishery resources; fisheries assessment methods and how these can be integrated within pro-poor capture fisheries management strategies; and, the role that enhancement fisheries can play in poverty alleviation. The paper concludes by highlighting what more needs to be done, building on the achievements of the FMSP, and outlining a vision for the future, getting research into use.

Annex 2.

Evidence of demand expressed for this Output by Seychelles Fishing Authority. The Joint communiqué attached is a public document, but the Scientific Committee Meeting to which it refers is not. The relevant text is inserted – see Paragraph 5

Joint Communiqué

British / Seychelles Fisheries Commission

Thursday 21st September 2006

1. The eleventh meeting of the British / Seychelles Fisheries Commission took place at the Seychelles Fishing Authority, Mahé, Seychelles on Thursday 21st September 2006. The UK delegation was led by Prof. John Beddington, Imperial College London. The Seychelles delegation was led by Mr Rondolph Payet, Managing Director, Seychelles Fishing Authority.
2. The Commission noted the work and progress made at IOTC since the 10th Commission. The Commission noted the ban on transshipment at sea that has been introduced by the UK. The Seychelles is considering such a ban in consultation with the Indian Ocean Commission countries.
3. The Commission noted the creation of two new regional fisheries organisations. The South-West Indian Ocean Fisheries Commission (SWIOFC) which is to address the management of the fish stocks in coastal areas of the Indian Ocean and the Southern Indian Ocean Fisheries Agreement (SIOFA) which addresses the deep water non-tuna fish stocks found on the High Seas. The Seychelles as chair of the Commission indicated that they would very much welcome the UK as a member of SWIOFC. The UK indicated that this was under active consideration. In the case of SIOFA, the Seychelles has signed the agreement. The UK indicated that they would consult on this issue.
4. The Commission noted the work of four regional projects. The Southwest Indian Ocean Fisheries Project (SWIOFP) is a World Bank funded GEF project with a number of smaller sub-projects investigating a number of specific issues relating to fisheries in the region. The SWIOFP is projected to start in 2007. The EU funded Indian Ocean Commission Pilot Project for the Monitoring, Control and Surveillance of Large Pelagics in the Indian Ocean (IO MCS) is a three year project and has been running for eighteen months. It has been proposed that this project will be extended by another year to continue work programmes that have been started under the project. The EU funded Regional Tuna Tagging Project (RTTP) based in the Seychelles has been working to extend the understanding of the tuna stocks through a large scale tagging study around the Western Indian Ocean. The EU funded 5 year project Regional Programme for the Sustainable Management of the Coastal Zones in the Indian Ocean has just commenced and this programme will be managed through the Indian Ocean Commission.
5. The Commission noted the previous work of the UK Department for International Development's Fisheries Management Science Programme and the Research into Use Programme that will follow on from the work of the FMSP projects. The Commission noted the demand expressed at the meeting of the Scientific Sub-Committee for the products of this programme. ('The FMSP ended in March 2006 but the tools under the programme remain relevant. Their use within Seychelles and within the context of the BSFC were discussed and any constraints to their adoption. In particular, there was a demand for products relating to the development of fisheries management plans'.)
6. The Commission noted the Economic Partnership Agreement negotiations of the Eastern and Southern African (ESA) countries which will replace the Cotonou Agreement. The Commission noted in particular the reliance of the Seychelles on the fisheries sector as compared to the other members of the ESA and discussed its potential impact. The UK agreed to consult further on this issue and noted the potential problems for BIOT FCMZ (Chagos Archipelago) fisheries management.
7. The Commission noted the current and proposed licensing agreements for the offshore purse seine and longline fisheries and the licensing of vessels in the inshore fisheries adopted by the Seychelles and by the BIOT Authorities. The Seychelles and UK delegations agreed to continue to share information in future.
8. The Commission noted the illegal fishing activities that have been detected in the Seychelles EEZ and the BIOT FCMZ (Chagos Archipelago) in the past sixteen months. The Commission strongly reaffirmed its support for the actions

taken by both governments to combat and address the problems of illegal activity.

9. The Commission agreed to endorse the recommendations of the Scientific Sub-Committees to their respective governments.
10. The Commission welcomed the successful exchange of data and information and the progress made on joint analyses and verification of fisheries data through the Scientific Sub-Committee Meetings.
11. The Commission welcomed the recommendations for collaborative research made in the reports of the Scientific Committee at its seventeenth and eighteenth meetings. The Commission agreed to endorse these recommendations.
12. The Commission reaffirmed the need for cooperation between the Seychelles and the UK Governments on inshore fisheries through this Commission and on the tuna fisheries both through this Commission and within the Indian Ocean Tuna Commission.
13. The Commission noted with deep regret the death of Dr Geoff Kirkwood in March and extended their profound sympathy to his wife.
14. The nineteenth meeting of the Scientific Sub-Committee of the British / Seychelles Fisheries Commission and the twelfth meeting of the British / Seychelles Fisheries Commission will provisionally be held in London in April or May 2007. The nineteenth Scientific Sub-Committee Meeting will in this case be a one day meeting. The twentieth Scientific Sub-Committee Meeting will be held in the Seychelles during September / October 2007 and will be a two day meeting.
15. The Commission noted the benefit of the timing of the Commission meeting in the Seychelles during September. It was proposed that the thirteenth Commission meeting in the Seychelles during 2008 should be held during September.

Mr Rondolph Payet
Head of Seychelles Delegation

Prof John Beddington
Head of UK Delegation

21st September 2006
