

## APPENDIX 4

### FINAL TECHNICAL REPORT

DATE SHEET COMPLETED: 20 /03/2005

Revised: 29/04/2005

TITLE OF PROJECT

Uptake of Participatory Fisheries Stock  
Assessment (PFSA) Toolkit

PROGRAMME MANAGER / INSTITUTION

Marine Resources Assessment Group

REPORTING PERIOD

FROM

15/05/04

TO

28/02/05



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## EXECUTIVE SUMMARY

**A very brief summary of the purpose of the project, the research activities, the outputs of the project, and the contribution of the project towards DFID's development goals. (Up to 500 words).**

Small-scale fisheries provide important contributions to the livelihoods of poor people in developing countries through income, food security and protein and micro-nutrient availability. However, there has been a lack of tools for supporting management of these fisheries, especially in developing countries where there is a lack of historical data, capacity and financial resources to undertake traditional stock assessments and data collection. ParFish fills this gap by providing a resource-efficient stock assessment technique that does not require long-term time series data, can be applied with limited resources to provide a starting point for management decisions and involves the resource users in setting management objectives, data collection and management planning.

The purpose of the project was to increase uptake of the PFSA (now ParFish) methodology for data-poor, artisanal fisheries in developing countries so that stock assessment institutions can more effectively collect, share and analyse information with relevant stakeholders to improve fishery dependent livelihoods.

The main objective was to develop a strategy and supporting materials to promote the ParFish methodology created under FMSP (R7947). The project developed a Toolkit to support the use of ParFish that consists of a framework and guidance on implementing ParFish, carrying out data collection, feedback and participatory planning activities; user-friendly Software for data entry and stock assessment analysis; and, a Software Manual providing step-by-step guidance on using the Software.

The ParFish Toolkit was tested in Zanzibar through a case study, which served to further develop and refine the toolkit, and increase the capacity of IMS and other institutions involved in the implementation of ParFish. The project also promoted the uptake and further support of ParFish through its communication activities, which included dissemination of project flyers, presentations, meetings, articles and training events at national (Tanzania and Zanzibar), regional (East Africa) and international levels, and the production of proposals for further funding of ParFish activities.

This project contributes to DFID's development objectives through the provision of baseline information and improved data collection systems which involve communities, a demand identified in the FMSP East Africa Strategy paper (DFID, 2002). The methodology provides a starting point for adaptive and participatory management involving the resource users. This helps promote good governance of fisheries and empowerment of the resource users who become more involved in decisions which affect their livelihoods, have their voices heard, and build links with the institutions responsible for supporting resource management.

The outcome of implementing the ParFish approach is expected to be more sustainable resource use and management, which will support the continued contribution of fisheries resources to the livelihoods of the rural poor, and thus help their way out of poverty.

# 1. Background

Information should include a description of the importance of the researchable constraint(s) that the project sought to address and a summary of any significant research previously carried out. Also, some reference to how the demand for the project was identified.

## 1.1. Developmental Need

Across the developing world coral-reef fishery resources are of central importance in the suite of livelihood strategies employed by tens of thousands of fisher communities. Small-scale fisheries provide important contributions to the livelihoods of poor people in developing countries through income, food security and protein and micro-nutrient availability. However, the coping and adaptive strategies of the majority of communities appear largely unable to stem falling catches or the destruction of reef habitat.

There are a number of reasons for the dilemmas faced by stakeholders in coral reef fisheries management. At one level, the potential for success of those (often external) voices calling for restraint in the level of fishing is constrained by the significant poverty imperative faced by most dependent stakeholders in these fisheries. Human population growth implies that limited resources are being targeted by ever increasing numbers of fishers. This creates a negative feedback cycle of increasing poverty and increasing fishing pressure that further reduces natural productivity of coral reefs. At another level, despite the importance of such fisheries to the wider economic and nutritional health of coastal communities, investment in management by the State is usually minimal. This situation is exacerbated by the fact that the poverty faced by fisher communities perpetuates their social and political exclusion such that they are often without effective means to participate in or influence what limited management decision-making may currently be underway. Finally, the technical assessment of such complex eco-systems is challenging and costly, requiring a considerable amount of data and resources to collect this data.

Management research agencies (e.g. Universities; development agencies; FAO & UNDP), State management authorities and NGOs are constantly seeking approaches to address these resource, governance and technical constraints. Issues of resource limits are being addressed through the promotion of alternative livelihoods or the enhancement of resource productivity (or access to new resources) through FADs, artificial reefs, mariculture, improved post-harvest technology and increased resource value through market development etc. ParFish focuses on addressing governance and technical issues through the provision of improved information for use by dependent stakeholders.

## 1.2. Researchable constraints

Stock assessments are an important component for managing fisheries, and provide advice on recommended exploitation rates in order to maintain sustainability of the resources, but there is a lack of stock assessment methodologies which support data-poor small-scale fisheries. Existing assessment methods often demand detailed time-series of catch and effort data, data beyond the scope of the majority of State (NGO) agencies in developing countries operating under severe financial constraints. The result is that there is often no information available on which to base management decisions, which can result in the unsustainable exploitation of stocks, leading to associated social and economic problems.

Experience has shown that participation of resource users is important for sustainable management of resources, but participation is not integral to the methodology of previous stock assessments. Neither have participatory methods (for rapid rural appraisal) addressed

adequately quantitative assessment or dealt with uncertainty. Participation of resource users in the stock assessment facilitates their uptake and acceptance of the results, making them more likely to take ownership of the results and recommendations, and take management decisions or actions based on them.

ParFish addresses these constraints by providing:

- Resource-efficient stock assessment technique that does not require long-term time series data, can be applied with limited resources to provide a starting point for management decisions and involves the resource users in setting management objectives, data collection and management planning;
- Access to clear, reliable and cost-effective resource assessments. While data should be used where they are available, their absence should not prevent stock assessments and management advice;
- Decision-making protocols that rigorously capture stakeholder knowledge, objectives and utility that have previously been generally unavailable in fisheries;
- An approach which encourages the involvement of resource users, explicitly incorporates their knowledge in the assessment and includes ways of communicating the results of the assessment to them so that they can assimilate and use the information to develop participatory management plans.

### **1.3. Scientific Background**

This project built on previous work undertaken by project R7947 which developed the stock assessment and data collection techniques (see Medley, 2003). No further scientific research has been undertaken in R8397.

There are a number of stock assessment methodologies currently available, but none that are able to cope with data-poor artisanal fisheries and integrate a truly participatory approach. ParFish provides this type of methodology using a decision analysis technique.

This technique is used to build a target reference point and estimates limit reference points based upon estimated probability distributions for the state of the fishery in response to different fishing controls. The advantage of using a probabilistic approach is that uncertainty is explicit and even very uncertain information might be used which otherwise would have to be dismissed. This enables a stock assessment to build up information from various sources more easily. ParFish applies a particular, but 'standard' decision analysis approach (e.g. Lindgren 1976).

ParFish is innovative in two ways in respect it use of the logistic model for stock assessment:

- Firstly, it builds individual probabilities using non-parametric kernel smoothing functions (Silverman 1986). This is more flexible and faster than using parametric approaches, at the cost of lower accuracy where parametric distributions can be identified or are known. The method is able to use information as long as it can be represented as parameter frequencies. These frequencies are treated as though they have been drawn from some underlying probability distribution, which encapsulates the uncertainty in the stock assessment.
- Secondly, it uses interviews with resource users to model subjective probabilities for initial parameters and to model the 'utility', that is a measure of preference among different outcomes for the fishery. The method for obtaining subjective probabilities is based on one described by Press (1986). Again, the method builds a probability from individual fishers' best estimates of the current state and productivity of the stock using kernel smoothers to bridge differences in opinion. The 'utility' measure is based on fishers ranking different outcomes in the fishery

and providing a relative score on how good or bad these outcomes are. This is a new method, but related to various approaches used to model utility (see Keeney and Raiffa 1993). In particular, it contrasts catch and effort under different scenarios using pairwise comparisons. It could be further developed into a multi-attribute hierarchical utility model, but field work has shown that simpler and faster methods perform better than complex ones, even though they may be more theoretically rigorous.

ParFish could also provide multi-species stock assessments in the future although this goes beyond the method promoted in this project and would require further testing given the large number of parameters involved. A multispecies model does exist in the software but has been hidden for this release. A simpler model was chosen for this initial version of ParFish to assist with its uptake by a wide range of organisations. Multispecies analysis and assessments are planned to be investigated further at a later date.

The ParFish methodology has been developed into a Toolkit which includes:

- Guidelines on implementation of ParFish, a framework for implementing the approach and the necessary tools such as participatory approaches, interview sheets, examples of how information and concepts can be presented to fishers, experimental schedules, and methods of communicating the results back to fishers.
- User-friendly software package;
- Software user manual.

The Toolkit was required for effective promotion of ParFish and use by fisheries management or stock assessment institutes. In terms of the framework, the adaptive learning approach was chosen as the most appropriate as it provides a structured approach to information generation or experimentation (Garaway & Arthur, 2002). It allows for analysis of stakeholders, an understanding of the management and resource user context and analysis of the communication channels available. These are all important steps to undertaking ParFish within a fishery as this approach will ensure that the right people are involved in the process from the beginning, the right communication channels and methods are formed and a forum is created to discuss and agree the recommendations or management options. It is also important that the management options are possible within the context, and an understanding of this from the beginning helps guide the design and implementation of a ParFish assessment.

The ParFish Toolkit also supports co-management approaches by guiding resource user involvement; the sharing of information with the relevant stakeholders (e.g. local government, NGOs); and developing a forum for discussion on possible management options. The development of participatory techniques in the Toolkit has been guided by best-practice and established guidelines such as Srinivasan (1990), Bunce et al. (2000), Walters et al. (1998) and FAO's Participation Website, established by the Informal Working Group on Participatory Approaches and Methods to Support Sustainable Livelihoods and Food Security (IWG-PA), with the aim to capitalise on FAO's most successful normative and field experiences with participatory approaches and methods. Other participatory tools have been specifically developed for the Toolkit, including the stock assessment and preference interviews and innovative ways of presenting concepts and theories of fish stock dynamics, stock assessments and management recommendations to the fishers.

## **1.4. Demand for the Project**

Co-management is being widely promoted as an approach to the management of fisheries, and ParFish complements this by providing a framework within which information can be



collected, and management recommendations can be made and discussed with the fishers and other stakeholders involved in the process.

Prior to the commencement of the project, a number of institutions at the regional and international levels had expressed interest in ParFish as a new approach to stock assessment that supports co-management systems, such as the Caribbean Regional Fisheries Mechanism, the United Nations Food and Agriculture Organization staff who had received copies of the ParFish software as part of the R7947 project, and staff at the World Wide Fund for Nature - Kiunga Marine National Reserve in Kenya. As a result of the promotional and awareness-raising activities of this project, substantial interest in the approach was generated from a wide variety of stakeholders. Interest stems from ParFish being a new and rapid approach to stock assessment that supports co-management, is participatory and is particularly applicable in small-scale fisheries. Institutions that have expressed an interest include: the World Bank through the Marine and Coastal Environment Management Project in Tanzania; FAO Regional Office for Asia and the Pacific; WorldFish Center, Bay of Bengal Programme, CORDIO (Coral Reef Degradation in the Indian Ocean) in collaboration with fishers at Diani, Kenya, the Sustainable Fisheries Livelihoods Program in West Africa, Government Fisheries Departments in India, the Western Pacific Fishery Management Council, the Lake Victoria Fisheries Organisation, WWF-Brazil (Amazon) and researchers, consultants and other projects from Canada, the Philippines, Sri Lanka, Tanzania, West Africa, US and Europe.

At the national level in Tanzania, there is considerable interest from the Institute of Marine Sciences (IMS), Zanzibar in developing capacity in the ParFish methodology. Through their participation in field testing and development of the approach in Zanzibar, the Institute for Marine Sciences, the Fisheries Department, the Menai Bay Conservation Area and the fishers at Kizimkazi have all become interested in ParFish. Interest in ParFish by fishers themselves stems from collecting information and being involved in the stock assessment process, as well as being a central partner in discussions concerning the recommendations and implementation of management measures.

The 1999 DFID Country Strategy Paper for Tanzania supports the sustainable management of the natural environment through community-based approaches. The FMSP East Africa Strategy paper (DFID, 2002), also reports a high demand for baseline information and improved data collection systems including the involvement of communities. This project addresses these areas by providing baseline information (stock assessment) in Zanzibar, and also a method for data collection with community involvement that can be applied elsewhere in the country with the support of IMS. In addition there is a new World Bank funded project, 'Marine and Coastal Environmental Management Project' (MACEMP), which has stated stock assessments and participatory planning as part of the objectives (World Bank, 2003) and has expressed interest in the use of ParFish for community development and fisheries monitoring components of the project.

The principles underlying ParFish support international fisheries policy and direction. The United Nations Program of Action on Sustainable Development concluded that it was necessary:

***'To strengthen national capacities, particularly in scientific education and training, to enable Governments, employers and workers to meet their environmental and development objectives and to facilitate the transfer and assimilation of new environmentally sound, socially acceptable and appropriate technology and know-how.'***  
AGENDA 21, Rio de Janeiro, 1992

ParFish supports this by providing an appropriate methodology for promoting environmentally sound, socially acceptable and appropriate resource management plans, and training will build national capacity to enable governments to implement this through their fisheries management and research institutions.

The FAO Code of Conduct for Responsible Fisheries (CCRF) contains several articles which ParFish supports:

***Article 6.3 States should prevent over fishing and excess fishing capacity.***

ParFish allows an assessment of the state of the stock and appropriate management actions for small scale fisheries which otherwise cannot be assessed through a lack of resources and information.

***Article 6.4 Conservation and management decisions for fisheries should be based on the best scientific evidence available, also taking into account local knowledge of the resources and their habitat, as well as relevant environmental, economic and social factors.***

ParFish allows many sources of information to be combined in the assessment, including 'standard' data such as catch and effort time series as well as fisher knowledge recorded through interviews. Fisher interviews also take account of economic and social factors.

***Article 6.5 States and sub regional and regional fisheries management organisations should apply a precautionary approach.***

The absence of adequate scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species and non-target species and their environment.

ParFish focuses on identifying the best management action under uncertainty. This means that a recommendation can always be made. At the same time, ParFish identifies the main sources of uncertainty and can be used as the basis for recommending future data collection and research.

***Article 6.18 Recognising the important contributions of artisanal and small-scale fisheries to employment, income and food security, States should appropriately protect the rights of fishers and fish workers.***

The participatory framework allows wider management issues important to fishers to be taken into account, as well as exploitation issues addressed by the stock assessment.

While some institutions would have been able to use the software as it stood at the end of project R7947, it was apparent that others would need more guidance and support. This project responded to the interest and demand expressed for the ParFish methodology, developing a user-friendly version of the Software and a Software Manual to guide people in its use, and Guidelines for applying the ParFish methodology in a participatory and adaptive framework.

## 2. Project Purpose

The purpose of the project and how it addressed the identified development opportunity or identified constraint to development.

The purpose of the project was to develop and promote a Toolkit for increasing the uptake of the ParFish Software and methodology for data-poor, artisanal fisheries in developing countries so that stock assessment institutions can more effectively collect, share and analyse information with relevant stakeholders to improve fishery dependent livelihoods. This is expected to contribute to poverty reduction through the improved and sustainable management of small scale fisheries on which the poor are dependent and through the subsequent benefits expected for associated fishery dependent livelihoods.

The ParFish software and methodology provides a stock assessment technique that can be used to provide management advice for fisheries that have no or little existing data. It also involves the resource users in setting management objectives, data collection and management planning. However, in its previous form, the software was difficult to use and there were no guidance notes on implementing the approach or selecting data collection methodologies. This project addressed this constraint by developing a Toolkit which comprises:

- **ParFish Guidelines**, which provide:
  - A framework for the implementation of ParFish;
  - Guidance on carrying out each stage of implementation, from identifying the fishery and understanding the context, involving stakeholders and carrying out the stock assessment to interpreting and feeding back the results, developing management action plans and evaluation;
  - A selection of Tools for implementing the approach;
  - Concepts involved and ways of communicating them to stakeholders;
- **ParFish Software**, which includes:
  - New easy to use interface;
  - Step-wise approach to guide the user through entering data, setting up models, etc.;
  - A wizard for setting up the most common models encountered;
  - New control panel on the analysis page to allow settings for the analysis to be adjusted directly from the analysis page;
  - New graphical outputs;
- **ParFish Software Manual**, which provides step-by-step guidance on using the Software.

The complete Toolkit provides the guidance necessary for adapting ParFish to a local situation and implementing it, including analysing the data and interpreting the results. Training in the approach will support the use of the Toolkit and may help some institutions implement the approach.

## 3. Research Activities

This section should include detailed descriptions of all the research activities (research studies, surveys, experiments etc) conducted to achieve the outputs of the project. Information on any facilities, expertise and special resources used to implement the project should also be included.

Indicate any modification to the proposed research activities, and whether planned inputs were achieved.

### 3.1. Development of Toolkit

As described in Section 2, the Toolkit consists of three parts: the Guidelines, Software and Software Manual. Here we describe the development and testing of each part. The three parts are necessary for implementation of the ParFish approach. The Guidelines provide the framework, guidance and tools for implementing the approach, the Software provides the data analysis tool, and the Software Manual is necessary to accompany the Software to guide users through its use. The Software also contains a context-sensitive help file, but this does not provide step-by-step guidance on using the Software, as the Software Manual does.

#### 3.1.1. Guidelines

##### *Overall process*

The overall process for developing the Guidelines was as follows:

- Review of current ParFish material and other available materials that could inform the Guidelines and Toolkit;
- Development of ParFish Guidelines (Stages 1 – 3), including tools for implementing the approach;
- Testing of Stages 1 – 3 with the Tanzanian Institute of Marine Sciences (IMS);
- Implementation of Case Study in Kizimkazi, Zanzibar;
- Development of materials for Stages 4 – 6 based on experience of Case Study, and refinement of Stages 1 – 3;
- Review of Guidelines by Communications Expert and by Adaptive Learning and Fisheries Specialist;
- Modifications made and final version produced.

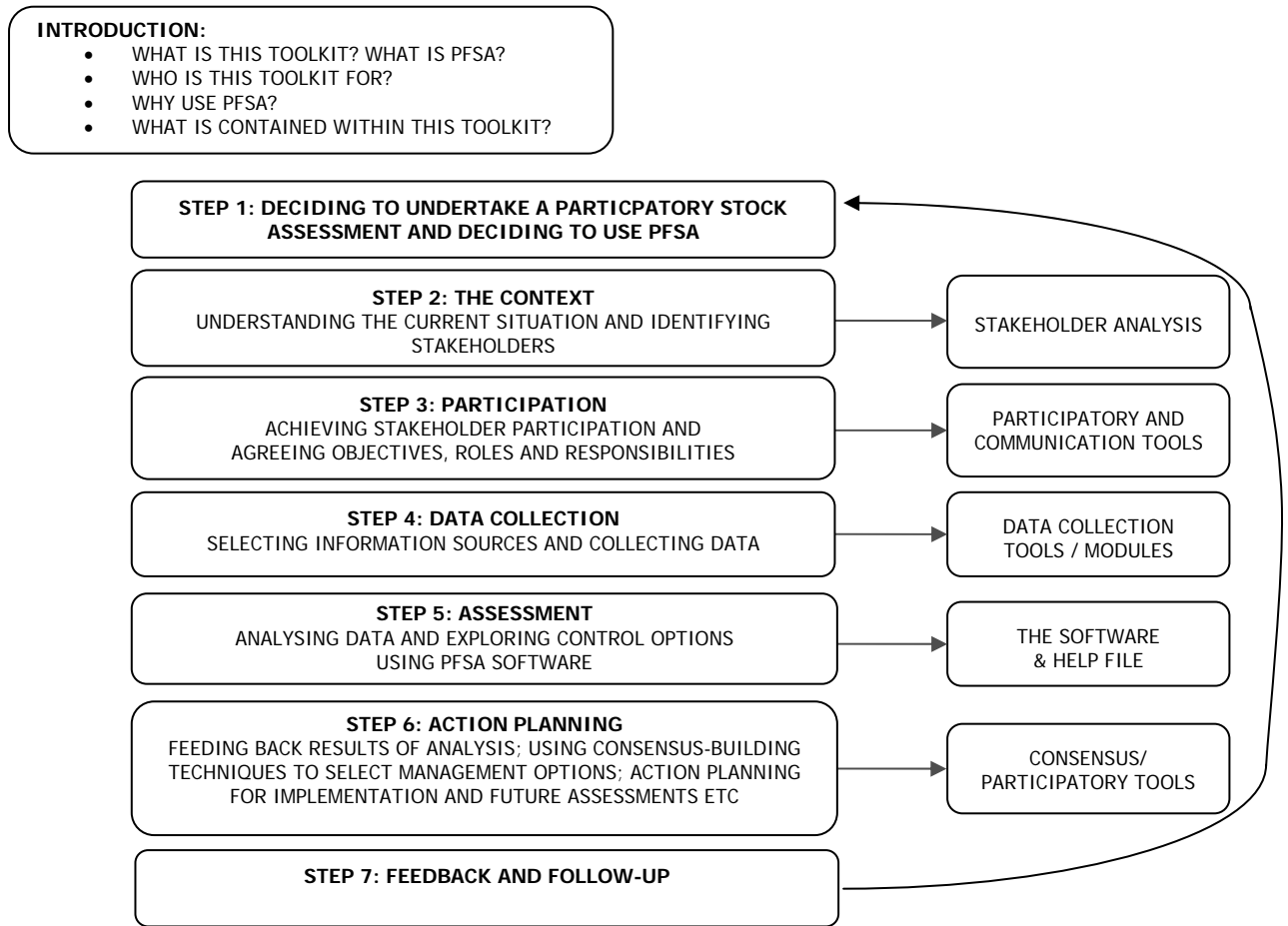
This process differed slightly from the process foreseen in the initial logframe of the project, which envisaged the development of the complete Guidelines before carrying out the Case Study in Kizimkazi. However, this was modified because the Case Study was necessary to inform the development of the later stages of the Guidelines for interpreting and feeding back the results of the stock assessment to stakeholders, developing a management plan and evaluation of the process, depending on the experience in Kizimkazi and how well different ideas worked in practice.

##### *Framework*

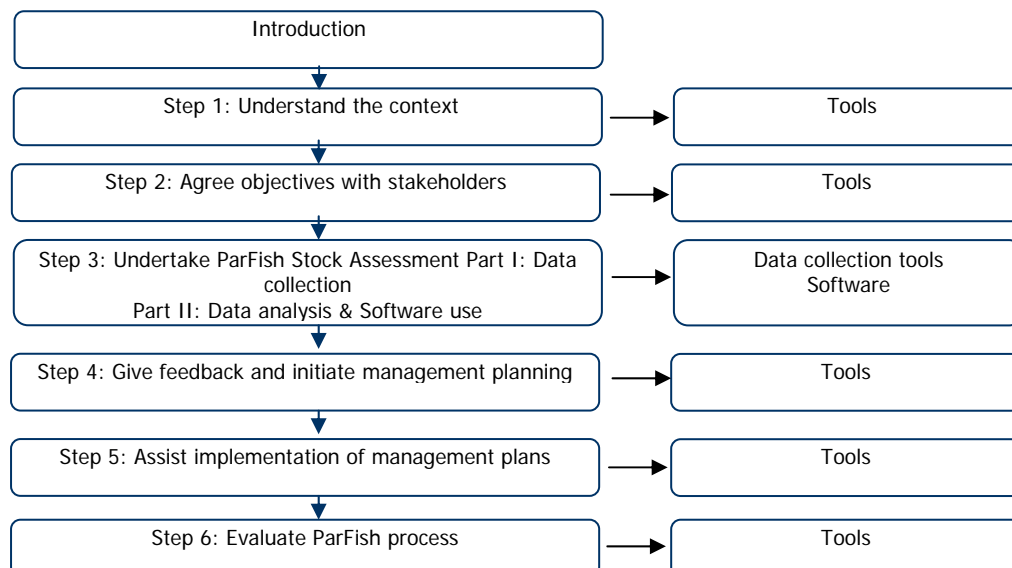
Adaptive Learning was chosen to inform the development of a framework for ParFish, because it provides a structured approach to information generation or experimentation, and allows for analysis of stakeholders, an understanding of the context and analysis of communication channels available. Figure 1 illustrates how the ParFish framework evolved.

**Figure 1: Evolution of the framework for ParFish**

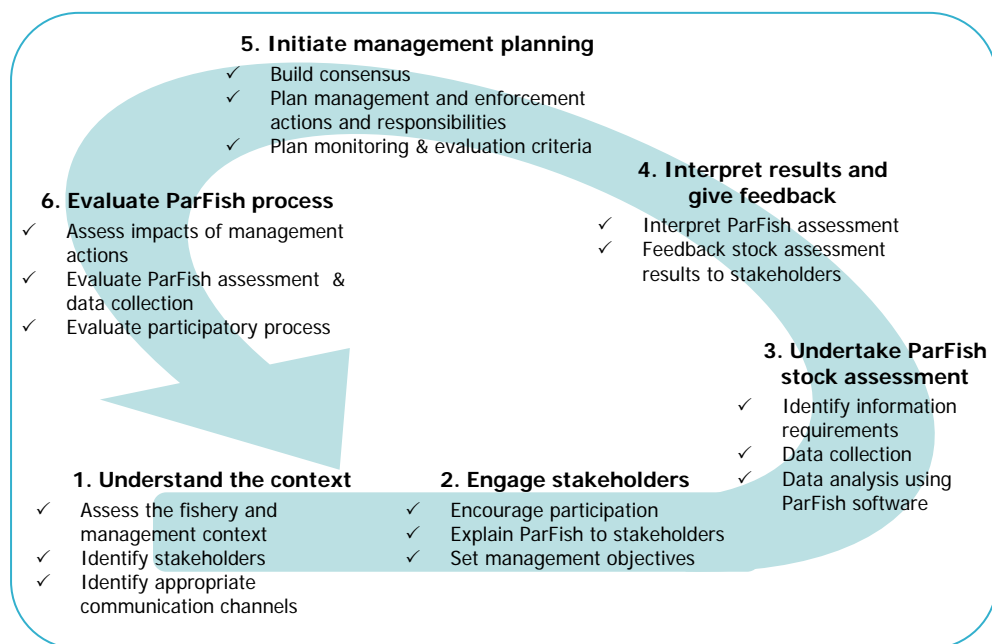
(i) Framework 1, involving an introduction and 7 steps, with different tools within each step.



(ii) Framework 2, comprising an introduction and 6 steps, with tools associated with each step.



(iii) Framework 3 (final), comprising 6 Stages each linking to Tools, with the Tools grouped together after Stage 6.



The Guidelines broadly follow the initial overall structure identified (Figure 1, i). However, the 'Steps' have been altered to 'Stages' to avoid confusion with the 'Steps' in the ParFish Software, and the content of some Steps/Stages has been rearranged. The overall framework was also changed from a linear approach to a circular one to reflect more of an adaptive approach. The current summary diagram (Figure 1, iii) now illustrates how the evaluation and monitoring information provide feedback to the knowledge on the context, restarting the assessment cycle and highlighting the adaptive nature of the approach.

Originally it was envisaged that the Tools would be within each relevant Stage in the Guidelines. However, in the final version, the Tools are grouped together after all 6 Stages. This means that the main text is kept together, making it easier for users to gain an overview of the whole process quickly, without having to read through all the Tools as well. Also, certain Tools are not exclusively associated with only one Stage, so having them grouped together makes it easier to refer to the relevant Tool, and easier for the user to locate it. Concepts are also included, which provide ways of presenting some of the concepts involved to stakeholders. Additionally, the Zanzibar Case Study is referred to throughout the text, to indicate how the approach and Tools were applied in practice in Kizimkazi, and what the outcomes were.

## ***Content***

The content of the Guidelines was developed from two main sources:

- Material that had been developed under project R7947 for data collection, but had not been documented or presented in a way that would allow others to carry it out;
- New material was developed for the other aspects of the Guidelines, based on existing sources where available, to put ParFish in context and strengthen the links with management.

The Guidelines are provided in Annex .

A general narrative was developed for each Stage, providing a rationale and background information for each part, and indicating which Tools can be used to assist the user. The Tools were identified based on the activities that would be needed to implement ParFish. These include data collection tools such as the interviews and fishing experiments, and other tasks that may otherwise be difficult for the user to implement without guidance. Some Tools are specific to ParFish; others cover material that can be found in other sources and books, such as some participatory techniques and stakeholder analysis. Rather than referring the user to existing texts for these aspects, they are included as Tools in the ParFish Guidelines for several reasons: (1) they are important for the implementation of the approach; (2) many fisheries institutions and other organisations in developing countries that may use ParFish often do not have sufficient resources to maintain an up-to-date library for all the fields that their work covers; and (3) some fisheries researchers and managers do not have experience or training in participatory methodologies and so may not have come across some of the approaches recommended.

New material was developed for the first two stages to put the ParFish stock assessment into context. Stage 1 covers an assessment of the context of the fishery, to help the user understand the fishery and the stakeholders involved, which will help the implementation of the process. Stage 2 explains the importance of engaging stakeholders in the process and how to promote this. Tools were developed for Stage 1 to provide guidance on what background information can be collected, for carrying out a stakeholder analysis and engagement plan and for developing a communication plan. Tools and Concepts were developed for Stage 2 to cover facilitation techniques for meetings and workshops; participatory data collection such as participatory mapping of fishing grounds. Concepts were also developed for this stage to cover fish stock dynamics, overfishing, the need for management and how ParFish works. Novel approaches were developed for explaining these concepts, for example the 'bau' board (a traditional Zanzibari game using hollows in a piece of wood and seeds) to explain fish stock growth and mortality through fishing, and sustainable and unsustainable levels of fishing effort.

Stage 3 covers the ParFish stock assessment and data collection, and drew most heavily on already existing material. The Stock Assessment and Preference Interviews were reviewed and some questions were removed, which were no longer utilised in the data analysis. This helped shorten and simplify the interviews. The notes on carrying out the Interviews were developed into Tools to guide the user. Data collection forms and printable versions of the preference scenario cards for the Preference Interview were also developed.

Previously there had been no guidance on interpreting the results of the stock assessment and providing management advice. Stage 4 concentrates on this aspect. A Tool has been developed that explains how to interpret the various outputs of the Software, many of which are new, and which outputs to consider to determine the state of the stock, the level of fishing effort, the recommended control levels etc. Tools were also developed that guide the user on how to present the results to fishers and to government fisheries officials. Stage 5 provides guidance on identifying and prioritising actions and developing a management plan for the fishery. Stage 6 covers evaluating the process and outcomes to identify lessons learned.

## *Review process*

### **Testing with IMS and Case Study**

A series of workshops were held with IMS to review Stages 1 – 3 of the Guidelines. The process and activities undertaken for ParFish in 2003 were revisited in order to assess whether all the relevant steps undergone had been included within the guidelines. Some extra activities were identified that had been carried out in the previous project but had not yet been documented in the Toolkit. Examples include: initial village visits to introduce the ParFish team to the village chiefs and fishers and explain ParFish; mapping of the fishing grounds using GPS in preparation for the fishing experiment; identification of gears used in the fishery; and translation of the interviews into the local language.

Each step of the Toolkit was reviewed and workshop participants commented on the clarity and comprehensiveness of each section and the tools. In general it was felt that the tools presented were useful for implementing ParFish. The review identified certain passages of text that were not clear or where further explanation was required, for example, to cover background on Bayesian statistics.

The Case Study helped develop and test the content for Stages 4 and 5 of the Guidelines. Some Tools that had been developed for the earlier Stages but had not been used in the previous project were also tested, for example carrying out a stakeholder analysis and participatory mapping of fishing grounds. This is covered in more detail in Section 3.2.

### **Specialist Reviewers**

The completed Toolkit (including Guidelines) was reviewed by a Communications Expert, which resulted in changes to the layout, font size, graphics and design of the Guidelines to make them easier to read and to bring out the main points more clearly.

The Guidelines were also reviewed by a specialist in adaptive learning, fisheries science and participatory approaches, which resulted in modifications and clarifications to the text.

## **3.1.2. Software**

### *Overall Process*

The overall process for development of the Software was as follows:

- Review of the previous version of the Software to identify difficulties in its use for a non-expert user;
- Review of other stock assessment software to identify good practice;
- Identification of options for an improved user interface and outputs;
- Improvements made to Software;
- Testing of Software by IMS and identification of further improvements;
- Improvements made to Software;
- Debugging (continuous and on-going);
- Testing of final version of Software with Software Manual.



## *Software Development*

The interface for the software has undergone significant changes from the original produced under R7947. The structure now reflects the step-wise application of the process, introduced to make it easier to use the methodology. The graphical interface has been redesigned to reflect this change. The steps are presented on the main form, and each step takes the user to a separate form. The colour scheme and themes have been improved to enhance user's understanding of the software structure and give the software a friendlier feel. These colours are also used within the Software Manual to assist with locating relevant guidance. A new form has been added for the analysis, which allows users to set the inputs for the analysis and view the various outputs on the same page.

Numerous detailed changes were made to improve the behaviour and stability of the software. These include resetting the model appropriately when changing attributes and controls of the scenario, minimising the chance of numerical errors, and improving handling multiple gears. Testing and improving the software in terms of stability and debugging is an on-going process as a full test and release process has never formed part of the project. The current release is probably best considered a beta test release. Contact will be maintained with users to enable corrections to the software and further updates will be made through the follow-up DFID FMSP project.

There have been no technical changes to the underlying methodology. The software has been simplified by preventing users accessing some of the underlying methodology, particularly that dealing with multispecies assessment. Issues relating to changes in species composition, sizes and % maturity are not covered in the current methodology because of the complexity of the resultant analysis (see the FTR for project R7947). We are focussing on a tool that can be used by local facilitators, rather than external specialist consultants, therefore we are focussing on building up from simple models.

The multispecies assessment is still in the software, but it is hidden. It would need the same treatment as the single species system in terms of making it easy to use and understand before access should be allowed. It was considered necessary to develop the single species (or species group) model first. Given the complexity and difficulties in developing a complete system for single species, this appears to have been the correct choice. In terms of training, users should become familiar with the single species methodology first.

## *User testing*

The Software was tested by users in IMS. A brief explanation of the Software was given, and participants were given a copy of the Software User-Manual (in development), datasets, and specific tasks to carry out which involved:

- Arranging interview data in the correct format in the Excel template;
- Arranging catch and effort data (long term time series) in the Excel template;
- Arranging fishing experiment data in the Excel template;
- Completing the background information for a fishery in the software;
- Setting up Interview Models, Catch-Effort Models and Fishing Experiment Models, fitting models and generating parameter frequencies;
- Checking that smoothing has been successful for the posterior PDFs;
- Importing preferences interview data;
- Setting control levels;
- Carrying out analyses; and
- Interpreting analysis output graphs.

Their use of the Software was observed and notes made of any difficulties encountered and ways of working that the Software did not support, in order to improve the interface and functionality. These observations provided further ideas for improving the Software, which were subsequently incorporated. An independent tester also tested the Software together with the Software Manual.

To illustrate testing the software, the results of an analysis of the Turks and Caicos Island Conch Fishery, using the latest version of the Software, are provided in Section 4.1.2

### **3.1.3. Software Manual**

#### *Overall Process*

The overall process for development of the Software Manual was as follows:

- Review of the help file from the previous Software: this highlighted the need for a separate Software Manual to provide step-by-step guidance on using the software, in addition to the context-sensitive help provided in the help file;
- Development of the Software Manual providing step-by-step guidance on using the Software;
- Review of the Software Manual.

#### *Development of the Software Manual*

The design and format of the Software Manual drew on other user guides and manuals. A step-by-step guide to carrying out each task involved in using the Software was identified as the best approach, together with figures illustrating the screens that appear as you carry out certain tasks.

#### *Review and Testing*

The Software Manual was reviewed by the Communications Expert, who identified improvements in the layout, font size, figures and presentation of the steps in each task. These improvements made the manual easier to follow. The manual was also reviewed by an in-house communications specialist. It was tested by an independent tester with no prior experience of the ParFish Software, which ensured that the manual provided sufficient and complete guidance for users.

## **3.2. Case Study**

### *Previous phase*

The Case Study in Kizimkazi, Zanzibar, was initiated under the previous ParFish project, under which ParFish assessments were carried out for the fringing reef (Mtende and Mkunguni villages) and for offshore patch reefs (Dimbani village). The Final Technical Report for R7947 (Medley, 2003) details the field work carried out. In summary, stock assessment and

preference interviews were conducted with fishers from the three villages, for the handline fisheries on the fringing reef and offshore patch reefs. Fishing experiments were carried out for the fringing reef and offshore patch reefs, and a survey index (fish underwater visual census) was carried out for the fringing reef during the fishing experiment. Some initial results from the assessment were fed back to the fishers at the end of the previous project in 2003.

## *Current phase*

The objectives of the case study under the current project were:

- To test Tools and approaches described in the Guidelines;
- To continue the ParFish process, feed back results of the assessment and work towards developing a management action plan for Kizimkazi.

An initial visit was made to the three villages (Dimbani, Mkunguni and Mtende) to speak to the village chiefs (*Shehas*) to request permission to visit the villages several times over the following weeks in order to meet with fishers and discuss fisheries management. The assessments had covered the fringing reef (involving villages Mkunguni and Mtende) and the outer patch reefs (involving the Dimbai village). Two meetings were held with the fishers in the Dimbani and Mkunguni villages. Meetings were not held with the fishers in Mtende due to lack of time. However Mtende is a much smaller village than Mkunguni, and fewer fishers had taken part in the assessment. The timing for the meetings was arranged in advance with one or more of the fishers, who then informed the others. The meetings were held at a time when most fishers had already returned from their fishing activities, to maximise possible attendance at the meetings. Representatives of all gear types were present at the meetings.

Because almost a year had passed between the field work of the previous project and the current phase, it was necessary to remind the fishers of the activities they had been involved in previously. Therefore, the first meetings held with the fishers covered the following issues:

- Reminder of what they did last year related to data collection for ParFish;
- Reintroduction to ParFish;
- Discussion of the plans for the current field work phase;
- Testing of some concepts (uncertainty and fish stock dynamics) from the Guidelines.

The fishers remembered taking part in ParFish the previous year. They remembered the fishing experiment, fishing in the same place every day, having their catches weighed and measured and remembered that their catches decreased. They also remembered the interviews.

The concepts that were tested were the oranges in a jar example for explaining uncertainty and the use of information in improving our estimates, and the 'bau' board example for explaining fish stock dynamics, sustainable fishing and overfishing. The concepts were found to work well and only needed minor adjustments before being included in the Guidelines.

The second meetings that were held with the fishers covered the following issues:

- Feedback of results of the assessment;
- Identification of problems in the fishery (testing of part of Tool for developing management options);
- Testing of participatory mapping Tool;
- Ways forward.

The results of the assessment were presented in a simplified format to the fishers. The feedback focussed on the state of the stock (whether it was overfished or not, relating this back to the 'bau' concept and the expected influence this would have on their catch rates), and on the recommendations for control levels in the fishery, using the preference cards from the Preference Interview. The fishers were familiar with the preference cards to indicate the expected changes in catch per unit effort over time from maintaining the current effort and from reducing effort in the fishery.

The participatory mapping Tool was tested and proved useful in identifying fishing areas. Using a piece of flipchart paper, an outline of the coast of the area was drawn, and the locations of the villages marked on the map. The fishers then indicated the rough locations and names of the reefs where they fished. This was compared to the areas that had been mapped under the previous project. Some reefs were identified that had not been mapped previously when calculating the fishing area. These areas were mapped subsequently using the information from the participatory mapping session. This exercise informed the Guidelines which recommend the use of the participatory mapping tool.

The fishers also felt that other gears in addition to the handline fishery should be included in the assessment, especially the net fishers. Although there are fewer net fishers they were perceived to have a greater impact on the resource. Interviews were subsequently carried out with net fishers in Dimbani and Mkunguni, and the data incorporated in the assessment. Traps were not included because initial studies on catch composition in the fishery under project R7947 indicated that the handline and net fishers catch similar species, but the traps catch different species.

The approach used to identify problems in the fishery was applied differently in the two villages. The fishers were consulted whether they wanted to identify the problems they face individually (and anonymously) or in groups. In one village, the fishers wanted to identify problems in groups according to their main fishing gear. In the other village, fishers wanted to identify problems individually. Both these options are given in the Guidelines.

Both villages agreed with the recommendations of the assessment, that a reduction in effort would probably bring about an increase in catch per unit effort, but neither village was prepared to reduce fishing effort independently. As a result, the need for a multi-stakeholder workshop was identified to discuss management options amongst all the villages involved and ensure the representation of different stakeholders. Fishers from both villages requested a meeting with fishers from the other village, and the Fisheries Department and protected area staff (Menai Bay Conservation Area), to discuss the issues faced in the fishery and possible solutions. This in itself represented a positive achievement, as there is a long-standing rivalry between the two villages, and in the past they had not been willing to meet together.

The multi-stakeholder workshop was held in January 2005, with representatives from all three villages (Mtende, Mkunguni and Dimbani), fishers, Shehas, representatives from fishermen's committees and women's committees, beach recorders, the Department of Fisheries, Menai Bay Conservation Area, Department of Environment, State University of Zanzibar and the Institute for Marine Sciences. A full list of participants is provided in **Error! Reference source not found..**

The objective of the workshop was to review the state of the fisheries of Kizimkazi and the priorities for management, and to agree on recommended solutions for action. The process was as follows:

- Welcome and introductions;
- Overview of objectives and a survey of what the participants expectations were for the workshop;
- Presentations: results of coral monitoring activities; results of the framesurvey in Kizimkazi; results and recommendations of the ParFish assessment; why fisheries monitoring and statistics are important.

- Group work: stakeholder analysis for Kizimkazi;
- Group work: Identification of problems and priorities for management;
- Group work: Identification of possible solutions for addressing the priorities;
- Plenary: agreement on recommendations for management.

The workshop was held over two days. The first day was held in Mkunguni and the second day was held in Dimbani, to minimise rivalry between the fishers from the two villages.

### **3.3. Capacity of IMS**

The capacity of IMS (and staff from other institutions involved in the project, here referred to as just 'IMS' for simplicity) in implementing ParFish was reviewed at the beginning of the fieldwork phase of the project. The areas where they felt confident and where they were more uncertain were discussed. The initial capacity of people varied depending on the involvement they had in the previous project; some people had played an integral role in the development of the techniques and were fully capable in those areas, others were new to ParFish with this project.

Training was carried out throughout the fieldwork phase with IMS. The sessions for reviewing the Guidelines also contributed to training and capacity building, as the testing of some Tools (e.g. Stakeholder Analysis) provided training to those involved in carrying this out. Training sessions were organised to cover specific aspects of ParFish where a need was identified, for example:

- The Stock Assessment and Preference Interviews;
- Bayesian statistics, probability and uncertainty;
- The ParFish Software;
- Interpretation of the outputs of the Software.

Furthermore, the participatory manner in which the case study was approached, where everyone was involved in planning and facilitating the meetings with the fishers, provided further training in those aspects.

The capacity of the 10 people most closely involved with the implementation of ParFish during project R7947 and R8397 was assessed objectively by the main partner from IMS (Dr Narriman) with the Social Development Expert (Suzannah Walmsley), at the beginning and end of the current project. Their capacity was assessed on a scale of 0 – 3 before and after the current project was implemented, for the key activities in each Stage of ParFish. The scale was as follows:

- 0 = 'know nothing'
- 1 = 'some idea'
- 2 = 'fairly confident, able to undertake with some support'
- 3 = 'confident, can undertake without support'.

The results are given in section 4.3.

### **3.4. Promotion activities**

#### **3.4.1. Development of the Communications Plan**

The overall objective of promotion activities in the project was to raise awareness of the ParFish methodology within a number of different institutions nationally in Tanzania, regionally in East Africa, West Africa and Asia and to institutions with an International remit.

At the national level specific objectives included obtaining support for the methodology from policy makers and donors in order to further the use of ParFish within Tanzania. At the regional level the objectives were to increase awareness of ParFish, generate further demand for the method and ensure the resulting Toolkit from the project was available to interested institutions. Lastly at an international level the objectives were again to promote the methodology but also to gain support wider promotional, technical or financial support to sustain the utility and interest in ParFish.

### **3.4.2. Revisions to the Communication Plan**

A draft communications plan was developed at the start of the project outlining the objectives and the proposed activities. This was then updated throughout the project in August 2004, November 2004 and February 2004. The updates reflected new understanding of the communications context but also provided a place to record ongoing communications activities. The most up to date communication plan (February 2004) is provided in Annex 4, although as records of activities are given here within the main text they have been removed from the communications plan to avoid repetition.

The main changes made to the communications plan throughout the project are summarised below:

- **November 2004 update:** The national and East Africa regional components of the communications plan were updated following a visit to Zanzibar which had included evaluation of promotion activities together with the Institute for Marine Sciences (IMS). The evaluation reviewed the Knowledge, Attitude, Practice and Influence (KAPI) of stakeholders at the national and East Africa region and identified specific ways of targeting these stakeholders.

Key promotion activities were identified through this process including:

- Using WIOMSA as an intermediary body to channel information to potential users.
  - The need to give a specific presentation to the Zanzibar Fisheries Department to raise awareness of the activities that had taken place in the Kizimkazi ParFish case study; get feed back on ways to improve results of the case study and gain their support for the follow-on process within Kizimkazi and more broadly within Zanzibar and Tanzania.
- **February 2005 update:** This final update allowed the on-going communications activities to be recorded, a change to the structure of the plan allowing for sections to cover National Level Stakeholders and Regional and International Level Stakeholders.

### **3.4.3. Development of Communications Materials**

The main communications materials developed throughout the project have included flyers, policy briefs and presentations.

#### ***Flyers and Briefs***

The first flyer for the project was developed in order to raise awareness of the forthcoming ParFish Toolkit, and also to provide information on the case study ongoing in Kizimkazi, Zanzibar (Flyer 1, see Annex 5). The flyer provided a way of introducing ParFish to a number of target audiences, and by providing contact details correspondence was initiated with a number of institutions in East African, West African, Asian and other regions.

To provide more in-depth information on ParFish a brief was produced entitled, 'Can ParFish assist in the assessment and management of small-scale developing fisheries?' (Brief 1, see Annex 5). This brief discussed the need for addressing management of small-scale fisheries, how ParFish provides a tool to assist with management, further background to the approach and the scientific background of the assessment method; experiences of ParFish to date and next steps within the project and for others interested in future collaborations. The brief was sent to institutions that had expressed an interest in ParFish and had demanded further information.

Towards the end of the project a further flyer and brief were produced. This second flyer (Flyer 2, see Annex 5) was sent to all communications stakeholders informing them of the completed ParFish Toolkit and instructions on how to access a copy. It also included details on the outcomes of the Kizimkazi case study and follow-on work that has been initiated through a further DFID-back project and proposals in the pipeline with WIOMSA, WWF and other partners.

A second brief was also prepared to answer a number of the questions that had been raised concerning the methodology (Brief 2, see Annex 5). This brief was directed mainly towards answering the question on how ParFish can assist management of fisheries and covered the following topics:

- What can ParFish be used for?
- Why is ParFish participatory?
- Is ParFish relevant to fisheries management?
- How does ParFish compare to other stock assessment methodologies?
- What practical inputs are required to use ParFish?
- The costs and benefits of ParFish

## ***Presentations***

As well as the flyers and policy briefs a number of power point presentations were developed for different stakeholders (see Annex 5), including the Zanzibar Fisheries Department, MRAG Ltd, and The Lake Victoria Fisheries Organisation (LVFO).

## ***Proposals***

Throughout the project opportunities were sought for submission of proposals for further support to application of the ParFish methodology. The following opportunities were identified throughout the project:

- **World Wildlife Fund (WWF) Eastern African Marine Ecosystem Programme (EAME)**: WWF held a donor conference in March 2005 to consider priorities for support to a sustainable Eastern African Marine Ecosystem. WWF called for concept notes to be submitted by the relevant countries (including Kenya, Mozambique and Tanzania.)
- **Western Indian Ocean Marine Science Association (WIOMSA)**: WIOMSA runs a Marine Science for Management (MASMA) grant scheme supported by the Swedish International Development Agency. The objectives of the MASMA scheme are to strengthen the knowledge base of coastal and marine environment of the Western Indian region, raise awareness of important coastal management issues and to disseminate

information for sustainable use of coastal and marine resources. As well as calling for proposals for research projects, MASMA also supports training courses to increase research capacity in the region.

- **Marine and Coastal Management Project (MACEMP), Tanzania:** The MACEMP project is being supported and coordinated by the World Bank. Prior to the launch of MACEMP, the Japanese Social Development Fund (JSDF) is supporting a variety of pilot projects to test different approaches and methods in community development. These will be applied in selected communities along the coast of Tanzania and provide lessons learned to be scaled up during the implementation of the nation-wide MACEMP project. JSDF called for proposals in designing and implementing these pilot projects.

#### 3.4.4. Communications Channels

Following the development of the communication materials, they were distributed through a number of communications channels. These included:

- **Emails:** Correspondence on ParFish was kept up through emails
- **Telephone calls:** Telephone calls were made to a number of regional and international stakeholders to further discussion on ParFish and answer specific queries on the methodology.
- **Web-sites and List servers:** Relevant websites and list-servers were identified to act as communications channels for information on ParFish
- **Meetings:** A number of meetings were held to introduce or present ParFish.

Further details on these communication channels are given in the Outputs section.



## 4. Outputs

The research results and products achieved by the project. Were all the anticipated outputs achieved and if not, what were the reasons?

Research results should be presented as tables, graphs or sketches rather than lengthy writing, and provided in as quantitative a form as far is as possible.

The anticipated outputs of the project were: a Toolkit to support implementation of ParFish; increased capacity of IMS; a case study applying ParFish; and the ParFish Toolkit promoted nationally, regionally and internationally. These were all achieved. Each output is discussed in more detail below.

### 4.1. Toolkit

The ParFish Toolkit was developed, tested, reviewed and refined, comprising Guidelines, Software and Software Manual. It forms the main output of the project.

#### 4.1.1. Guidelines

The Guidelines were developed and are available (Annex 2, Medley et al. 2005). They provide guidance for implementing a ParFish stock assessment within an adaptive framework and in a participatory way, including Tools for carrying out important activities, and Concepts for explaining key theories to stakeholders. A summary of the contents of the Guidelines is provided in Box 1, and a list of the Tools and Concepts is provided in Table 1. The experiences from implementing ParFish in Zanzibar are illustrated throughout the Guidelines as case studies. A copy of the Guidelines is provided in Annex .

**Table 1: Tools and Concepts provided in ParFish Guidelines**

Tool No.	Name	Comments
1	Resources Required for ParFish	Indicates the resources you may require for each stage of ParFish
2	Background Information to Compile	Outlines the essential background information and other useful information for the ParFish process
3	Checklist of Potential Sources of Information	Provides possible sources for the information in Tool 2
4	Institutional Analysis and Design Framework	Assists understanding of the management system
5	Stakeholder Analysis	Identifies people and institutions that have a role or interest in ParFish
6	Developing a Stakeholder Engagement Plan	Helps you define how stakeholders can be involved in ParFish
7	Developing a Communications Plan	Helps you define how you communicate with stakeholders
8	Setting up Meetings with Interested Groups	Provides guidance for setting up meetings with stakeholders
9	Schedule for Meetings	Provides a schedule of the issues to cover in meetings at each stage of the ParFish process
10	Facilitation Techniques	Provides possible techniques for facilitating meetings and encouraging participation
11	Participatory Mapping of Fishing Grounds	Enables fishers to indicate the areas where they fish, to help identify fishing grounds and the

		fishery area.
12	Key Informant Interviews	Provides advice on preparing and conducting interviews with people who can provide background information
13	Agreeing Objectives with Stakeholders	Assists the definition and agreement of management and assessment objectives
14	Sampling Catch Units	Will be required to convert or standardise units if kg are not used as standard
15	Mapping and Calculating the Fishing Area	This is essential if you carry out fishing experiments, and useful even if you don't
16	Stock Assessment Interview	Provides and explains the questions for the stock assessment interview
17	Preference Interview	Provides and explains the questions and scenario ranking for the preference interview
18	Fishing Experiments	Explains how to design and carry out a fishing experiment to obtain more information on the stock
19	Using existing Catch and Effort Data	Explains how to find and incorporate existing catch and effort data in the ParFish assessment
20	Guidance for Monitoring	Provides guidance on what monitoring can be undertaken to gather more information and reduce uncertainty
21	Monitoring the Recovery of a Closed Area	Explains how to monitor a closed area to provide more information for a further ParFish assessment
22	Guidance Notes for interpreting the ParFish Analysis	Explains how to interpret the outputs of the software into useful information on stock status and management recommendations
23	Outline for a Summary of the ParFish Analysis for Government Fisheries Officials	Provides a framework that can be used to present the assessment results to government fisheries officials
24	Communicating the Results of the ParFish Analysis to Fishers	Provides ideas on how to communicate the results and recommendations of the analysis to fishers
25	Prioritising Issues and Developing an Action Plan with Stakeholders	Provides a process to prioritise issues and develop an action plan, an important step towards implementing some assessment recommendations
26	Example of an Outline Management Plan	Provides an outline management plan that can be used as a basis for developing one for the fishery.
27	Evaluation Framework	Provides a framework for evaluating the ParFish process and outcomes
<b>Concept No.</b>	<b>Name</b>	<b>Comments</b>
1	Introduction to ParFish and Fisheries Management	Suggests ways of explaining why manage fisheries, what is ParFish and how ParFish involves stakeholders.
2	Fish Stock Dynamics	Suggests ways of explaining that stock dynamics, over-exploited stock, and overfishing.
3	Fisheries Monitoring and Assessment	Suggests ways of explaining why we might need a stock assessment and why data is useful.
4	Uncertainty, adaptive and precautionary approaches	Suggests ways of explaining uncertainty and probability, how information helps increase our certainty, and possible management strategies in the face of uncertainty.
5	How ParFish works	Suggests ways of explaining how ParFish estimates stock size, growth and potential catch, and how ParFish uses interviews with fishers to collect information.

## Box 1: Outline of contents of ParFish Guidelines

### **Introduction to ParFish**

- What is the ParFish approach?
- What are the objectives of ParFish?
- What are the principles of the ParFish approach?
- What is the ParFish stock assessment?

### **The ParFish Guidelines**

- Who are these Guidelines for?
- Aims of the Guidelines
- Structure of the Guidelines
- Features of these Guidelines
- Adapting the Guidelines

### **Deciding to use ParFish**

- Why use ParFish?
- When and where is it suitable to use ParFish?
- Considerations and Assumptions
- How does ParFish compare to other stock assessment methodologies?

### **STAGE 1: Understand the Context**

1. Understanding the fishery
2. Identifying stakeholders
3. Developing a stakeholder engagement plan
4. Identifying appropriate communication channels

### **STAGE 2: Engage Stakeholders**

1. Encouraging participation in ParFish
2. Explaining ParFish to stakeholders
3. Collecting information through participatory approaches
4. Setting management objectives with stakeholders

### **STAGE 3: Undertake ParFish Stock Assessment**

1. Deciding what data needs to be collected
2. Carrying out your data collection
3. Inputting data into Excel
4. Analysing your data
5. Collecting monitoring data

### **STAGE 4: Interpret Results and Give Feedback**

1. Interpreting the outputs of the ParFish Software
2. Communicating the results to government fisheries officials
3. Communicating the results to fishers

### **STAGE 5: Initiate Management**

1. Prioritising issues for management
2. Initiating management planning

### **STAGE 6: Evaluate the ParFish Process**

1. Evaluating the process
2. Evaluating the outcomes

## 4.1.2. Software

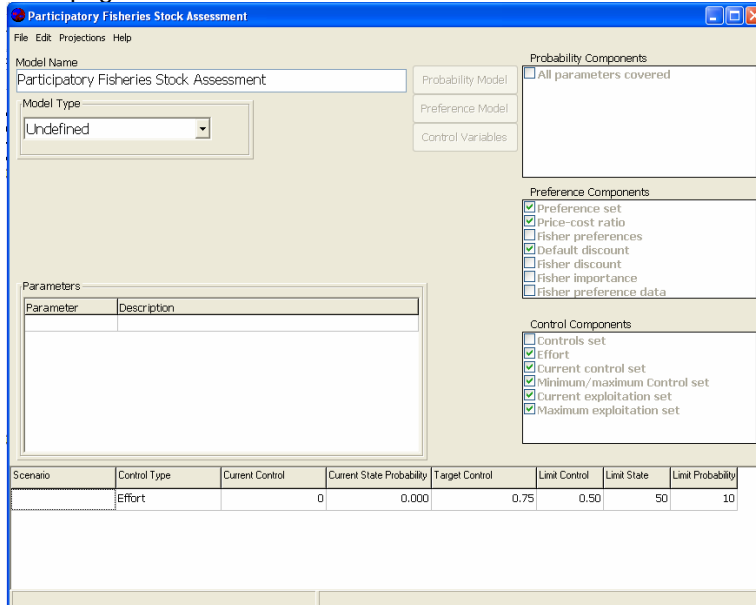
### *Changes to the Software Interface*

Figure 2 shows the evolution of the Software interface, from the original interface from project R7947, to the current user-friendly interface.

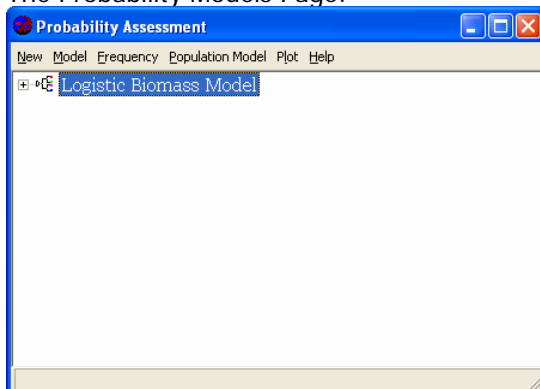
**Figure 2: Evolution of the Software interface**

**(i) Original interface from project R7947**

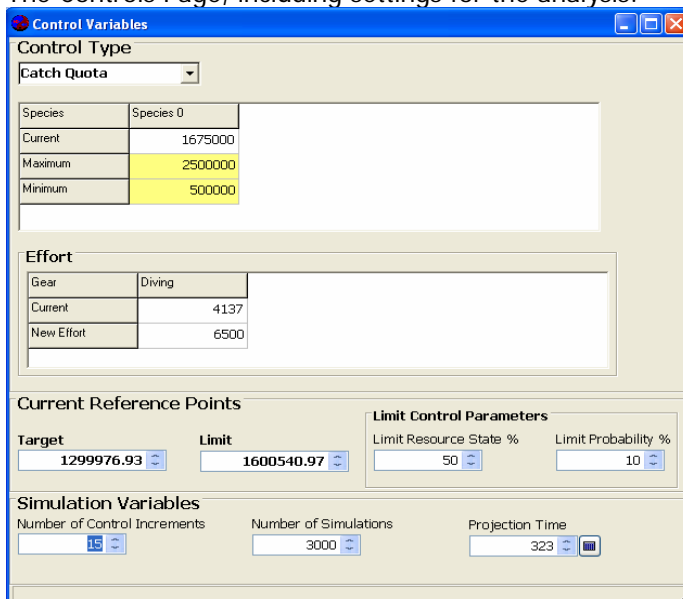
**Main page**



**The Probability Models Page:**

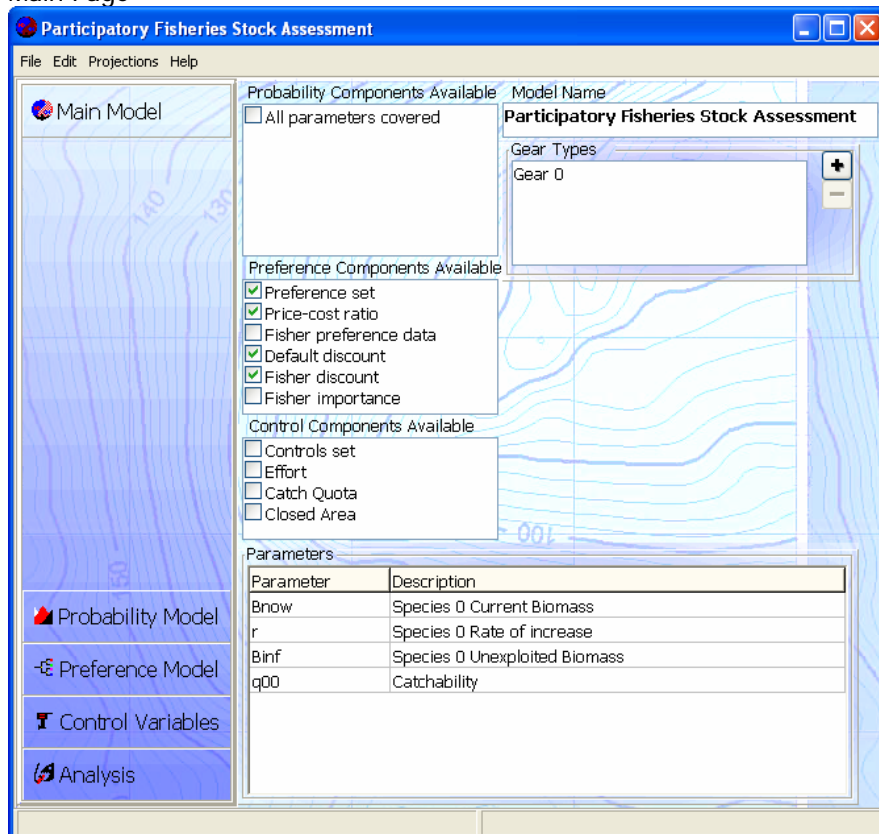


**The Controls Page, including settings for the analysis:**



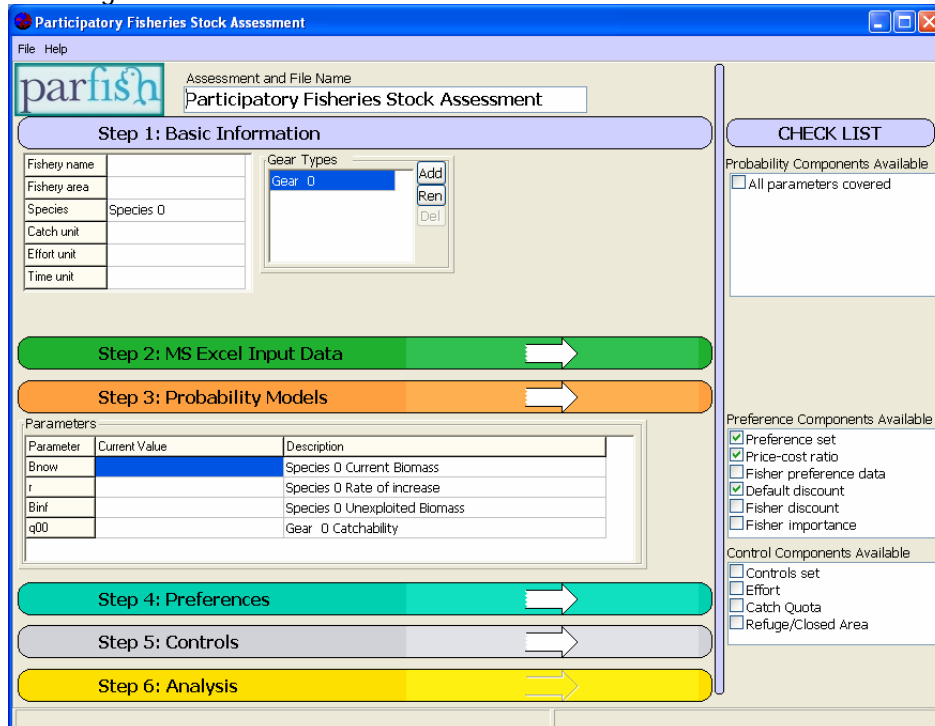
## (ii) Version 2 of the software interface

### Main Page

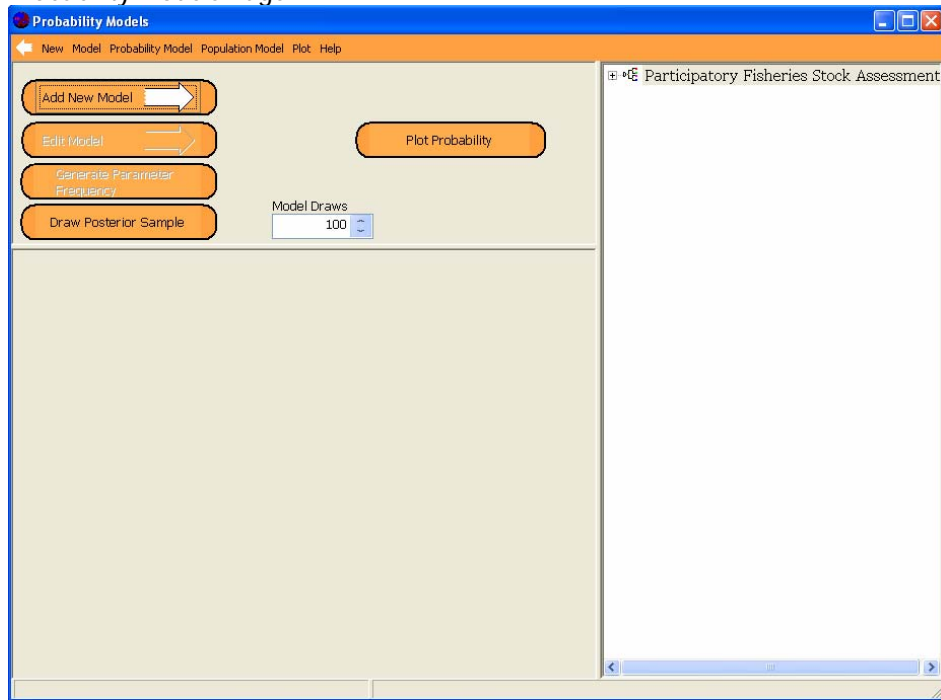


## (iii) Final Software interface

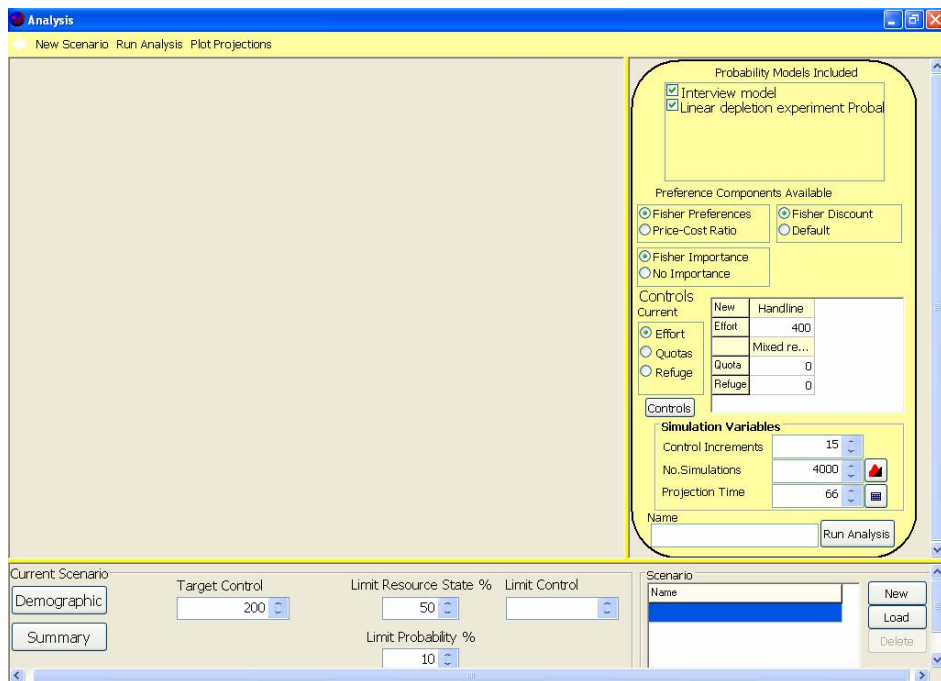
### Main Page



## Probability Models Page



## Analysis Page



## *Summary of Additions and Improvements to the Software*

A new array of indicators and reference points are produced as outputs from the projections: MSY, F at MSY, F at optimum (optimum based on the maximum fisher preference or price-cost ratio score), CPUE 5-year projections and preference score 5-year projections for each interviewee based on applying the target control. All outputs are in the form of probabilities with the exception of the expected preference. The mean, mode, median, and confidence intervals are given as standard for all reference points.

All output reference point graphs allow the user to change their scale (in terms of maximum and minimum and log or linear). This allows the user to smooth probabilities on a log-scale, where appropriate, and exclude outliers.

A probability model assistant (or "wizard") has been provided which takes the user through the process of setting up a stock assessment model in the software. Three models are currently provided, but the same format can be extended to other models as they are developed. The hierarchical model structure in the software has a natural form that an assistant can take the user through constructing in a stepwise fashion.

The Software has been linked to Excel, to allow easier storage and manipulation of data. The software allows data to be entered and maintained in Excel spreadsheets. A template is provided and automatically linked to the ParFish model PFA file. The link between Excel and ParFish currently only works for users as administrators, and will not work, for example, on network systems. This problem is being addressed.

Output "scenarios" now store not just the text output, but all the input controls and graphics as well. This allows much easier comparison between scenarios and will allow development of more rigorous Monte Carlo projections.

Explicit units are requested by the software. These encourage standardisation of units, as inconsistent specification of units in different parts of the software could lead to very poor results. Units now appear on output graphs, making them explicit.

3D probability plots for parameters are allowed. These serve no particular purpose now beyond allowing the user to look for potential problems in the probability specification. In future developments of the software, they will be a useful diagnostic tool for checking appropriate scaling of parameters.

Numerous other improvements were made, including allowing graphs to be exported or printed, a new "vote" graphic to represent uncertainty and preference among controls, additional hints on the forms, improved cut-and-paste behaviour for data entry, and improved pop-up menus.

## *Analysis of the Turks and Caicos Islands Conch Fishery*

An analysis of the Turks and Caicos conch fishery was carried out using the new ParFish Software to assess the relative value of ParFish compared to not carrying out an assessment. This can be done by calculating the change in expected utility based on carrying out management actions based on advice from the software. Utility was measured in 2 ways: using the fisher preferences and using price-cost ratio. Preferences were estimated from data obtained from interview and the price cost ratio (PCR) is estimated from economic information (see ParFish software documentation).

For the Turks and Caicos Islands queen conch fishery we estimate the last years catch was 1.65 million pounds at US\$0.60 per pound landed weight, indicating a value of total landings at US\$990 000. The catching cost is difficult to obtain. Fuel costs were around US\$60 per day in 1992, but there was no information on other costs, such as the labour opportunity costs or the investment and maintenance costs. There is historical evidence that large numbers of fishers would leave the fishery when catches fall below 200lbs per day, so we use this as a conservative estimate the daily cost of fishing (i.e.  $200 \times 0.6 = \text{US}\$120$ ). The last year's effort was estimated to be 4138 boat days, so the total cost was  $4138 \times 120 = \text{US}\$496\,560$ . The price-cost ratio in this case is  $990000/496560 = 1.99$ . If we apply this ratio, we obtain an expected utility maximum equivalent to the expected discounted economic rent optimum. This is clearly going to be an approximation, but can be derived very rapidly and can be used as a check on a realistic range on the controls.

Default 5% discount rate is applied in all scenarios, which allows them to be compared. In addition a maximum effort limit is applied. Even without management control, there is a limit to the effort which can be applied. This was chosen to be 6000 boat days for all scenarios. Historically effort has responded to economic conditions, but has not been sustained above 5000 boat days for more than a few years, 6000 boat days is a reasonable upper limit unless conditions in the fishery change.

## Results

The optimal controls are set out in Table 1 as conch quotas for the landings. There are two sources of information, interviews which give a prior probability and the catch-effort model based on 30 years of data. The analysis using only the catch effort model represents a classical stock assessment. Using both the catch effort model and interviews gives a Bayesian analysis based on all information making up the "posterior" probability. The interview only model is of interest because for many assessments this might be the only information available.

All combinations of the analyses give 6 targets based on the Bayesian action (decision analysis). This includes using combinations of the PCR or fisher preferences with the catch effort mode and or interviews.

Table 1 illustrates the results. The preference model consistently gives a lower target quota control. The interview for the stock assessment model generally has the effect of raising the quota. The interviews assessments of resource productivity are in general optimistic compared to relying on catch-effort data alone.

Table 1: Target Quotas and % chance of overfishing based on the separate models.

	<b>Catch-Effort Model</b>	<b>Interviews Only</b>	<b>Interviews and Catch-Effort Model</b>
<b>Price-Cost Ratio</b>	1.51	2.50	2.00
<b>Risk of fishing (%)</b>	27	>36	30
<b>Preferences</b>	1.40	1.84	1.59
<b>Risk of fishing (%)</b>	20	21	18

There is no guarantee any particular answer is right. However we might assume that the more information we add the better the estimate. Because the fishers' opinion differs from the model, we also might tend to choose the objective information only (i.e. assume a non-informative prior). Therefore the Catch-effort model only represents the best estimates for the control. Given this is the case, we can compare how much worse the other advice is compared to this "optimum" (Table 2).



Without effective control, the quota seemed to be sustained above 2.0 million pounds 1976-1980 which probably led to an overfished state. While the 2.0 million pound mark was exceeded, it probably represents the minimum uncontrolled quota and therefore the benchmark for management. If the interview only control was applied, a quota of 1.84 million pounds<sup>1</sup> would have been applied.

The regret function indicates how well the control does relative to the best option. The 2.00 million pound quota scores relatively badly both for the PCR ratio and preference scores. The 1.84 million pound quota, appropriate for the interview only data, reduces this loss significantly. That is, it would cut the effective utility loss by approximately 50%. In theory, utility measures the true value of income, so the value of action would exceed the simple monetary gain. Avoiding overexploitation would sustain livelihoods while minimising the lost opportunities.

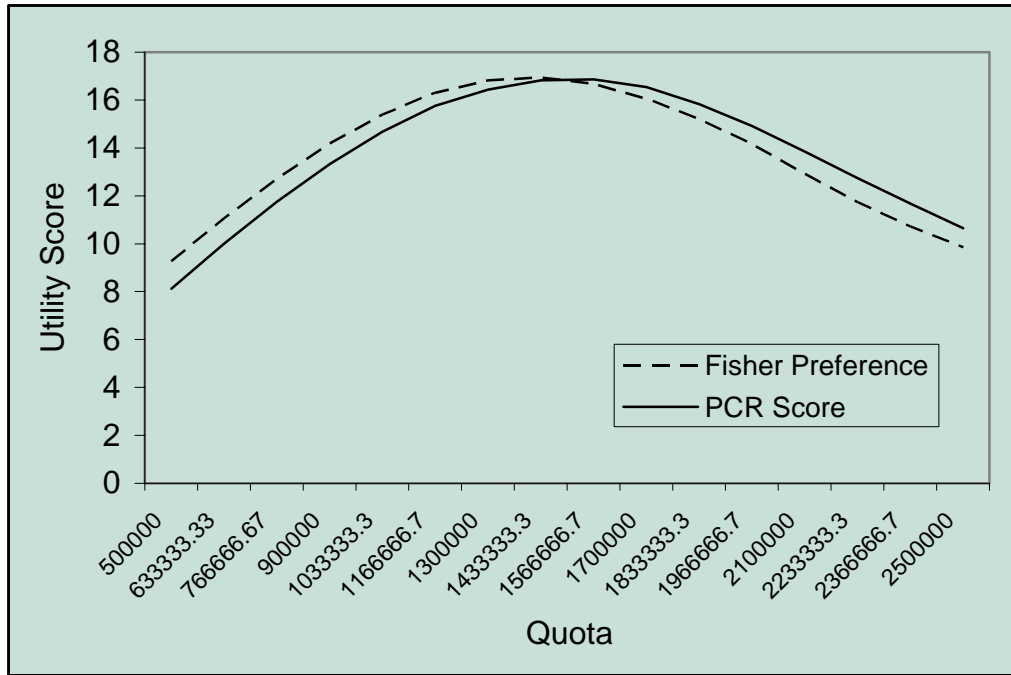
It appears the lower quotas will turn out to be sustainable in the longer term. Previous classical analyses gave similar results, with a tendency to lower the quota. The implication is that, assuming this case example is representative, on average considerable benefits both in terms of sustainability and utility, may be gained by application of this assessment as long as the principles of adaptive management are applied.

Table 2: "Regret" values indicating the cost of the various optimums compared to the best option based on all the available data. As more information is added, the results indicate lower quotas are more appropriate target.

<b>Quota (million pounds)</b>	<b>Preference</b>	<b>PCR Ratio</b>
1.40	0.000	-0.099
1.51	-0.099	0.000
1.59	-0.325	-0.079
1.84	-1.749	-1.070
2.00	-3.079	-2.178
2.50	-7.045	-6.198

---

<sup>1</sup> In fact, the quota would have been set closer to 1.7 million pounds if the fisher discounts are used. The default global discount was used for consistency across scenarios.



**Figure 3: Comparison between the two utility scores across the allowable control range. The preference score shows greater curvature, implying greater sensitivity to risk.**

### 4.1.3. Software Manual

The Software Manual has been produced and tested and provides a step-by-step guide to using the Software, based around the 6 Steps outlined on the main page of the Software. It explains how to enter the basic information, how to input data into Excel and import it into the Software to build probability models, how to import preference data and set control levels, and how to run analyses and interpret the different graphical outputs.

The Software Manual is available in electronic format and hard copy. A copy is provided in Annex .

## 4.2. Case Study

The case study in Kizimkazi, Zanzibar, successfully achieved real discussion on management options for the fishery. The multi-stakeholder workshop resulted in acceptance of the results of the assessment and encouragement of stakeholders to address sustainability of the resource. The participants agreed on the most important issues facing the fishery and on possible solutions. The recommendations of the workshop are included in Annex 1. However, it was found that developing and agreeing on a participatory resource management action plans takes considerable time. Due to the short time-frame available, it was not possible to achieve this during the life of the project. The next step would be the formalisation of the recommendations from the workshop into commitments from those responsible for implementing them. It would be necessary to have someone to facilitate the process and keep things moving forward, and commitment is required from the institutions involved.

A further outcome of the case study was an improved relationship between the fishers and the institutions involved, particularly IMS. This supports ParFish's principle of encouraging participation of resource users in the stock assessment, to improve acceptance of the results and discussion of management options.

### **4.3. Increased capacity of IMS**

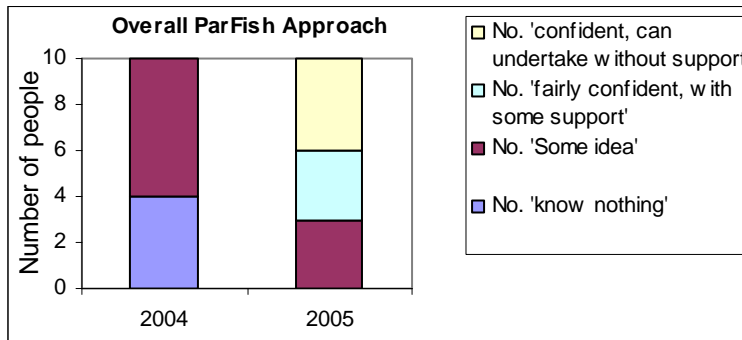
The current project increased the capacity of IMS in the implementation of ParFish and they are now the regional experts for the approach. IMS represents a ParFish resource centre that can provide support to the East Africa region for implementing ParFish. This has already resulted in their inclusion in proposals (with WWF/CARE and SAMAKI Consulting) for community development and fisheries management projects incorporating ParFish, in both Tanzania and Kenya, independently of support from MRAG and DFID.

The capacity of IMS (including people from other institutions that were involved in the case study, and invited by IMS to take part), increased during the project. The graphs in Figure 4 show the capacity of people for implementing different aspects of the ParFish approach, before the start of the current project ('2004') and at the end of the current project ('2005').

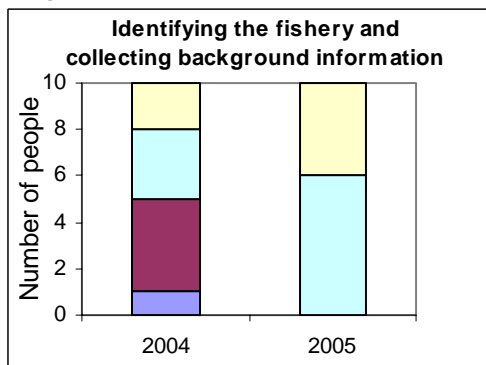
The results show a clear increase in the proportion of people 'fairly confident, able to undertake with some support' and 'confident, can undertake without support', in 2005 compared to 2004 for all aspects. This is obviously the case for Stages 4 – 6, which were not covered by the previous project, and so there was no prior knowledge of these aspects.

The only two aspects that no-one involved is fully confident with and would be able to undertake without support, are the use of the Software, and the interpretation of the results. This may be improved now with the addition of a section in the Software Manual about interpreting the graphs, and tools in the Guidelines for interpreting the results, but it points to a clear need for further capacity-building in these areas before IMS will be able to implement the complete process independently.

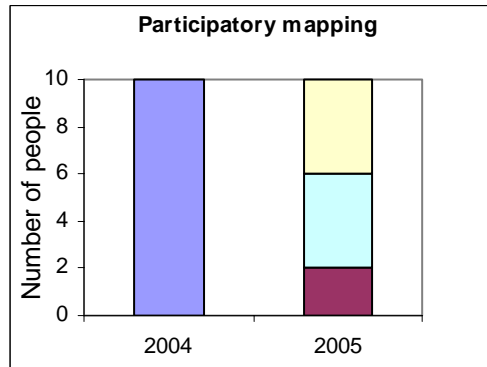
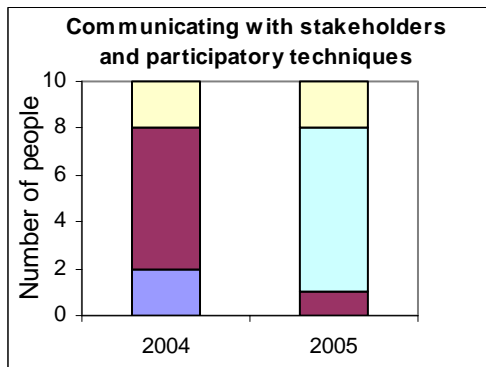
**Figure 4: Capacity of IMS in implementing various aspects of ParFish, before ('2004') and after ('2005') the current project**



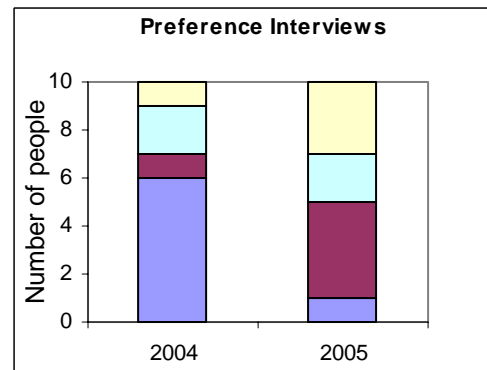
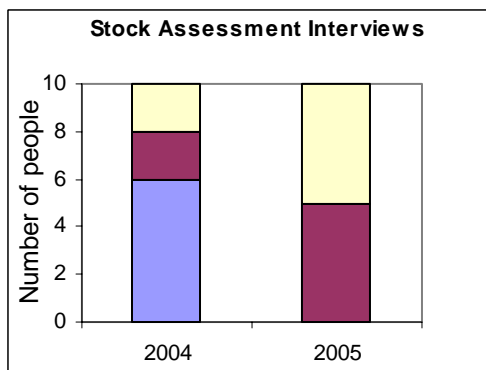
**Stage 1**

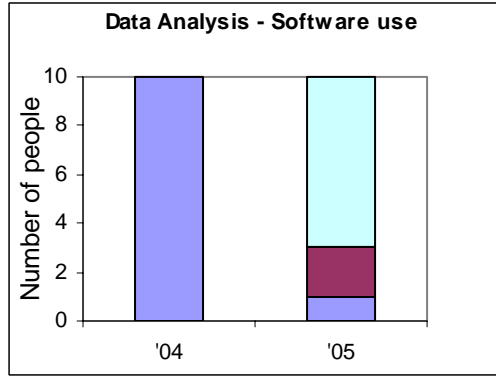
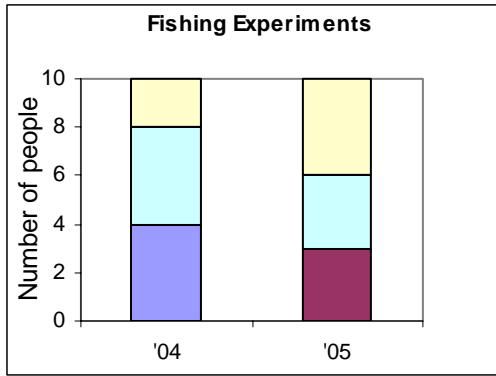


**Stage 2**

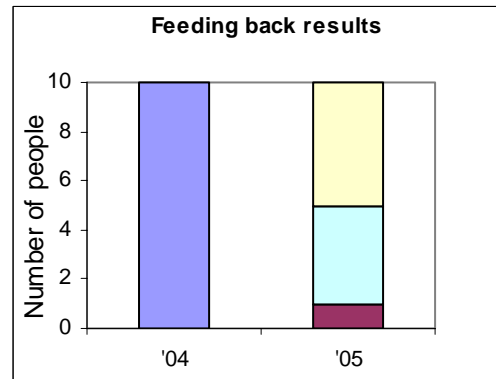
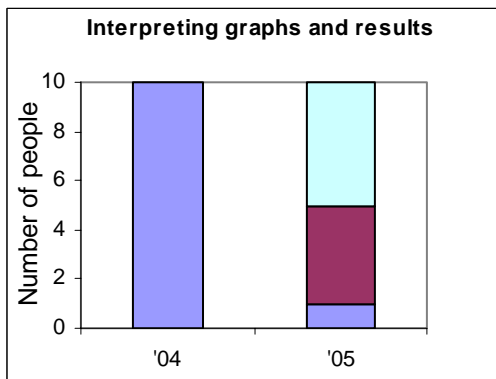


**Stage 3**

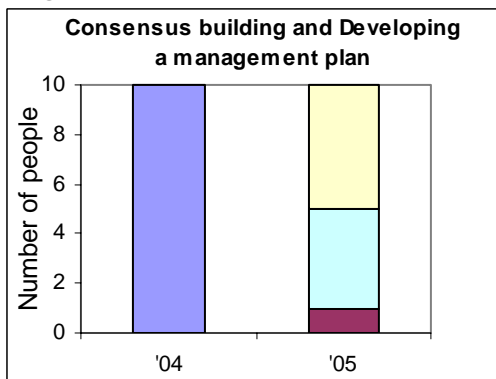




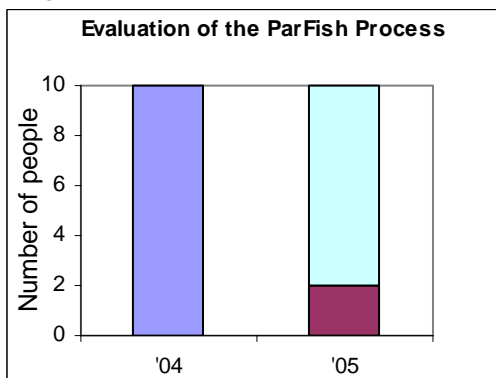
**Stage 4**



**Stage 5**



**Stage 6**



## **4.4. Promotion of ParFish**

### **4.4.1. Promotion Activities**

Highlights:

- A greater awareness of ParFish through flyers, briefs, talks, and articles in regional newsletters such as WIOMSA quarterly bulletin.
- Interest in ParFish through a major 'Marine and Coastal Environmental Management Project' supported by the World Bank in Tanzania
- Growing interest in the approach illustrated through 25+ requests for the Toolkit
- Three further proposals submitted with regional partners to support further use and promotion of ParFish

### **4.4.2. Communications plan**

The final communications plan for the project is given in Annex 4. This differs from the initial communications plan in the following ways:

- The draft communications plan devised in April 2004 was sub-divided into sections covering local level; national & regional level; international level (general); and international level (Asia specific) stakeholders. Throughout the project it was found that a more appropriate way of recording the information was through dividing the sections into:
  - Section 2: Local level stakeholders (Kizimkazi, Zanzibar)
  - Section 3: National level stakeholders (Tanzania)
  - Section 4: Regional and international level stakeholders (Regional level institutions were recorded for East Africa, West Africa, South-West Africa, India & Asia, South America, Europe, Pacific, Caribbean, US, and the Middle-East.)
- Communications plans at the national, regional and international level were updated with activities that were considered the most feasible and appropriate and also will provide information on the indicators achieved.

### **4.4.3. Communications materials**

Throughout the project flyers, briefs, presentations and proposals were produced as the main communications materials. In addition a chapter was prepared for input into a set of guidelines to stock assessment published by FMSP in collaboration with FAO.

#### ***Project flyers and briefs***

- Two flyers were produced: Flyer 1 in October 2004 and Flyer 2 in March 2005 (see Annex 5).
- Two briefs were produced: Brief 1 in October 2004 and Brief 2 in October 2004 (see Annex 5).

Distribution of project flyers and briefs is summarised in Table 2 below. If more than one person within each organisation received the materials the number is indicated in brackets.

**Table 2: Distribution of project flyers and briefs  
National Level Communication Stakeholders**

Organisation	Responsibility	Flyer 1 Oct 04	Brief 1 Oct 04	Flyer 2 Mar 05	Brief 2 Mar 05
<b>POLICY MAKERS/FISHERIES AGENCIES</b>				✓	✓
Department of Fisheries (Zanzibar)	Implements fisheries management in Zanzibar	✓ (4)	✓	✓	✓
Ministry of Agriculture, Natural Resources, Environment and Cooperatives in Zanzibar (MANREC)	Department of fisheries in Zanzibar sits within this Ministry	✓		✓	✓
Department of Fisheries (Tanzania)	Implements fisheries management in Tanzania	✓		✓	✓
Ministry of Natural Resources in Tanzania (MNRT)	Department of fisheries in Tanzania sits within this Ministry	✓		✓	✓
Department of Environment (Zanzibar)	Responsible for environmental policies and concerns	✓		✓	✓
National Environment Management Council	Advisor to Government Environmental Research	✓		✓	✓
Marine Parks Unit (MNRT)	Collaboative management of marine parks	✓		✓	✓
<b>NGOS</b>					
Tanzania Coastal Management Partnership	Parastatal under NEMC. Coordination of national ICM activities, capacity building, networks	✓ (2)		✓	✓
WWF - Mafia Island Marine Park	Responsible for running the Mafia Island reserve	✓ (2)		✓	✓
Tanga Coastal Zone Conservation and Development Programme	Capacity building of government institutions and community development	✓ (3)		✓	✓
<b>RESEARCH INSTITUTES</b>					
Tanzania Fisheries Research Institute (TAFIRI)	Involved in lake environments but would be the main institutions to be able to undertake assessments on	✓ (5)		✓	✓

	the mainland				
State University of Zanzibar	Training, Research & Education	✓		✓	✓
University of Dar es Salaam (Natural Resource Information Centre - TANRIC)	Training, research, information management	✓		✓	✓
<b>TRAINING INSTITUTES</b>					
Faculty of Aquatic Sciences and Technology at Kunduchi (FAST)	FAST have a fisheries science diploma that ParFish could be incorporated into.	✓		✓	✓
Mbengani Fisheries Development Centre	Stock assessment, fish processing, marine engineering	✓		✓	✓
Costech Commission for Science and Technology	Training on technology	✓		✓	✓

### Regional and International Level Communication Stakeholders

Organisation	Region	Flyer 1 Oct 04	Brief 1 Oct 04	Flyer 2 Mar 05	Brief 2 Mar 05
<b>Regional Organisations</b>					
<b>EAST AFRICA</b>					
WIOMSA	Western Indian Ocean	✓(4)		✓	✓
WWF Kenya	Kenya	✓	✓	✓	✓
CORDIO	Kenya	✓(2)	✓	✓	✓
LVFO	Uganda, Tanzania, Kenya	✓(6)	✓(4)	✓	✓
KMFRI (Kenya Research Fisheries Institute)	Kenya	✓		✓	✓
Kinondoni Coastal Area Management Programme (KICAMP)	Kenya	✓		✓	✓
LAVEMP	Uganda, Tanzania, Kenya	✓		✓	✓
Universidade de Eduardo Mondlane – Mozambique	Mozambique	✓(2)		✓	✓
<b>WEST AFRICA</b>					



Sustainable Fisheries Livelihoods Project (SFLP)	West Africa	✓(2)	✓	✓	✓
Institute of Agricultural Research	Cameroon	✓		✓	✓
World Conservation Society	Gabon	✓	✓	✓	✓
<b>SOUTH WEST AFRICA</b>					
Benefit	South-West Africa	✓		✓	✓
BCLME	South-West Africa	✓		✓	✓
<b>INDIA &amp; ASIA</b>					
Bay of Bengal Programme	Bangladesh, India etc	✓	✓	✓	✓
Department of Fisheries (Andhra Pradesh), India	India	✓	✓	✓	✓
World Fish	Asia	✓(3)	✓	✓	✓
University of Philippines	Philippines	✓	✓	✓	✓
Kerela Central Marine Fisheries Research Institute	India	✓(4)		✓	✓
Mumbai Central Insitute of Fisheries Education	India	✓		✓	✓
Asian Fisheries Society	Asia	✓		✓	✓
STREAM	Asia	✓		✓	✓
Department of Fisheries, Cambodia	Asia	✓		✓	✓
SEAFDEC (Southeast Asia Fisheries Development Center)	Thailand	✓		✓	✓
Forth Fishery Project	Bangladesh	✓		✓	✓
CUSRI (Social Research Unity)	Thailand	✓		✓	✓
Centre for Development Studies	India	✓		✓	✓
Heherson Alvarez Dept Natural Resources, Philliphines	Asia	✓		✓	✓
Fisheries Community Development and Resources Management Project	Sri Lanka (GTZ)	✓		✓	✓
DFID	DFID (SE Asia)	✓		✓	✓
	DFID India	✓		✓	✓

<b>SOUTH AMERICA</b>					
ProVarzea Project, Amazon	Brazil	✓		✓	✓
<b>EUROPE</b>					
CEMARE	UK	✓(3)		✓	✓
Reef Map	UK	✓		✓	✓
Fishtech Management Consultants	UK	✓		✓	✓
University of Guelph	Netherlands	✓		✓	✓
University of A S (Norway)	Norway	✓	✓	✓	✓
University of Niemegeen (Netherlands)	Netherlands	✓		✓	✓
<b>PACIFIC</b>					
NOAA	Pacific	✓	✓	✓	✓
BIOMAR Reserve, Galapagos	Galapagos	✓	✓	✓	✓
<b>CARIBBEAN</b>					
CEMES (Centre for Resource Management and Environmental Studies)	Univeristy of West Indies	✓		✓	✓
<b>US</b>					
University of British Columbia	US	✓		✓	✓
<b>MIDDLE EAST</b>					
Environmental Society of Oman (ESO)	Oman	✓	✓	✓	✓
<b>International organisations (donors)</b>					
World Bank	Washington	✓	✓	✓	✓
	India	✓		✓	✓
	Tanzania	✓(2)	✓(2)	✓	✓
IUCN		✓		✓	✓
FAO	FAO HQ	✓(3)		✓	✓
	FAO Asia & Pacific Regional Office	✓(3)		✓	✓
WWF	Tanzania Office	✓	✓	✓	✓
CARE	Tanzania Office	✓	✓	✓	✓

## *Presentations*

Four main presentations were prepared during the ParFish project, and adapted for other meetings (see Section on Communications channels for a full list of meetings held). The latest version of these presentations is given in Annex 5.

## *Proposals*

Following identification of the opportunities, the following inputs to proposals were provided throughout the project:

- Inputs were provided on request (December 2004) to WWF/CARE/SAMAKI joint proposal to JDSF funding for pilot community development projects in Tanzania.
- Concept note submitted to the WWF Eastern African Marine Ecosystem to support a framework for implementing ParFish in Tanzania and the region (see Annex 6). This was submitted with partners in IMS and CORDIO.
- Letter of Interest submitted to WIOMSA (March 2005) to support a training workshop in ParFish for organisations in the Western Indian Ocean region (see Annex 6). This was submitted with partners in IMS, CORDIO and University of Newfoundland.
- A further proposal was submitted and accepted by DFID to test the stock assessment component within fisheries in Gabon and Kenya. This proposal also includes running a training course in ParFish in India and undertaking a case study in Andhra Pradesh. This proposal was submitted with partners in the Department of Fisheries in Andhra Pradesh, the Bay of Bengal Intergovernmental Organisation, CORDIO, and the World Conservation Society (WCS) in Gabon. (see FMSP Proposal (RD1 05-05)).

## *FMSP/FAO publication*

A chapter for the FMSP/FAO publication on guidelines to stock assessment was submitted in February 2005.

## *ParFish Toolkit*

The finalised ParFish Toolkit is the main promotion material for the ParFish approach. 150 paper copies and CDs are currently being produced. These will be distributed to all interested institutions, including currently identified communications stakeholders and those whom we receive feedback from following the March 2005 ParFish Flyer and Brief.

The final list of recipients will be reported in the next Annual Report Questionnaire for the project.

### **4.4.4. Communication channels**

A range of communications channels were used throughout the project these included:

- Ongoing correspondence through emails and telephone calls
- Newsletters
- Websites/List Servers
- Training sessions
- Meetings and presentations

## *Ongoing correspondence (emails and telephone calls)*

Communications were maintained with a number of communications stakeholders through email and telephone calls. Table 3 and Table 4 illustrate the organisations with which the project had active communications.

**Table 3: Communications maintained with National Level Stakeholders**

Organisation	Position
Department of Fisheries (Zanzibar)	MACEMP Coordinator Statistician Mafia Bay Coordinator
WWF Tanzania	Tanzania office
Research Institute (TAFIRI)	Research Officer – socio-economist
Institute of Marine Sciences	Assistant Director Researchers
Department of Environment	Environment officers

**Table 4 Communications maintained with Regional and International Level Stakeholders**

Institution	Region	Email correspondence	Telephone conversation
<b>Regional organisations</b>			
<b>EAST AFRICA</b>			
WIOMSA	Western Indian Ocean	✓	✓
WWF Kenya	Kenya	✓	✓
CORDIO	Kenya	✓	✓
LVFO	Uganda, Tanzania,	✓	✓
<b>WEST AFRICA</b>			
Sustainable Fisheries Livelihoods	West Africa	✓	✓
Institute of Agricultural Research	Cameroon	✓	
World Conservation Society	Gabon	✓	✓
<b>INDIA &amp; ASIA</b>			
Bay of Bengal Programme	Bangladesh, India etc	✓	✓

Department of Fisheries (Andhra Pradesh), India	India	✓	✓
World Fish	Asia	✓	✓
University of Philippines	Philippines	✓	✓
GTZ Fisheries Community Development and Resources Management Project	Sri Lanka	✓	✓
<b>SOUTH AMERICA</b>			
ProVarzea Project, Amazon	Brazil	✓	✓
<b>EUROPE</b>			
University of A S (Norway)	Norway	✓	✓
<b>PACIFIC</b>			
NOAA	Pacific	✓	
BIOMAR Reserve, Galapagos	Galapagos	✓	
<b>International organisations</b>			
World Bank	Washington	✓	✓
	Tanzania	✓	✓
FAO Asia & Pacific Regional Office	Asia & Pacific	✓	✓
WWF	Tanzania	✓	✓

## *Publications*

An article on ParFish was published in WIOMSA Newsbrief Vol 9 No. 3 of September 2004 (see Annex 5). The ParFish Flyer 1 was included as a supplement in the mailed versions of the Newsbrief.

A chapter within the FAO/FMSP guidelines will be published and distributed to over 200 fisheries institutions worldwide. The current citation of the forthcoming publication is Hoggath, D.D et al (In press 2005) Stock Assessment for Fisheries Management – A framework guide to the use of FMSP fish stock assessment tools. FAO Fisheries Technical Paper.

## *Websites/List Servers*

The following web-links or mention on list-servers has been achieved.

- Fisheries Management Science Programme (FMSP) Website
- OneFish: <http://www.onefish.org/id/225732>

- Asian Fisheries Society:
- WIOMSA website: [www.wiomsa.org](http://www.wiomsa.org)
- Stream website

## *Training session*

ParFish was introduced within a training workshop in September 2004 held in India for fisheries research institutions in India as part of project R8360 also funded by DFID. This included representatives from fisheries research institutes within a number of Indian and nearby States including: 6 representatives from Andhra Pradesh; 6 from Orissa, 6 from West Bengal, 3 from Karnataka and two representatives from Bangladesh. In addition there were representatives from the Central Marine Fisheries Research Institute (CMFRI) and the Central Institute for Fisheries Education (CIFE).

## *Meetings/Presentations*

The presentations on ParFish given throughout the project are summarised in Table 5.

**Table 5 Presentations given on ParFish**

<b>Date</b>	<b>Description</b>
July 2004	Introductory talk to CARICOM Regional Fisheries Mechanisms (CFRM) at the First Scientific Meeting
October 2004	Presentation to Department of Fisheries, Zanzibar. Thirteen members of the DoF were present including representatives from statistics, marine products, monitoring control & surveillance, artisanal fisheries, and Menai Bay conservation area.
December 2004	Presentation to the Lake Victoria Fisheries Organisation (LVFO) during an Expert Panel Meeting reviewing research and stock assessment methods on Lake Victoria
January 2005	Internal presentation to consultants and researchers at Marine Resources Assessment Group and Renewable Resources Assessment Group at Imperial College London.
January 2005	Meeting with WWF Tanzania on the use of ParFish in Tanzania.
February 2005	Presentation to Newcastle University (Tropical Coastal Management Masters Programme).
February 2005	Presentation to Jamaica University of West Indies and Trinidad Fisheries Department.

The presentation to the Lake Victoria Fisheries Organisation was a key opportunity for promoting the ParFish approach and Toolkit at a regional workshop. This workshop included representatives from fisheries research institutions in Tanzania, Kenya and Uganda.

In addition to these presentations a meeting was held with World Bank representatives concerning the MACEMP programme and how ParFish may be able to support its objectives. Interest was expressed in the ParFish approach specifically for assisting management of small-scale coastal fisheries in Tanzania, and a communications channel set up to keep the World Bank updated with developments of the case study and ParFish Toolkit.

#### 4.4.5. Evaluation of Outputs

A large proportion of the promotion activities were achieved throughout the project. In addition a number of key opportunities were taken up including promotion to the forthcoming World Bank Marine and Coastal Management Programme in Tanzania and promotion through the Lake Victoria Fisheries Organisation. While targets were reached for the number of institutions contacted, the number of institutions with which communications were maintained fell slightly below target (see Table 6). However, other targets were exceeded for example communications were maintained with a number of institutions outside the target area and three proposals were submitted for gaining future support to ParFish.

**Table 6 Comparison of targets and achievements in maintaining communications**

<b>Stakeholder Level</b>	<b>Target</b>	<b>Achieved</b>
National Level (Tanzania)	5	5
East and West Africa Regions	10	7
Asia Region	5	4
Other regions		7

A presentation to FAO was not achieved within the project time-line but contacts were made and interest within FAO confirmed. It was decided that presenting following the production of the Toolkit would be the most effective as it would provide FAO with an existing product for consideration. The presentation is planned to take place within the next month and a budget has been secured for this activity.

## 5. Contribution of Outputs

Include how the outputs will contribute towards DFID's development goals. The identified promotion pathways to target institutions and beneficiaries. What follow up action/research is necessary to promote the findings of the work to achieve their developmental benefit? This should include a list of publications, plans for future dissemination, as appropriate. For projects aimed at developing a device, material or process, specify:

- (a) What further market studies need to be done?
- (b) How the product will be made available to intended users?
- (c) What further stages will be needed to develop, test and establish manufacture of a product?
- (d) How, and by whom, will the further stages be carried out and paid for?

**NOTE:** Four copies of the draft final technical report must be submitted to the Programme manager to be refereed. Once referee's comments have been incorporated, two copies of the finalised report should be sent to the Programme manager. Project Completion Reports and Final Technical Reports are also required by DFID in electronic format, for storing on the 'NARSIS' database. These should be submitted to the Programme Manager in either Word or Word Perfect formats. Where possible, portable display format (PDF) copies of the reports should also be submitted.

Increased uptake of the ParFish approach will result in stock assessments being carried out for small-scale fisheries in developing countries in a participatory way. This will provide improved information on which to base management decisions, leading to more sustainable resource use and management. The involvement of resource users in the process supports good governance principles and will result in better designed and more acceptable management measures that take account of fishers knowledge and opinions. This will support the continued contribution of fisheries resources to the livelihoods of the rural poor, and thus help their way out of poverty.

### 5.1. Further market studies required

Further market studies to determine who the potential audiences are, is not considered necessary. We believe that the potential audience for the ParFish Toolkit (fisheries management, research and development organisations, together with community development organisations) has been correctly identified.

However, a market study that could provide useful feedback would be to monitor the uptake and application of the Toolkit by the institutions requesting it, and to explore their experiences in using the Guidelines, Software and Software Manual. Any difficulties they encounter could be used to inform improvements in the guidance provided and design of the products. A questionnaire will be sent out with the completed Toolkit requesting feedback on these issues, which will partly address this need.



## **5.2. Distribution**

The Toolkit will be distributed in hard copy with an accompanying CD containing the Software to the institutions that have requested a copy. This is considered important because the Guidelines are over 100 pages long, and the Software Manual is over 50 pages long. To print out these documents from an electronic copy may be difficult for some institutions that have limited printing resources. Hard copies will also be provided to participants in future ParFish training courses. The Toolkit will also be produced on CD, and will be available electronically by email or download from the internet. This will enable the Toolkit to be made available to a greater number of institutions than the resources of the project allow to be produced and sent out in hard copy.

## **5.3. Further development requirements**

### **5.3.1. Further case studies and testing**

The Toolkit has so far been tested and shown to be applicable in East Africa (Zanzibar). The stock assessment methodology has also been tested in the Caribbean (Turks and Caicos Islands). Responses from communications activities have highlighted the need for further testing in different fisheries and different social and economic contexts, to assure potential users of its applicability in different environments. This issue will start to be addressed by the follow-on project R8464, which will carry out a case study in India, support case studies in Gabon and Kenya, and produce a revised version of the Toolkit based on the lessons learned from these experiences.

### **5.3.2. Research and development**

Research and development of the methodology forms an important part of the promotion. Fisheries are all different and there is a wide array of possible data that can be collected and controls implemented. ParFish currently covers data types and controls common to many fisheries, but there is considerable scope to expand these. Developing and testing the method makes the approach of considerable more interest to prospective users than a simple off-the-shelf package. In particular, further development and testing should be carried out for more complex models including multispecies assessments, models for specific fisheries such as floodplain fisheries, migratory stocks and lake fisheries, and for the incorporation of other direct measures such as changes in fish size or relative biomass in the preference interviews.

Further research and development could also be applied to investigate different ways of constructing priors from fishers' knowledge. Estimates of unexploited stock size and growth rate based on fisher interviews could be improved through developing alternative questions. There may be also be other ways of obtaining probabilities for these parameters. This research could be carried out through further funding to ParFish development, other research programmes or PhD research.

There are various statistical and numerical methods which would improve the stability of the software. The central idea, to provide a robust method allowing all and any information pertinent to the central problems of stock assessment and management advice, requires robust numerical techniques that can cope with very imprecise data (e.g. data with very high variance). Some new techniques have been published in the mathematical and statistical literature which could be trialled. This would involve programming and testing various methods on simulated data, which would also help the software conduct automated diagnosis

and correction. Currently, numerical failure leaves the user with no way to turn but contact the programmer (Paul Medley).

Another area that could be investigated is the weighting given to different fishers (currently based on an 'importance' score which relates to the dependency of the fisher on the fishery). The influence of using different weightings on the results could be investigated, and weightings could be developed that take into account measures of poverty, equity and benefits from the fishery. This and other methods might further help implement policies of good governance and sustainable livelihoods.

### **5.3.3. Training and development of local expertise**

Expertise in the implementation of ParFish has been built up in Zanzibar, although the evaluation indicated that they require some further training in the use of the Software and interpretation of the results to be fully capable in all stages of the approach.

A network of institutions and people capable of implementing ParFish needs to be built up in other regions for ParFish to achieve its full developmental impact. This will be addressed in the Bay of Bengal region through the follow-on project R8464, which will carry out a training workshop in India involving participants from the region, and a case study in Andhra Pradesh, India. Other case studies in Kenya and Gabon will also increase local capacity in those institutions. There is still much more scope for increasing local capacity for carrying out participatory fisheries stock assessments. Further training courses should be run in different regions, and implementation of ParFish supported where required.

### **5.3.4. Integration into routine government data collection**

The integration of the ParFish approach into routine government collection of fisheries data is an area that could be focussed on in future to improve the uptake of the outputs and increase their developmental impact. This is a longer-term issue that would have to be encouraged with the relevant fisheries departments in various countries, starting specifically with those countries where case studies have been carried out. The involvement of staff from fisheries departments in the case studies has helped raise awareness and build capacity in the approach in fisheries departments, but further lobbying, support and time would be required to implement the approach throughout their data collection systems.

## **5.4. Future implementation**

Continued implementation of ParFish will take place under FMSP project R8464, which will develop and carry out a training course in the Bay of Bengal region, support a case study in Andhra Pradesh, and support other case studies in Kenya and Gabon, whilst continuing promotion and uptake activities.

A further proposal for a training course has been developed and submitted to the Western Indian Ocean Marine Science Association (WIOMSA) to run a training course for institutions in the Western Indian Ocean region, where there is considerable interest in the approach. A concept note has also been submitted to WWF's East African Marine Ecoregion programme to support further ParFish activities, and we are currently in discussions with the World Bank concerning the use of ParFish within the Marine and Coastal Environment Management Program in Tanzania and Zanzibar.



## 6. Publications and other communication materials

### 7.1. Books and book chapters

Chapter in FAO/FMSP Stock Assessment Guidelines. Hoggath D.D et al (In press 2005) Stock Assessment for Fisheries Management – A Framework guide to the use of FMSP fish stock assessment. FAO Fisheries Technical Paper.

### 7.2. Journal articles

#### 7.2.1 Peer reviewed and published

See R7947

Medley P.A.H. Non-parametric multidimensional probability density estimation for Bayesian applications. Biometrics

Medley P.A.H. at al. Interviewing Fishers to Obtain Expert Priors and Utility for Decision Analysis

Medley P.A.H. A new approach to multispecies modelling for the analysis of fish communities.

#### 7.2.2 Pending publication (in press)

#### 7.2.3 Drafted

### 7.3 Institutional Report Series

### 7.4 Symposium, conference, workshop papers and posters

### 7.5 Newsletter articles

WIOMSA Newsbrief Vol 9 No. 3 of September 2004 (Annex 5)

### 7.6 Academic theses

### 7.7 Extension leaflets, brochures, policy briefs and posters

Flyers and brief (Annex 5)

### 7.8 Manuals and guidelines

ParFish Toolkit (Guidelines, Software Manual) Annex 2 & 3

### 7.9 Media presentations (videos, web sited papers, TV, radio, interviews etc)

- OneFish: <http://www.onefish.org/id/225732>
- Asian Fisheries Society:
- WIOMSA website: [www.wiomsa.org](http://www.wiomsa.org)
- Stream website

### 7.10 Project reports and data records

Quarterly Reports, Annual Report, Project Completion Summary

#### 7.10.1 Citation for the project Final Technical Report (FTR)

Medley, P.A; Walmsley, S; Howard C (2005) Uptake of Participatory Fisheries Stock Assessment (PFSA) Toolkit: Final Technical Report. London: MRAG Ltd.

#### 7.10.2 Project technical reports including project internal workshop papers and proceedings

#### 7.10.3 Literature reviews

#### 7.10.4 Scoping studies

#### 7.10.5 Datasets, software applications

ParFish Software

#### 7.10.6 Project web site and/or other project related web addresses

FMSP website

## 7. References cited in the report, sections 1-7

- Aiken, K.A., Kong, G.A., Smikle, S., Mahon, R. and Appledorn, R. (1999). The queen conch fishery on Pedro Bank, Jamaica: discovery, development, management, *Ocean & Coastal Management, Volume 42, Issue 12, December 1999, Pages 1069-1081*
- Ali, A.B. and Lee, K.Y. (2003). Chenderoh Reservoir, Malaysia: a characterization of a small-scale, multigear and multispecies artisanal fishery in the tropics, *Fisheries Research, Volume 23, Issues 3-4, June 1995, Pages 267-281*
- Anon. (1999). Nation Fisheries Development and Management Plan, Anguilla Department of Fisheries, Anguilla, British West Indies.
- Berger, J.O. (1985). Statistical Decision Theory and Bayesian Analysis (2<sup>nd</sup> Ed.). Springer-Verlag, New York.
- Bulmer MG (1974) On fitting the Poisson lognormal distribution to species abundance data. *Biometrics* 30: 101-110
- Bunce, L., Townsley, P., Pomeroy, R. & Pollnac, R. 2000. Socioeconomic Manual for Coral Reef Management. Australian Institute of Marine Science, 251 p.
- Crosby, M.P., Brighthouse, G. and Pichon, M. (2002). Priorities and strategies for addressing natural and anthropogenic threats to coral reefs in Pacific Island Nations. *Oceans & Coastal Management* 45 (2002) 121-137
- DFID (2002) Fisheries Management Science Programme. Programme Development Visit to East Africa 15 Feb-5 March 2002.
- Dovie, D.B.K. (2003). Whose involvement?—can hierarchical valuation scheme intercede for participatory methods for evaluating secondary forest resource use? *Forest Policy and Economics, Volume 5, Issue 3, September 2003, Pages 265-283*
- Faddeeva VN (1959) Computational Methods of Linear Algebra. Dover Publications Inc. New York.
- Garaway, C. & Arthur, R. 2002 Adaptive learning: Lessons from Southern Lao PDR.
- Gaudian G, Medley PAH, Ormond RFG (1995) Estimation of the size of a coral reef fish population. *Mar Ecol Prog Ser* 56:13-27
- Gelman A, Carlin JB, Stern, HS, Rubin, DB (1995) Bayesian Data Analysis. Chapman and Hall, London.
- Hilborn R, Walters CJ (1992) Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty. Chapman and Hall, New York
- Keeney RL and Raiffa H (1993) Decisions with Multiple Objectives. Preferences and Value Tradeoffs. Cambridge University Press, Cambridge, UK.
- Lassen, H and Medley, P (2001) Virtual Population Analysis. A practical manual for stock assessment. FAO Fisheries Technical Paper 400. FAO, Rome. 129 p.
- Leslie PH, Davis DHS (1939) An attempt to determine the absolute number of

rats on a given area. *J Anim Ecol* 8: 94-113

Lindgren B.W. 1976. *Statistical theory*. 3<sup>rd</sup> Edition. Macmillan Publishing Co. Inc., New York.

Magurran AE (1988) *Ecological Diversity and Its Measurement*. Chapman and Hall, London.

Mahon, R., Almergi, S., McConney, P., Parker, C. and Brewster, L. (2003). Participatory methodology used for sea urchin co-management in Barbados. *Ocean & Coastal Management* 46 (2003) 1-25

Manly, BFJ (1997) *Randomization, Bootstrap and Monte Carlo Methods in Biology*. Second Edition. Chapman and Hall, London.

May RM (1975) Patterns of species abundance and diversity. In: *Ecology and Evolution of Communities*. Eds: ML Cody and JM Diamond. Harvard University Press, Cambridge, MA. pp. 81-120

McCullagh P, Nelder JA (1989) *Generalized linear models*. Second Edition. Chapman and Hall, New York.

Medley, P.A.H. (1998). A decision theory case study: choosing a season opening for a spiny lobster (*Panulirus argus* L.) fishery. *Fisheries Science* 36: 159-170.

Medley, P.A.H. (In Prep). A New Approach to Multi-species Modelling for the Analysis of Fish Communities.

Medley, P.A.H., G. Gaudian and S.M. Wells (1993). Coral Reef Fisheries Stock Assessment. *Reviews in Fish Biology and Fisheries*, 3 (3): 242-285.

Medley, P.A. 2003. *Participatory Fisheries Stock Assessment: Final Technical Report*. London: MRAG Ltd. 94pp.

Medley, P.A.H., Walmsley, S.F. & Howard, C.H. 2005. *Participatory Fisheries Stock Assessment Guidelines*. London: MRAG.

Moser, C.A. and Kalton, G. (1979). *Surveys in Social Investigation*. Galliard, Great Britain.

MRAG 1999. The performance of customary marine tenure in the management of community fishery resources in Melanesia. R.6436

Pauly, D. 1980 On the interrelationships between natural mortality, growth parameters and mean environmental temperature in 175 fish stocks. *J. Cons. CIEM* 39(2):175-192.

Pido, M.D. (1995). The application of Rapid Rural Appraisal techniques in coastal resources planning: experience in Malampaya Sound, Philippines, *Ocean & Coastal Management, Volume 26, Issue 1, 1995, Pages 57-72*

Pomeroy, RS and Williams MJ (1994) *Fisheries Co-management and small scale fisheries: A policy brief*. *ICLARM Contrib.* 1128:15pp Press, SJ (1989) *Bayesian Statistics: Principles, models and applications*. Wiley Series in Probability and Mathematics, John Wiley and Sons, New York.

Press, WH, Flannery, BP, Teukolsky, SA and Vetterling WT (1989) *Numerical Recipes in Pascal. The art of scientific computing*. Cambridge University Press, New York.

Press S.J. 1989. *Bayesian statistics: principles, models and applications*. Wiley and sons, New York.

Punt, A and Hilborn, R (1997) Fisheries Stock Assessment and Decision Analysis: the Bayesian Approach. *Reviews in Fish Biology and Fisheries*, 7: 1-29.

Ruddle, K, Hviding, E and Johannes RE (1992) Marine resources management in the context of customary tenure. *Marine Resource Economics* 7(4) pp 275-296

Saaty, T.L. (1995). Decision-Making for Leaders – The Analytical Hierarchy Process for Decisions in a Complex World. RWS Publications, Pittsburgh.

Saaty, T.L. and J. Alexander (1989). Conflict Resolution: The Analytic Hierarchy Process. Praeger, New York.

Sparre, P. (1991). Introduction to multispecies virtual population analysis. *mICES Mar. Sci. Symp.*, 193:12-21.

Sparre, P. Venema, S.C. (1992) Introduction to tropical fish stock assessment. Part 1. Manual. FAO Fisheries Technical Paper No. 306.1 rev 1. Rome, FAO. 376 p.

Srinivasen, L. 1990. Tools for Community Participation. A manual for training trainers in participatory techniques. PROWWESS/UNDP Technical Series, New York, 179 p.

Sugihara G (1980) Minimal community structure: an explanation of species abundance patterns. *Amer. Nat.* 116: 770-787

Townsley, P. (1998) Social issues in fisheries. FAO Fisheries Technical Paper. 375. FAO, Rome. 93p.

Ugland KI, Gray JS (1982) Lognormal distributions and the concept of community equilibrium. *Oikos* 39: 171-8

van Lint JH and Wilson RM 2001 A course in combinatorics. 2nd Edition. Cambridge University Press.

Walters, J.S., Maragos, J. Siar, S. & White, A.T. 1998. Participatory Coastal Resource Assessment. A Handbook for Community Workers and Coastal Resource Managers. Coastal Resource Management Project and Silliman University, Cebu City, Philippines, 113 p.

World Bank (2003) Tanzania Marine and Coastal Environmental Management (MACEMP) Project. Preparation Mission (November 18-28, 2003) Aide Memoire.

## 8. Project logframe

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<b>Goal</b>			
FMSP research outputs disseminated and promoted to relevant stakeholders at all levels resulting in benefits for poor people generated by the application of new knowledge to fisheries management systems.	Number of stock assessments using PFSA approach	Institution and workshop reports Scientific publications	Institutions that are targeted with the FMSP research output (in this case the PFSA software and associated tool kits) have sufficient capacity and resources to use the methodology.  In the application of the PFSA software to produce participatory resource management, sufficient co-management arrangements exist to implement management action plans.
<b>Purpose</b>			
Increased uptake of the PFSA methodology for data-poor, artisanal fisheries in developing countries so that stock assessment institutions can more effectively collect, share and analyse information with relevant stakeholders to improve fishery dependent livelihoods.	By month 6, case study carried out applying the results of the PFSA methodology to produce a participatory resource management action plan.  By month 6, capacity of the Institute of Marine Science (IMS) for PFSA methodology increased  By month 7, toolkit developed and refined  By End of Project (EOP) toolkit promoted nationally, regionally and internationally	Peer review of final report and correspondences from target institutions.	Sufficient interest and capacity to use the methodology exists.  Institutional commitment to participatory management methods  Communities willing to participate in applying information from PFSA to develop participatory resource management action plans
<b>Outputs</b>			
<b>1. PFSA tool kit developed and refined</b> consisting of 3 parts: Part A: Undertaking PFSA design and information collection using an adaptive learning approach Part B: Using PFSA software and analysing results Part C: Using PFSA results to develop a participatory management action plan using suitable approach e.g. PAPD Participatory Action Plan Development	By month 2, preliminary tool kit components developed (Parts A, B & C)  By month 4, Parts A & B of tool kit refined following a workshop with previous case study participants  By month 6, case study undertaken in Kizimkazi to test Part C of the tool kit and develop a participatory resource management action plan developed for Kizimkazi  By month 7, Part C of tool kit refined based on the experience from the case study, and entire kit compiled.	Review by communications specialist  Final report	A common approach for communication to a wide variety of stakeholders exists or a number of different approaches can be incorporated within one tool kit.  Willingness of resource user stakeholders to participate in case study and commitment by IMS to take a significant role



<p><b>2. Increased capacity of Tanzanian Institute of Marine Sciences (IMS) to use and promote PFSA</b></p>	<p>By month 3, capacity and skills of IMS for PFSA reviewed.</p> <p>At least 2 staff from IMS involved in the case study, and at least 2 involved in developing and implementing the national and regional communications plan.</p> <p>By EOP, capacity of IMS increased through: training, involvement of staff members in the case study and in refining the tool kit, and involvement in developing and implementing a national level communications strategy.</p>	<p>Project reports (review of capacity and skills of IMS at project start and EOP)</p>	<p>IMS has adequate support from parent institutions to allow capacity building to take place.</p>
<p><b>3. PFSA promoted nationally, regionally and internationally</b></p> <p>(In all of these areas there will be certain areas of focus depending on opportunities, previous contact, and prioritisation – see draft communications plans in Annex B)</p>	<p>By month 3, communication plans in place for promoting PFSA:</p> <p>(i) Nationally within Tanzania (ii) Regionally within East and West Africa (iii) Regionally within SE Asia (iv) Internationally</p> <p>By EOP, at least 10, 25 and 3 institutions contacted at the national, regional and international levels respectively, and communications maintained as detailed in the communications plan.</p> <p>By EOP tool kit provided to at least 8 institutions on their request</p> <p>By EOP, 1 proposal for promotion of and support to PFSA received from an international or regional organisation</p> <p>By EOP communications plans updated for inclusion in the final report.</p>	<p>Communications plans (see indicators in draft plans – Annex B)</p> <p>Peer review of final report</p>	<p>Sufficient information available to identify target institutions and communication mechanisms</p> <p>Target institutions have sufficient resources and interest to support or adopt PFSA methodology</p>
<p><b>Activities</b></p> <p><b>Total Activities Budget</b></p> <p><b>Personnel Emoluments</b>      <b>33797</b></p> <p><b>Capital Equipment</b>            <b>0</b></p> <p><b>Travel and subsistence</b>        <b>11770</b></p> <p><b>Recurrent</b>                         <b>5500</b></p> <p><b>Other charges</b>                    <b>3500</b></p> <p><b>Overhead</b>                         <b>13973</b></p>			
<p><b>Activity 1: PFSA Tool Kit developed and refined</b></p>			
<p><b>BUDGET</b></p> <p>Activity 1 Budget</p> <p>Fees                                    29820</p> <p>Reimbursables/others            15000</p>	<p><b>MILESTONES</b></p>		
<p>1.1 Review existing tool kit and identify development needs and options</p>			
<p>1.2 Review and collate relevant materials for use in the tool kit (e.g. methodologies for participatory and consensus-building techniques) from existing literature</p>			

<p>1.3 Develop tool kit components</p> <p>The tool kit development will depend on steps 1.1 and 1.2. outlined above, but it is likely to comprise of 3 parts:</p> <p>Part A: Undertaking PFSA design and information collection:</p> <ul style="list-style-type: none"> <li>• A framework for the methodology e.g. an adaptive learning approach (See Annex A)</li> <li>• Tools for information collection (i.e. interview sheets, scenario cards, experiment designs, and communication materials)</li> </ul> <p>Part B: Using PFSA software and analysing the results:</p> <ul style="list-style-type: none"> <li>• Software with user friendly interfaces for data inputting, analysis and outputs</li> <li>• Teaching manual to accompany software and to teach basics of Bayesian statistics</li> <li>• Communication materials for presenting the results to different stakeholder groups and involving them in the analysis.</li> </ul> <p>Part C: Using PFSA results to develop a participatory management action plan:</p> <ul style="list-style-type: none"> <li>• A framework for action planning and consensus building e.g. PAPD Participatory Action Plan Development guidelines.</li> </ul>	<p>By month 2, Preliminary tool kit complete.</p>	<p>Project reports</p> <p>Review report of tool kit by communications specialist</p>	<p>There exists an effective approach to communicate the key information to stakeholders taking into account their education and experience.</p>				
<p>1.4 Review of tool kit by Communications Specialist.</p>	<p>By month 3, review of tool kit complete.</p>	<p>Review report</p>					
<p>1.5 Refine tool kit Parts A and B through a workshop with key stakeholders involved in the previous PFSA case study in Kizimkazi in Zanzibar</p>	<p>By month 4, refined Tool kit Parts A and B complete.</p>	<p>Review report of tool kit by communications specialist</p>	<p>Stakeholders willing to take part in workshop</p>				
<p>1.6 Undertake a follow up case study to test Part C of the Tool kit in Kizimkazi in Zanzibar</p> <ul style="list-style-type: none"> <li>• Planning of case study with IMS, fisheries scientist, research assistant and communications/social advisor.</li> <li>• Undertake stakeholder analysis, and analysis of the management and communication context</li> <li>• Identify and prioritise problems with stakeholders</li> <li>• Analyse results from PFSA and potential solutions</li> <li>• Build consensus on solutions</li> <li>• Draft a community action plan</li> </ul>	<p>By month 6, participatory management action plan complete for Zanzibar.</p>	<p>Project reports</p>	<p>Stakeholders willing to take part in case study</p>				
<p>1.7 Refine Tool kit Part C based on experience of case study and with inputs from communications expert.</p>	<p>By month 7, refined Tool kit Part C complete</p>	<p>Project reports</p> <p>Completed tool kit</p>	<p>Case study provides sufficient experience to inform Tool kit Part C</p>				
<p><b>Activity 2: Increased capacity of Tanzanian Institute of Marine Sciences (IMS – partner organisation in Tanzania) to use and promote PFSA</b></p> <p>Activity 2 Budget</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 150px;">Fees</td> <td style="text-align: right;">10000</td> </tr> <tr> <td>Reimbursables/others</td> <td style="text-align: right;">0</td> </tr> </table>				Fees	10000	Reimbursables/others	0
Fees	10000						
Reimbursables/others	0						

2.1. Review of capacity and skills of IMS in relation to the use and promotion of PFSA	By month 3, review of IMS capacity undertaken	Project reports	IMS has adequate support from parent institutions to allow capacity building to take place
2.2 Training of IMS staff in aspects of PFSA and use of tool kit		Project reports	
2.3 IMS participation in the case study (in particular to increase capacity in Part C tool kit activities)		Project reports	
2.4. IMS participation in developing and implementing a national communication plan (and aspects of a regional communication plan) for promoting PFSA		Communication plan updates	
2.5 Review capacity and skills of IMS at the end of the project	Review of IMS capacity undertaken again by EOP	Project reports	
<b>Activity 3: PFSA promoted nationally (Tanzania), regionally and internationally</b> (See also draft communications plan, Annex B)			
Activity 3 Budget			
Fees	7950		
Reimbursables/others	5700		
<b>BUDGET</b>	<b>MILESTONES</b>		
<b>3.1 PFSA promoted nationally within Tanzania</b> <ul style="list-style-type: none"> <li>Refine communications plan for promoting PFSA within Tanzania with IMS</li> <li>Development of promotional materials (as part of communication strategy) – brochure, presentation etc.</li> <li>Promotion of PFSA to national institutions (e.g. emails, letters, promotion brochure, presentations etc)</li> <li>Promotion of PFSA at a national workshop or specific training events</li> <li>Tool kits distributed in response to requests from other institutions</li> </ul>	By month 3, communications plan complete By month 4, promotional materials complete By month 5, at least 10 national institutions contacted Communications maintained with at least 5 institutions as detailed in the communications plan by the EOP (communication objectives may differ for different institutions – see communications plan in Annex B) Tool kit used by IMS to give training in PFSA or its promotion within at least 2 national institutions	Final report including an updated communications plan Communications from other institutions	Target national institutions can obtain resources to adopt and support PFSA methodology
<b>3.2 PFSA promoted regionally in East and West Africa Regions</b> <ul style="list-style-type: none"> <li>Refine communications plan for promoting PFSA within the East and West Africa Regions</li> <li>Development of communication material to be used at the regional level (e.g. presentation, emails etc)</li> <li>Use of communication materials to promote PFSA to institutions in the regions</li> <li>Promotion of toolkit at a regional workshop (e.g. opportunity of WIOMSA symposium where scientific research projects of the region are presented)</li> <li>Tool kits distributed in response to requests from other institutions</li> </ul>	By month 3, East/West Africa communication plan developed. By month 5, promotional materials complete. By month 5, at least 15 institutions in the East and West Africa Region contacted. Communications maintained with at least 7 institutions as detailed in the communications plan by the EOP (communication objectives may differ for different institutions – see communications plan in Annex B). Tool kit sent to at least 2 institutions in the East or West Africa regions (excluding Tanzania) by EOP. Tool kit promoted at one regional workshop by EOP	Final report including an updated communications plan Communications from other institutions	Target regional institutions have sufficient resources and interest to adopt or promote PFSA methodology

<p><b>3.3 Promote PFSA in SE Asia region</b></p> <ul style="list-style-type: none"> <li>• Refine communications plan for promoting PFSA in the SE Asia region</li> <li>• Develop communication materials for use at the regional level if different from those produced in 3.2.</li> <li>• Use of communication materials to promote PFSA to institutions in the regions</li> <li>• Promotion of tool kit at FMSP stock assessment workshop including refining the tool kit for the SE Asian context</li> <li>• Tool kits distributed in response to requests</li> </ul>	<p>By month 3, SE Asia communication plan developed.</p> <p>By month 4, promotional materials complete.</p> <p>By month 5, at least 10 national institutions contacted.</p> <p>Communications maintained with at least 5 institutions as detailed in the communications plan by the EOP.</p> <p>Tool kit promoted as an example during a one-day seminar on Bayesian stock assessment methodologies forming part of a general stock assessment workshop to be held in India during 20-24<sup>th</sup> September, targeting a number of stock assessment and fishery institutes in India (as part of FMSP project R8360, also funded by DFID).</p> <p>Tool kit sent to at least 2 institutions on request in the SE Asia region by EOP.</p>	<p>Final report including an updated communications plan</p> <p>Communications from other institutions</p> <p>FMSP workshop report</p>	<p>Target regional institutions have sufficient resources and interest to adopt or promote PFSA methodology</p>
<p><b>3.4 Promote PFSA internationally</b></p> <ul style="list-style-type: none"> <li>• Refine communications plan for promoting PFSA internationally</li> <li>• Provide chapter on PFSA (using Parts A and B of the tool kit) for inclusion within the FAO manual on stock assessment currently being developed as part of FMSP project R8360.</li> <li>• Approach FAO and other international institutions for future support to and promotion of PFSA tool kit</li> <li>• A specific promotion effort to FAO including a trip to the Rome offices to present the benefits of PFSA to the stock assessment division.</li> </ul>	<p>By July 31<sup>st</sup> (end of month 3) provide chapter on PFSA for FMSP/FAO stock assessment manual to be distributed to over 500 stock assessment or fisheries institute worldwide.</p> <p>By month 4, international communication plan developed.</p> <p>By month 5, promotional materials complete</p> <p>By month 7, at least 3 international institutions contacted and promotion efforts made.</p> <p>By EOP, 1 proposal for promotion of and support to PFSA received from an international or regional organisation.</p>	<p>Final report including an updated communications plan</p> <p>Communications from international institutions</p>	<p>Target international institutions have sufficient resources and interest to adopt or promote PFSA methodology</p>

## **9. Keywords**

Promotion; Fisheries management; Stock assessment; Bayesian; Decision-making; Participatory; Communications; Tanzania; Zanzibar; Fisheries management planning.



## Annex 1: Participants at the Multi-Stakeholder Meeting in Zanzibar, January 2005

Stakeholder Groups	Sub-category	Name
Fishers: Mkunguni (8)	Hand line and net fisher	Ali Ibrahim Shoka
	Net fisher, tuna fisher	Khalid Ameer Juma 'Kibuldoza'
	Trap fisher	Mbaraka Mikidadi
	Trap fisher	Haji Khamis
	Handline fisher	Dahala Shehe Balozi
	Handline fisher	Khamis Dau
	Head - Fishers Association	Khatib Pandu
	Head of Women's Committee	Mwachum Shaka Ali
Others; Mkunguni (3)	Village Chief	Ali Hassan Mwitwa
	Beach Recorder	Mohammed Ali Khamis
	Headmaster	Said Hamad Ramadhan
Fishers: Dimbani (12)	Trap fisher	Haji Khamis Omari
	Net fisher and Trap fisher	Simba Miraji
	Fisher	Abdu Khamis (Chau)
	Handline fisher	Mahfoudh Mussa Makame
	Handline fisher & net fisher	Jamhuri Haji Ali
	Gillnet fisher	Pandu Abdalla Daudi
	Trap fisher / Fence trap fisher	Is'haka Hamad / Simba Ali Amer / Ali Vipuju
	Gillnet fisher	Ramadhan Rajab
	Fisher	Kassim Fadhil
	Trap fisher	Mohamadi Khamisi
	Assistant Head - Fishers Association	Nassor Rajab Mwalim
	Head of Women's Committee	Hole Khatib Khamis
Others: Dimbani (3)	Village Chief	Abdulrazak Hassan Ibrahim
	Beach recorder	Bakari Ali Hassan
	Headmaster	Ussi Othman Ussi
Fishers: Mtende (8)	Net fisher and octopus fisher	Sembuli Sheha (Ahmed Shehe Juma)
	Net fisher	Khatib Mwinyi
	Trap fisher	Ali Khamis Haji
	Trap fisher	Haji Pandu
	Handline fisher	Masoud Ameer Haji
	Handline and squid fisher	Haji Kombo Haji
	Head - Fishers Association	Mohammed Issa Hamad
Member of Women's Committee, octopus fisher	Biubwa Khamisi	
Others: Mtende (3)	Village Chief	Khamisi Juma Khamisi
	Beach Recorder	Bashir Faida Haji
	Headmaster	Faruku Issa Ahmed

Department Fisheries (6)	of	District Fisheries Officer	Shibli Mwita Haji
		Head of District Fisheries Officers	Issa Ameer Suleiman
		Menai Bay Conservation Area	Juma Haji Ame
		Head of Statistics Dept	Hamad Khatib
		Ex-Menai Bay Conservation Area, now MACEMP	Mohammed Soud
		Menai Bay Conservation Area	Omar Ameer
Department Environment (2)	of	Natural Resources Officer	Alawi Haji Hija
		Head of Monitoring, Evaluation and Planning Section	Makame M.Haji
Research Institutions (3)		Institute of Marine Sciences	Dr Narriman Jiddawi
			Saleh Yahya
		State University of Zanzibar	Mohammed Suleiman
		Marine Resources Assessment Group	Suzannah Walmsley

### Workshop Recommendations

1. To improve patrols in Menai Bay Conservation Area
2. To improve environmental education in villages around MBCA.
3. To control the number of visiting fishermen in MBCA.
4. To control illegal fishing methods and practices
5. To revive traditional fishing methods.
6. To exchange experience on patrols between villages
7. To establish closing system management in some areas.
8. To ban dive fishing for octopus and sea cucumbers.
9. To conduct researches on regular basis and feedback returned to fishers.
10. Law bodies to be responsible.
11. To help traditional fishermen to establish small enterprises.

### Things which villages can implement independently

1. Controlling octopus fishing
2. Controlling camping
3. Reviving traditional fishing methods.
4. Enacting bylaws
5. Environmental education
6. Feedback of workshop outcomes

### Menai Bay Conservation Area

1. To provide environmental education

### ZAFFIDE

1. Assist in establishment of Community-based Organizations

### Marine and Coastal Environment Management Project (MACEMP)

1. To help small enterprises of the community involved in fishing and seaweed farming.



## **Annex 2: The ParFish Guidelines**



## **Annex 3: The ParFish Software Manual**



## **Annex 4: Updated Communications Plan**



## **Annex 5: Communications Materials – flyers, briefs and presentation**





## **Annex 6: Proposals**