Application and Promotion of FMSP Participatory Fisheries Stock Assessment (ParFish)

R8464

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Contents

1 Executive Summary

1. **Executive Summary**:

The project tested, revised and widely promoted a methodology for participatory fisheries stock assessment (ParFish), developed under R7947 and R8397, through field testing, a training workshop and communication and promotion activities to increase capacity in its implementation, increase its dissemination and uptake to improve sustainable utilisation of artisanal fisheries resources in developing countries to contribute to the livelihoods of the poor.

Field testing of the methodology was undertaking with collaborating institutions in India, Gabon and Kenya and a training workshop was carried out in India. The case studies allowed testing of different approaches to data collection and provided lessons learned for promotional materials. The training workshop increased capacity of those involved and resulted in its uptake and application by participants' institutions, as well as providing new training materials which were included in the Toolkit. The Software was modified to make transition between different assessment models easier and to enable incorporation of other models such as age-based models at a later date. Communications and promotion activities resulted in interest in the methodology from the European Union and the Fisheries Department of the UN Food and Agriculture Organisation, which will be explored for further development and promotion of the approach.

Development and promotion of the methodology has achieved increased access of poor people, principally fishers and their dependents, to improved fisheries knowledge generated through the application of ParFish. ParFish enables stock assessments to be carried out rapidly in fisheries for which no prior data exist, and facilitate the implementation of management measures to improve sustainability of fisheries exploitation, thus supporting fisheries catches and fishers' livelihoods in the medium to long term. The participatory nature of the process gives fishers a voice in management of their resources and empowers them within a comanagement framework. The project has increased the capacity of fisheries management, research and implementing agencies' staff, particularly in the East Africa and Asia regions, to implement ParFish and involve fishers in fisheries assessment and management planning.

2 Background

Information should include a description of the importance of the goal or 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.

2.1 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. A lack of resources to collect and analyse data on the fishery results in a lack of information on which to base management decisions, which may jeopardise the sustainability of the fishery and put many people's livelihoods at risk. 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 these 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.

2.2 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 conventional stock assessments. Neither have participatory methods (e.g. those developed 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 an active role in management decisions or the implementation of actions based on them.

ParFish addresses these constraints 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;
- 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.

Case studies have important uses in developing and promoting new scientific methods. Primarily they are used to indicate when and how the method activities contribute to the FMSP goal. We used this strategy to develop the practical application of ParFish. A set of case studies in different areas that vary in their fisheries, environments and cultural contexts help provide evidence supporting the practical value of the approach, as well as allowing development and adaptation of the method to suit different types of fisheries.

2.3 Scientific Background

This project built on previous work undertaken by project R7947, which developed the stock assessment and data collection techniques (see Medley, 2003), and by project R8397, which developed the Toolkit for implementing ParFish. No further scientific research has been undertaken in R8464.

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 and Bayesian statistics.

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 of its 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 hierarchal utility model, but field work has shown that simpler and faster methods perform better than complex ones, even though the latter 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 (developed under R7947) 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.

Project R8397 developed the ParFish methodology into a Toolkit, which was required for effective promotion of ParFish and use by fisheries management or stock assessment institutes. It 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 (Walmsley *et al.* 2005a).
- User-friendly software package;
- Software user manual (Walmsley *et al.* 2005b).

The Toolkit was developed based on case studies carried out on a single-species fishery in the Turks and Caicos Islands and on a mixed reef fish fishery in Zanzibar, Tanzania. It proved successful in testing in these areas, but required testing in other situations to provide evidence for its applicability in other fisheries and cultural contexts. The appropriateness of the underlying model, as well as the participatory techniques recommended for implementation of the approach needed verification.

2.4 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.

A wide variety of stakeholders expressed an interest in the ParFish approach through the communications component of project R8397. 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-Kenya, WWF-Brazil (Amazon) and researchers, consultants and other projects from Canada, Gabon, the Philippines, Sri Lanka, Tanzania, Australia and UK.

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 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.

The FAO Strategy for Improving Information on the Status and Trends of Capture Fisheries recognises the importance of small-scale and multispecies fisheries, particularly in developing countries, and highlights the need for improving data and information for this sector. The use of rapid appraisal methodologies and participatory processes are specifically identified.

The FMSP East Africa Strategy paper (DFID, 2002), reports a high demand for baseline information and improved data collection systems which involve communities. ParFish addresses these areas by providing baseline information (stock assessment), and also a method for data collection with community involvement that can be applied elsewhere in the region with the support of IMS. There is a new World Bank funded project, 'Marine and Coastal Environmental Management Project' (MACEMP), which is starting implementation in late 2005, has stated stock assessments and participatory planning as part of the objectives (World Bank, 2003) and has shown interest in the ParFish methodology. ParFish can inform the World Bank project, and IMS will be able to provide support through their capacity and experience of ParFish. A proposal for supporting coastal livelihood development in Tanzania which incorporates ParFish, has already been approved for funding by the Japanese Social Development Fund.

Tanzania's Poverty Reduction Strategy recognises the environment as an important source of subsistence and income for many of the rural poor, and progress reports confirm that the government will 'initiate a process with a view to reviewing existing laws and regulations governing the utilisation and management of open-access resources (coastal fisheries and forestry) and initiate the implementation of community-based management of these resources' (United Republic of Tanzania, 2000). In Zanzibar, the Poverty Reduction Plan identifies 'rural small farmers and fishermen' as primary target groups for poverty reduction and the main strategic interventions to address the problem will be the assessment of fisheries potential in offshore and inshore grounds (Revolutionary Government of Zanzibar, 2002). ParFish addresses these issues by providing a methodology for stock assessment that can support initiation of management plans with community participation. Kenya's Economic Recovery Strategy for Wealth and Employment Creation also recognises the important contribution of fisheries to local incomes, subsistence and nutrition, particularly in the Nyanza and Coast provinces that have the highest incidence of poverty (Government of the Republic of Kenya, 2004).

India's rural development policy is shifting towards the emphasis of the participation of people through Panchayati Raj Institutions (PRIs), and promoting decentralisation to ensure this (Ministry of Rural Development, 2003). Andhra Pradesh is one of the largest and poorest states in India, with a population of almost 80 million, and one-third of the population living in poverty. DFID's Country Assistance Plan for India 2004 – 2008 (DFID, 2004) identifies Andhra Pradesh, Orissa, Madhya Pradesh and West Bengal as focus states for development assistance.

Gabon has a relatively high per capita Gross National Income (GNI) of US$ 3,060, but social indicators are barely higher than averages for sub-saharan Africa. Poverty alleviation, improved social outcomes, and better governance are becoming increasingly important policy goals for the Government and multilateral donors working in the country (World Bank, 2004). Fisheries in Gabon are worth US$ 55 million annually, with the majority of this coming from the artisanal sector (FAO, 2003).

Whilst considerable interest had been expressed in ParFish, to facilitate wider uptake of the approach, further examples of its use, and evidence of its application in a variety of situations were necessary in order to convince potential users of its applicability.

3 Project Purpose

The purpose of the project and how it addressed the identified development opportunity or identified constraint to development – what changes did the project aim to achieve

The purpose of the project was to promote the ParFish methodology and approach for fisheries stock assessment and management in developing countries, 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 provide a stock assessment technique that can be used to provide management advice for fisheries that have no or little existing data. It involves the resource users in setting management objectives, data collection and management planning, supporting co-management and enabling them to have a voice in the management of their fishery. The previous ParFish project R8397 developed 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:
  - 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. The increased uptake and application of ParFish through this project contributes to resolving the problems faced by many small-scale fisheries due to a lack of resources for data collection and management. This is achieved through the provision of a methodology for stock assessment in fisheries that have little or no existing data on which to base decisions for resource management, therefore providing a starting point for adaptive and participatory management involving the resource users. This in turn 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 a greater chance of sustainable resource use and management, which will support the continued contribution of fisheries resources to the livelihoods of the rural poor, thus contributing to sustainable livelihood strategies towards reducing poverty.

Some potential users had expressed a need to see practical evidence that the method

works in a range of situations. Therefore to facilitate successful promotion of the approach, a set of case studies in different areas that vary in their fisheries, environments and cultural contexts were necessary to provide evidence supporting the practical value of the approach. This project sought to test the approach in different fisheries in order to provide this evidence to support its uptake more widely, in addition to building practical experience across a number of institutions in implementing the approach. A further constraint to development is the lack of experience of potential users in applying the approach, which may limit their confidence to test the methodology in their fisheries. This project sought to overcome this constraint by providing a training course to those institutions that would be carrying out case studies, and to other institutions in the Bay of Bengal area, to increase the capacity of potential users. The training materials developed for the workshop can also be used by other institutions in the future that are interested in applying the approach. Increasing awareness of potential users was achieved by widely promoting the approach through implementing the communications plan including producing a synthesis document to contribute to FMSP project R8470.

This project follows on from FMSP projects R7947 and R8397, which developed the approach and the Toolkit to support its implementation. Further information on the method and models used, including comparisons between the ParFish approach and other ‘conventional’ stock assessment methodologies, can be found in the FTRs to these projects.

4 Outputs

The research results and findings achieved by the project against each output. 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.

Summarise the research products / communications media produced. Report how and with whom these were promoted (quantify where possible). Describe the identified promotion pathways to target institutions and beneficiaries. The project communications matrix should be inserted, and reported against.

4.1 Output 1: Revised ParFish Toolkit produced based on additional field testing of ParFish outside the original case study location.

4.1.1 Revised Toolkit

The ParFish Toolkit was revised by adding training materials, promotional material including information on case studies, and a revised version of the ParFish Software. It was decided not to modify the content of the Guidelines and Software Manual as it was felt they address the current need for support for practical implementation of ParFish. Lessons learned and results from the case studies were reported on and disseminated through the communications materials, and are also available together with the Toolkit from the FMSP website. More copies of the Toolkit have been printed and distributed, and copies are held in reserve ready for distribution after the end of this project, as demand arises.

Changes have been made to the internals of the ParFish Software to allow easy transition between assessment models, although the basic interface remains the same. Additional changes have been initiated for a future version of the software to be developed based on a life history model, something that has been requested by potential users including FAO. In the Andhra Pradesh case study, new interview questions were tested to see if it would be possible to obtain the priors for such a model from fisher interviews, which were successful (see Section 6.1.1). In addition, the ParFish statistical approach has been used in a different project promoting assessment and management planning techniques for enhancement fisheries software, EnhanceFish.

Training materials that were developed for the Mangalore Training workshop (see Section 5.2.2) were added to the Toolkit and are available for download from the FMSP website. In particular, an animated version (in Powerpoint) of how to carry out the Preference Interview, demonstrating how to use the binomial tree for ranking scenarios, is expected to be particularly useful for people wishing to learn how to implement ParFish. See training workshop report in Annex 2.1 and download of training materials from FMSP website.

Other communications materials about ParFish have also been made available as part of the Toolkit download, such as the Synthesis Document aimed at policy makers, fisheries managers and scientists. Information on various ParFish case studies is available through the Synthesis Document.

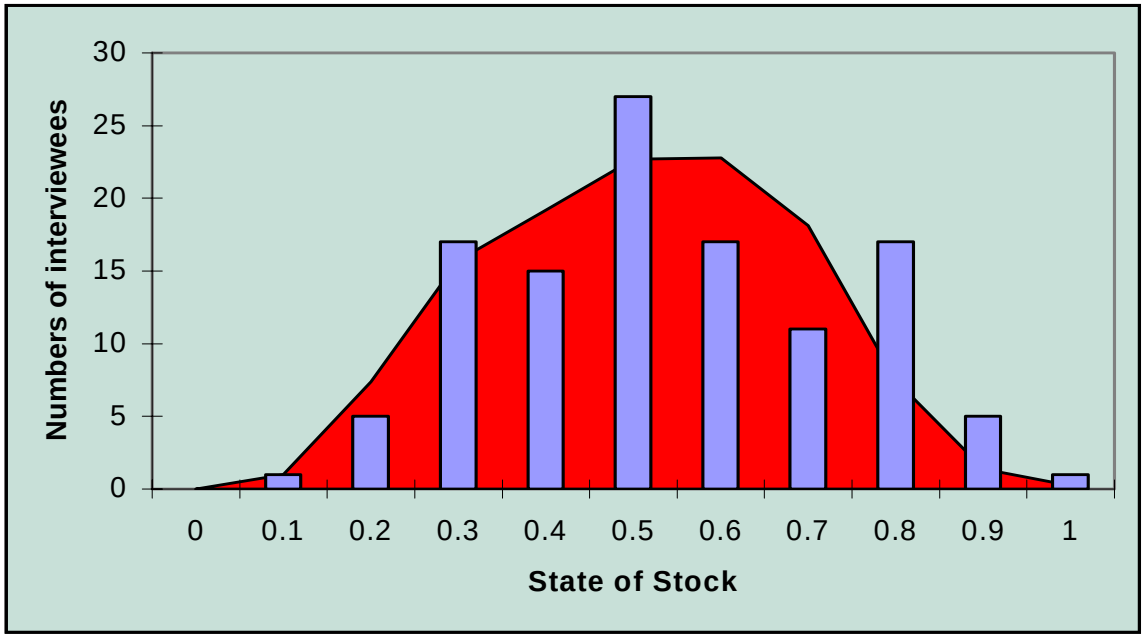
4.1.2 Andhra Pradesh Case Study

The Case Study was successfully completed in Andhra Pradesh and served to demonstrate that the principles on which ParFish is based are adaptable to a biologically different fishery, on a different continent and with a different socio-cultural context.

Four key people received training in ParFish, from Andhra Pradesh Fisheries Department, the State Institute for Fishing Technology and the United Fishermen's Association. In addition, Mr Varma, a Fisheries Officer based in the villages where the case study took place, was also key in helping obtain background information and carrying out key informant interviews. The people trained through the Case Study have the capacity to implement ParFish independently in the future, although some support with data analysis may facilitate the process. Mr Ram Mohan Rao, Assistant Director, SIFT, who was involved in the Case Study, will be using some aspects of ParFish as part of his research for his PhD.

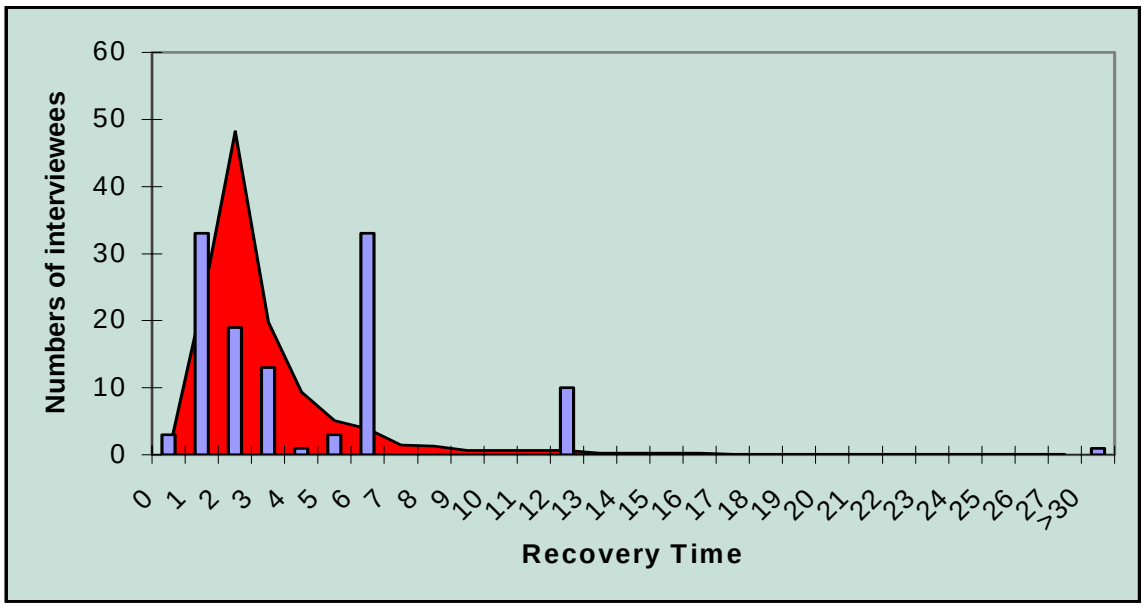
110 stock assessment interviews and 37 preference interviews were successfully completed with fishers about the mud crab (*Scylla serrata*) fishery in the Coringa mangroves, East Godavari District, Andhra Pradesh. Initial meetings were held with the fishers to introduce them to the ParFish process and seek their collaboration. During the interview data collection, different approaches to carrying out the interviews were tested, such as carrying out the Stock Assessment and Preference interviews together; carrying out the Stock Assessment separately from the Preference Interview; carrying out individual interviews and carrying out group interviews. See the report on the case study in Annex 1.2 and methodology / research activities in section 7 for more details.

Analysis of the ParFish interview data indicated that the fishers believe that the current stock biomass is roughly 55% (mode) of the unexploited biomass (90% confidence interval between 19% and 79%), with a 45% chance of the stock being overfished.



The histogram above shows the distribution of responses from fishermen about the state of the stock. We interpret the state in this figure as the stock is overfished when the values are below 0.5 and 0.5 is fully (sustainably) exploited. The fishers do not all agree, but the values are spread around the fully exploited point. The red area represents the expected response from fishers for the state of the stock as obtained from the analysis. We can see that based on fishers' beliefs, there is a possibility that the stock is overfished (45%), but overfishing is not extreme and no immediate management response is required.

The expected recovery time for the stock, based on the fishers' beliefs, is 2.3 months (median). The fishers expect a very high growth rate, which suggests that they may be accounting for immigration as well as growth rate in their answers. In the histogram below, the blue bars show the fishers' responses, and the red area shows the expected response from the fishers as obtained from the analysis, which corrects for the tendency for fishers to fix their replies at around the six month mark.



Fishers were enthusiastic about the case study and the new knowledge that was gained about their fishery. Through the workshop held at SIFT, the fishers expressed interest in the possibility of setting up co-management arrangements to manage the fishery and were very pleased at the opportunity to learn more about their fishery and to put their concerns across to the Department of Fisheries, NGOs and scientists working in the area. Some fishery control measures that were put forward to the fishers, SIFT and APDOF were closed seasons, habitat restoration, minimum size controls, returning berried females, effort control and closed areas. A poster was also prepared, aimed at the fishers, to encourage discussion about the state of the crab fishery and possible management measures. The poster (see Annex 1.2, poster is shown in English, but was printed in Telugu, the local language) was presented at the workshop at SIFT and 200 copies were distributed to the villages and other institutions involved in resource management in the area. In addition, the workshop at SIFT was covered by the local television channel (a 5-10 minute piece covering the workshop was shown on the evening news the same day) and newspapers. Several articles about the workshop were published in Telugu newspapers, and one in an English-language newspaper (see Annex 3.4).

This case study represents a completely different type of fishery from previous case studies which had been carried out on coral reef fisheries (single species gastropod and multispecies reef fish assemblage). It represents a single species fishery (*Scylla serrata*) conducted in a mangrove area using multiple gear types.

4.1.3 Gabon Case Study

The Gabon case study was carried out on an inshore net fishery for a variety of species with restricted ranges, and is the main fishery in the area. The Department of Fisheries representative for the region approved the work plan and was keen for the case study to take place. 30 fishers were interviewed for both the stock assessment and preference

interviews.

Overall, ParFish was positively received, and the World Conservation Society in Gabon is planning to expand the experience to cover the local lagoonal oyster fishery for which they are already collecting catch and effort data.

4.1.4 Kenya Case Study

The Kenya case study was able to gather and synthesise background information on the study site in order to plan data collection through the interviews. One staff member from Kenya Fisheries Department attended the training workshop in Mangalore and received training in all the ParFish techniques, and felt that on his return to Kenya he would be able implement the approach. However, this case study was not in a position to proceed to conducting the interviews during the life of the project due to several concomitant external factors at the field sites which impeded smooth implementation according to the current project's timetable, which are detailed below.

- There are a set of new fisheries regulations that are coming into place over the next few months on Beach Management Units (BMUs). These could really be a determining factor on how the fishers take and work with the results (more details in background document in Annex 1.3). The team has to make sure that they take time making fishers aware of these regulations with this implementation.

- The areas where the team is working in have been heavily influenced by research work, and issues have come up recently about allowances, payments etc, we have to start making sure that fishers are motivated for genuine reasons and not just the token received from research. This all came to a head in August/September and the staff and the Fisheries Officer were not very comfortable with starting a new series of work (and the ParFish interviews are more intensive than any they have implemented so far) while their project coordinator was away under these conditions.

- Before the above two issues could be settled the fasting month of Ramadhan began, and fishers prefer not to engage in meetings during this period, and Mr. Ndegwa from the Dept of Fisheries was on leave till after the end of Ramadhan (Mid Nov).

Despite this, interviews will still be carried out at a later date (planned for November / December 2005) and contact will be maintained with our collaborators. The team have begun exploring some dummy data sets with the ParFish Software and are learning its different functionalities. Mr Ndegwa, who attended the Mangalore training workshop, has arranged with the Director of Fisheries to extend the case study to three more sites along the Kenyan coast, and is providing training to staff on the ground so that they can effectively carry out the ParFish case studies.

Overall, the case studies found that the Toolkit was useful to support implementation of ParFish, and that no major modifications were necessary. Some alternative approaches to implementing the interviews (e.g. group vs individual interviews) that were trialled in Andhra Pradesh led to the conclusion that the individual interviews, as indicated in the Toolkit, were most appropriate, because the responses from the group interviews tended to be overly influenced by one or two influential individuals in the group. The individual interviews have the advantage that even though individual fishers may not be correct, their personal views are expressed.

4.2 Output 2: Increased capacity and commitment to use ParFish through wide uptake promotion to fisheries research, management and training institutions

4.2.1 Communications Planning

A stakeholder analysis was carried out and a Communications plan developed in coordination with FMSP projects R8470 and R8462. The Communications plan is reported against in Section 5.4.

4.2.2 Training Workshop

Training materials were developed including interactive and participatory exercises which demonstrated various principles of ParFish. The Toolkit also provided good training materials as it contains guidance on the implementation of each stage of the approach and of the various supporting Tools. The Toolkit was distributed to participants at the workshop as course material. The Workshop was held at St Alyoises College and was organised by the College of Fisheries, Mangalore. 14 participants, from a range of Indian state and national level fisheries management, research and teaching institutions from Andhra Pradesh, Orissa, West Bengal, Karnataka and Kerala, and from Kenya, received training in the six stages of ParFish including data collection and data analysis using the Software. The workshop was run by Dr Paul Medley, Ms Suzannah Walmsley and Dr Narriman Jiddawi (Institute of Marine Sciences, Zanzibar). The workshop received very positive feedback from the participants who all enjoyed it, and expressed that at the end of the workshop, they had a greater understanding of the overall ParFish process, the use of the ParFish software and how and when it can be applied, and how it can support co-management.

As a result of the training received at the workshop, some participants are already attempting to apply it in their own fisheries. West Bengal Fisheries Department are attempting to apply ParFish to the 'Kansabati reservoir' fishery. Orissa Fisheries Department participants have submitted a proposal to apply it in the Chilika Lagoon fishery. Dr Keshavanath, the workshop logistical organiser, is also taking up a ParFish case study on an estuarine fishery as a result of the training received during the Training workshop (see progress report in Annex 1.4).

Other workshop contacts are also in interested in the approach, including J.K.Patterson Edward from the Suganthi Devadson Marine Laboratory concerning the Vellpatti Crab Fishery and its potential certification by Marine Stewardship Council (MSC). Stephen Ndegwa from Kenya's Department of Fisheries will also implement ParFish in the near future in Kenya in collaboration with CORDIO, which was foreseen under this project.

4.2.3 Communication materials

A range of communication materials were produced by the project in accordance with the Communication Plan at the project and case study levels. The Andhra Pradesh case study produced a poster aimed at the fishers, to raise awareness and encourage discussion about the state of the fishery (see case study report in Annex 1.2). Project flyers (see Annex 3.1) updating stakeholders on progress were produced in March and August 2005 and distributed by email to the following numbers of stakeholders:

Policy Influencers	57
National Implementing agencies	7

Regional and International Implementing agencies	18
National Research	5
Regional and International Research	3
Promotion organisations	8
Capacity Building	1
Consultants	2

The flyers were also distributed on OneFish and on the FMSP website, and were distributed to participants in a number of international workshops (e.g. the Guidelines evaluation workshop for R8462 in Dhaka, Bangladesh). Updated information about the project was maintained on the FMSP website (see Annex 3.7). IMS has also been promoting ParFish through regional networks and contacts.

A presentation on ParFish was also given to the European Commission, including people from DG Research, FishCode, DG Development and Europe Aid (ACP country coordinator).

The Synthesis document (see section 5.3, below) was also distributed to the following numbers of stakeholders:

Policy Influencers	74
Regional & International Implementing Agencies	25
National Implementing agencies	18
National Research	7

A poster was prepared (see Annex 3.3), which compiled information about three FMSP projects relating to co-management, and was used to raise awareness at key meetings and conferences. It was displayed at the project R8462's Guidelines evaluation workshop in Dhaka, attended by 14 people from fisheries policy, management and extension institutions and projects; at the XIX Annual Meeting of the Society for Conservation Biology, at the Universidade de Brasília, Brazil, 15-19 July 2005, attended by about 1000 scientists, academics and students; and at the Climate Change and Fisheries workshop at DFID Headquarters, London. It will also be displayed at a workshop run by the Sustainable Fisheries Livelihoods Project in Senegal, 21 – 25 November 2005.

Other opportunities were also taken to promote ParFish, including a meeting of the Marine Stewardship Council in Miami, and a stock assessment conference in Hawaii.

The Toolkit has been sent out in hard copy to 70 people from 52 institutions in 28 countries. So far, 7 are attempting implementation of ParFish independently. A summary and link to the Toolkit has also been included on the Eldis website (see Annex 3.2). ParFish is also included as a chapter in the forthcoming FAO publication 'A Guide to Fisheries Stock Assessment using the FMSP Tools'.

Uptake of the approach, as a result of these promotion activities has been achieved in several cases. A PhD student from the University of Newcastle is using ParFish as part of his research on the use of fishers' knowledge in fisheries management and is carrying out research in collaboration with the Seychelles Fishing Authority (SFA) on the Bêche-de-mer fishery and a trap fishery. SFA are also interested in using ParFish for a study on on the outer island schooner fishery. The Galapagos Marine Reserve is particularly interested to apply ParFish where, after several years of conflicts and collapsing resources, there appears to be a new opportunity to change the system and make it truly participatory. They have recently developed a proposal to try to incorporate the fishers' knowledge and perceptions in future management models, along with the scientific information, and they believe there will be scope to use ParFish in this aspect and expect

to start implementation in January 2006. The Sustainable Fisheries Livelihoods Project (SFLP) in Ivory Coast will test ParFish on the Kossou Lake in order to develop a participatory method for fish stock assessment. This activity has a linkage with one of the major outputs of the SFLP project (a participatory management plan and functional institutions framework in place). ParFish will also be applied in Tanzania through a project funded by the Japanese Social Development Fund.

The ParFish team has also been invited to give talks at future seminars which are the result of current promotion activities and also provide for further future promotion opportunities:

- Reading University – offered an invitation to give talks on participation and the use of statistics in ParFish;
- The Principal Investigator is invited as a key speaker at a workshop on Data Needs for Coral Reef Fisheries, to be held in Oxford, early 2006;
- Newcastle University – Suzannah Walmsley has been invited to give a second talk on ParFish to students of the Masters course on Tropical Coastal Management in early 2006.

A proposal for implementation of ParFish in Tanzania and Zanzibar has been developed in collaboration with IMS and submitted to WWF-East African Marine Ecoregion for funding. Oliver Taylor has also submitted a proposal for using ParFish as the basis of a marine park and fisheries management project which is being initiated with funding from the USA.

4.3 Output 3: Synthesis of key points and lessons learned from ParFish disseminated via FMSP Project 05/09

A Synthesis Document summarising key points and lessons learned from ParFish, especially in relation to co-management, was produced. The document is aimed at fisheries policy makers, managers, scientists and facilitators and provides an accessible summary of the key points of ParFish. It was distributed to 124 policy makers, regional, national and international implementing and research agencies. Following review of the document by a communications advisor, the text was edited to break down long sentences and make it clearer to read, and captions were added to the photos. The document is included in Annex 3.6.

4.4 Communications Matrix

Communication stakeholders	Research Product / message to be communicated	Current knowledge, attitude, practice of stakeholders	Communication objectives: Desired outcome of communication / promotion	Communication channels and media in which research product will be communicated	Approach to monitor and evaluate implementation of communications plan	Results
Fishers within case study countries	Participation in stock assessments (through ParFish) can help fishers to understand their resource and become involved in its management and sustainability	No previous knowledge on ParFish but some understanding of co-management, depending on location	Actively involved in the ParFish case study and engaged to continue with the ParFish approach.	Community–level meetings facilitated by a relevant intermediary (e.g. research institution, fisheries department or project) Communications materials provided in Stage 2 and Stage 4 of the ParFish guidelines: Stage 2 covers tools for communicating and promoting ParFish to fishers Stage 4 covers tools for communicating concepts such as stock assessment issues, uncertainty, recommendations from the assessment. These are all designed to be used within community-level meetings.	Attendance at meetings Recorded issues raised within community-level meetings	Fishers were actively involved in the case studies through village meetings and interviews. In Andhra Pradesh, 130 fishers were interviewed, and 54 fishers, representing all 9 involved villages, attended the workshop for dissemination of the results. A poster was prepared and 200 copies were distributed to the villages involved and institutions working in natural resource management and community development in the region, to raise awareness of the issues surrounding the crab fishery and promote debate on its management. 54 fishers also attended the workshop held at SIFT, where the results of the assessment were communicated to them. Newspaper articles were also published in the local press in the local language, about the workshop. In Gabon, fishers attended the introductory village meeting and 30 fishers were interviewed. Issues raised in the meetings and workshops with fishers were recorded (see report on Andhra Pradesh case study)
Training Institutions within East Africa (e.g. FAST, Tanzania), Asia (e.g. CIRE,	ParFish is a useful method for stock assessment that complements co-management approaches. It also assists in teaching	Some knowledge in some regions e.g. East Africa through project flyers	Institutions consider including ParFish within their training remit	Project Flyers Selected institutions invited to training workshop Follow up emails & telephone calls	Distribution lists of flyers Feed-back monitoring from training workshop Record of email	Flyers were distributed to over 100 people, including 9 research and training institutions in East Africa and Asia. 68 copies of the Toolkit have been distributed. Three research and training institutions were involved in the Mangalore training workshop, from East Africa and India, and

CMFRI, India) **[Capacity Building organisations]**	about Bayesian statistics and decision support tools.			Distribution of the finalised ParFish toolkit on CD Synthesis product on the lessons learned from the ParFish approach FMSP website, links and list servers Newsletter articles	correspondence Distribution lists of ParFish toolkit Questionnaire on predicted use of the approach. Distribution lists of synthesis product.	feedback from the workshop was very positive. Independently, a professor from Rhodes University, South Africa, has confirmed that he will be using ParFish in his teaching materials. Emails and telephone calls were followed up (see email correspondence record in Annex 3.7). Information on the ParFish case study was included on the Andhra Pradesh Department of Fisheries website, including links to the FMSP and MRAG websites. The Synthesis product was distributed to 124 policy makers, and personnel in regional national and international implementing and research agencies. The FMSP website was kept up-to-date with project information, communication materials and downloads. Newspaper articles and television news reports contributed to awareness-raising about ParFish in the Andhra Pradesh region for the case study.
Fisheries management and research institutions in India (Fisheries Departments for Andhra Pradesh, Orissa, West Bengal, Karantaka and Kerala) **[Implementing organisations - National fisheries management)**	ParFish is a useful method for stock assessment that complements co-management approaches	Some knowledge of the software component of the approach through training courses in stock assessment [FMSP project R8360]. Less knowledge on the ParFish approach detailed in the ParFish toolkit.	Institutions consider using ParFish as a tool for stock assessment within a co-management arrangement.	Project Flyers Follow up emails & telephone calls Distribution of the finalised ParFish toolkit as hard copy and CD Synthesis product on the lessons learned from the ParFish approach FMSP website & links Selected institutions involved in testing stock assessment component of	Distribution lists of flyers Record of email correspondence Distribution lists of ParFish toolkit Feed-back monitoring from training workshop Web registrations for Toolkit download Questionnaire on predicted use of the approach.	See reporting above, and, personnel from 10 fisheries management and research agencies from East Africa and Asia were involved in the training workshop. Subsequent to the workshop, four of these institutions (in addition to SIFT, UFA and APDOF who were involved in the Andhra Pradesh case study) have either already started to apply ParFish, or have submitted proposals to their boards for applying ParFish in their fisheries. A questionnaire has also been developed and is being sent out with the Toolkit to solicit feedback on the potential usefulness of the approach and if/how the receiver foresees using it. During implementation of the case studies, face-to-face meetings were also held with

				toolkit. Selected institutions involved in Training workshop Face-to-face meetings Newsletter articles	Distribution lists of synthesis product.	the Commissioner of Fisheries, APDOF, Director of SIFT-Andhra Pradesh, and the Director of the Department of Fisheries, Gabon-Mayumba region.
Regional fisheries management and research institutions in Asia (e.g. Bay of Bengal Programme, WorldFish Center, FAO Regional Office, Fourth Fisheries Project, Asian Fisheries Society) **[Implementing organisations – Regional fisheries management)**	ParFish is a useful method for stock assessment that complements co-management approaches	Some knowledge on the approach through previous communication (e.g. project flyers, telephone conversations and email correspondence)	Institutions consider using and/or promoting ParFish as a tool for stock assessment within a co-management arrangement.	Project Flyers Follow up emails & telephone calls Distribution of the finalised ParFish toolkit as hard copy and CD Synthesis product on the lessons learned from the ParFish approach FMSP website & links Selected institutions involved in testing stock assessment component of toolkit. Selected institutions involved in Training workshop Newsletter articles	Distribution lists of flyers Record of email correspondence Distribution lists of ParFish toolkit Web registrations for Toolkit download Questionnaire on predicted use of the approach. Distribution lists of synthesis product.	See reporting above, and, flyers, Toolkit and Synthesis document were sent out to Bay of Bengal Programme, WorldFish Centre, FAO Regional Office and FAO Head Office, and Fourth Fisheries Project. This has generated considerable interest. FAO Regional Office (Asia & Pacific) are considering possible areas for its application and FAO Head Office are interested in the contribution ParFish could make to their strategy for improving information on the status and trends of capture fisheries, in particular for the small-scale sector (see Annex 3.5). Unfortunately Bay of Bengal Programme were unable to attend the training workshop because of commitments on post-tsunami assessments and planning, but they remain interested in the approach.

Fisheries management and research institutions in East Africa Region (e.g. CORDIO, , WWF, TAFIRI, TCMP, Tanga Coastal Zone Management Project, KMFRI, FIRRI) **[Implementing organisations – Regional fisheries management)**	ParFish is a useful method for stock assessment that complements co-management approaches	Some knowledge of ParFish through flyers, meetings and briefs.	Institutions consider using and/or promoting ParFish as a tool for stock assessment within a co-management arrangement.	Project Flyers Follow up emails & telephone calls Distribution of the finalised ParFish toolkit as hard copy and CD Synthesis product on the lessons learned from the ParFish approach FMSP website, links & list servers Selected institutions involved in testing stock assessment component of toolkit. Selected institutions involved in Training workshop WIOMSA newsletter	Distribution lists of flyers Record of email correspondence Distribution lists of ParFish toolkit Web registrations for Toolkit download Questionnaire on predicted use of the approach. Workshop feed-back forms Distribution lists of synthesis product.	See reporting above, and, Toolkits, flyers and the Synthesis document have been distributed to fisheries management and research agencies in the East Africa region. CORDIO/Department of Fisheries, Kenya, were involved in the training workshop, and IMS also provided training for the workshop. CORDIO and the Department of Fisheries, Kenya, have been involved in preparing for a ParFish case study under this project, and although it has not been possible to collect the interview data so far, training is being carried out on the ground for data collection before the end of 2006, and the planned area for implementation is being expanded to three more sites on approval of the Director of Fisheries. A proposal has been submitted to WWF East African Marine Ecoregion for funding application of ParFish in Tanzania and Zanzibar, and money has already been secured for use of ParFish in a coastal community livelihoods project under Japanese Social Development Fund funding with the World Bank Marine and Coastal Environment Management Project in Tanzania.
Fisheries management, research and training institutions globally i.e. Latin America, West and Southern Africa, Pacific, N. America, UK **[Implementing organisations – Regional/Interna**	ParFish is a useful method for stock assessment that complements co-management approaches	Some knowledge of ParFish through flyers in some areas, no previous knowledge in other areas	Institutions consider using and/or promoting ParFish as a tool for participatory stock assessment.	Project flyers Follow up emails & telephone calls Distribution of finalised ParFish toolkit Synthesis product on the lessons learned from the ParFish approach FMSP website, links & list servers	Distribution lists of flyers Record of email correspondence Distribution lists of ParFish toolkit Web registrations for Toolkit download Questionnaire on predicted use of the approach.	See reporting above, and, flyers, Toolkit and Synthesis document have been distributed to fisheries management, research and training institutions worldwide, including Ireland, Ecuador/Galapagos, Seychelles, Cote d'Ivoire, Mozambique, Cameroon, Brazil, India, Oman, Cambodia, Bangladesh, Gabon, Malaysia, Australia, USA, USA (Hawaii), Canada, Thailand, Philippines, South Africa and Nigeria. ParFish is also included as a chapter in a forthcoming FAO publication 'A Guide to Fisheries Stock Assessment using the FMSP Tools' which presents various different stock assessment techniques.

tional fisheries management)					Distribution lists of synthesis product.	
Policy Makers and Donors (e.g. World Bank, FAO, NOAA) **[Policy Influencers]**	ParFish is a useful method for stock assessment that complements co-management approaches. It is possible to address many of the management constraints to small-scale fisheries through further support.	Some knowledge in ParFish through flyers, briefs and meetings.	Interest in future support to ParFish.	Project Flyers Synthesis product on the lessons learned from the ParFish approach Policy brief/ Proposal FMSP website & links Email and telephone calls Face to face meetings Group meetings Newsletter article Final reports	Distribution lists Email correspondence	The Synthesis document was prepared specifically aimed at policy makers, decision makers, scientists, managers and facilitators, providing a summary of the importance of information-based management for small-scale fisheries, and how ParFish can support this. It was distributed to over 70 policy influencers and over 50 regional, national and international implementing agencies. Meetings, presentations, email correspondence and telephone calls have also been used to follow up on and encourage interest in the approach, including a presentation to the European Commisison (including DG Research, DG Development, FishCode and Europe Aid). Proposals have also been developed for implementation of ParFish in Tanzania (WWF) and Oman (USA funding).
Promotion organisations (e.g. Eldis, Stream, WIOMSA)	ParFish is a useful method for stock assessment that complements co-management approaches	Some knowledge in ParFish through flyers, briefs and meetings.	Promote information on ParFish to a wide range of further stakeholders	Website, links and list servers Email and telephone Newsletter articles Project flyers, briefs Final reports and Toolkit	Distribution lists Questionnaire on predicted use of the approach. Email correspondence	The ParFish Toolkit was promoted on internet portals including Eldis (see Annex 3.2) and OneFish. A search on Google for 'participatory fisheries' yields the R8464 page on the FMSP website in 1st place, a search for 'participation + fisheries stock assessment' or 'participation + fish stock assessment' yields the ParFish flyer in 2nd and 3rd place, respectively. A search for 'parfish' yields the ParFish flyer on OneFish in 1st and 2nd place, and the FMSP website in 3rd and 4th place.

5 Research Activities

This section should include descriptions of all the research and communication activities (research studies, surveys, experiments, communications pathways, product testing 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.

5.1 Output 1: Revised ParFish Toolkit produced based on additional field testing of ParFish outside the original case study location.

5.1.1 Andhra Pradesh Case Study

The Andhra Pradesh Case Study on mud crab, *Scylla serrata*, was conducted with the collaboration of the Andhra Pradesh Department of Fisheries (APDOF), the Andhra Pradesh State Institute of Fisheries Technology (SIFT) and the United Fishermen's Association (UFA), a grassroots fishermen's organisation that proved very useful for facilitation. The fishery involves nine villages that border the mangrove area, namely Pedavalasala, Chinna valasala, Gadimoga, Kothuru, Lakshmi pathi puram, PBV Palem, CBV Palem, Ramanna palem and Chollangi peta, and supports about 5000 fishers[1].

The fishery was selected on the basis that it was a sedentary stock within a defined area, and the villages involved in fishing the stock were easily identifiable as those villages situated along the edge of the mangrove area. No fishers from outside the mangrove area fished there for crabs.

Training was carried out with G.Venkata Raju (Assistant Director, APDOF), Ram Mohan Rao (Assistant Director, SIFT), P. Sreeramulu (Fisheries Officer, SIFT) and L. Narasimha Raju (General Secretary, UFA) by Suzannah Walmsley (MRAG) during a three-week visit to Andhra Pradesh. During this time, training was provided on collecting background information for the fishery, conducting a stakeholder analysis and developing a communications plan, and on carrying out the ParFish interviews. Regular trips were made to the villages in order to inform the fishers about ParFish, to familiarise them with the researchers and interviewers, to gather background information and to trial the questionnaires. An estimate of the number of fishers and fishing gears in each village was made through key informant interviews, and was used as the basis for the stratified sampling strategy which covered four different gear types across nine villages.

The training received was practical, hands-on training, and as the exercises were explained, they were put into practice for the mud crab fishery. For example, the stakeholder analysis and communications plan that were prepared are provided in Annex 1.1. The stock assessment and preference interviews were translated into Telugu, the local language, and adapted for the mud crab fishery. They were tested in the field with some fishers and fisheries department field officers (who were also fishers) and subsequently modified. The fishers use between 1 and 3 gears for fishing, and because the interviews were carried out for all of the gears that a fisher used, some interviews took a very long time and were tiring for both interviewer and fisher. As a result, stock

[1] Studies conducted by Bay of Bengal programme (BOBP) and Central Marine Fisheries Research Institute (CMFRI)

assessment interviews were carried out separately from preference interviews.

Data collection was carried out over a period of 3 weeks by the SIFT, UFA and APDOF staff. 110 stock assessment and 37 preference interviews were carried out, according to the stratified sampling strategy to sample fishers of different main gear types in different villages according to their numbers. The data were analysed during the Mangalore workshop using the ParFish Software.

Age-based questions were developed and tested with the fishers. Three different sizes were used, small, medium and large, and crab shells of crabs of each size were used to assist discussion of the following points:
Mortality: fishers were asked about how many of each size of crab they catch currently, and how many they think they would catch if the stock was unexploited.
Growth: fishers were asked about the maximum size/age to which the crabs could grow, and how long they think it takes for the crabs to grow from small to medium size, and from medium to large size.
Selectivity: fishers were asked to imagine equal numbers of each size crab in an area, and how many of each size they think they would catch in the area if they were to fish there. They could not conceptualise the idea of having equal numbers of each size crab in an area, or accept the notion of experimental fishing in a pond in which equal numbers of each size crab had been put, as they said they would not be able to catch anything in a pond. Instead, fishers were asked what proportion of each size crab they believed were in the natural environment, and what proportion of each size they actually catch when they go fishing. This enables the selectivity for each size category to be calculated.

A follow-up workshop to disseminate the results was held in Kakinada, involving fishers, government fisheries managers, NGOs, politicians and scientists. 54 fishers attended, including representatives from all of the villages involved in the fishery. During the workshop, the fishers were able to hear others talk about the conclusions of their work on the mangroves and the mud crabs, and were able to express their concerns about the current situation. One of the main concerns was that the channels dug in the mangroves in the ambit of the mangrove restoration project of the Swaminathan Foundation had in fact drained and thus destroyed the nursery areas of the mud crabs and was responsible for the decline in catches since 1998. Although this may not be the sole reason for the decline, the Swaminatham Foundation agreed that perhaps some negative impacts may have been felt. As a result the potential process for discussion of the issues was opened up.

5.1.2 Gabon Case Study

The case study was coordinated by Oliver Taylor in coordination with the Wildlife Conservation Society (WCS). A competent local staff member was identified to take on the interviewing role and a member of the Department of Fisheries was also involved in the field work. The interview sheets were translated into French and an initial village meeting was held to meet with the fishers, to explain the objectives of the work and seek their collaboration for the interviews. Interviews were carried out with individual fishers over a period of two weeks.

5.1.3 Kenya Case Study

Contacts were established with the team to be responsible for implementing the Kenya case study in Diani – Kenya. Training was provided for one of the team members, Mr Stephen Ndegwa from the Kenya Department of Fisheries, through the Mangalore workshop in India as described in Section 6.2.2. Background information was collected and compiled, and is presented in Annex 1.3. However, it was not possible to conduct the interviews during the life of the project due to several concomitant external factors at

the field sites which are detailed in Section 5.1.4.

5.2 Output 2: Increased capacity and commitment to use ParFish through wide uptake promotion to fisheries research, management and training institutions

5.2.1 Communication Plan

The communication plan was updated in collaboration with projects R8462 and R8470. This is reported on in Section 5.4.

5.2.2 Training workshop

Training sessions and materials were prepared by Paul Medley, Suzannah Walmsley and Narriman Jiddawi (IMS). The facilities of St Aloiyses College and the College of Fisheries, Mangalore, were used for the training workshop. The IT facilities at the College were very important for providing training in the use of the ParFish Software.

Presentations were developed to cover the six stages of ParFish, as well as extra background information on Bayesian Statistics, for the following sessions:

- Introduction to ParFish
- Previous experiences of ParFish (by IMS and APDOF)
- Introduction to Bayesian Statistics
- Understanding the context and collecting background information
- Data collection techniques
    - Interviews
    - Fishing experiments
- Software
- Feedback and management planning
- Evaluation of the workshop

Practical sessions and group participatory exercises were also developed on the following:

- An imaginary case study that brings out various important lessons learnt in previous testing experiences of ParFish, for the participants to plan what background information to collect and from where, carry out a stakeholder analysis and a communication plan.
- Participants experimented asking the interview questions to each other, as well as trying out the preference interview.
- A ‘fishing experiment’ using ping pong balls hidden in shredded paper in a large box was used as a practical example of the principles of the fishing depletion experiments and how the data can be used to estimate the initial population size using simple models in Excel. Detailed information on how to conduct the box experiment, and the models on which it is based, are included in the training workshop report.
- Training in the Software was through practical sessions using data sets from previous ParFish case studies.

5.2.3 Communication materials

Communication materials were developed to inform communication stakeholders of developments in the project, activities and case studies (i.e. flyers and email correspondence). A proposal was developed for WWF-EAME and project materials and

information were distributed on various websites (FMSP, Eldis, Onefish, Andhra Pradesh Fisheries Department). The revised Toolkit was distributed to interested people and institutions on request, and to key communication/promotion contacts. Communications were maintained by email and a record of email communications is provided in Annex 3.8.

5.3 Output 3: Synthesis of key points and lessons learned from ParFish disseminated via FMSP Project 05/09

5.3.1 Synthesis product

To produce the Synthesis Product, information was compiled from previous experiences of ParFish implementation. The target group was defined as fisheries managers, policy makers, scientists and facilitators, and a key question was identified that would be of interest to those groups. Then an outline of the product was developed and discussed to determine the sections and content of the document.

6 Contribution of Outputs

6.1 Contribution to FMSP's Purpose and Outputs

6.1.1 Purpose OVIs

Purpose: Benefits for poor people generated by application of new knowledge to fisheries management systems. By 2005, evidence of application of FMSP research products to benefit target communities[2] in target countries[2] by achieving:
Capture Fisheries: For at least one EFZ, coastal or inland capture fishery, one or more of the following:
OVI3: Improved access by poor people to fisheries knowledge generated by the Programme

Through the Andhra Pradesh case study, the current project utilised communication techniques developed for ParFish to explain concepts of fisheries stock dynamics, stock assessment and probability, improving access and understanding by poor fishers to the knowledge generated by the ParFish stock assessment. The participatory process used in ParFish also facilitated fishers' involvement and enabled them to have contact with staff of the Department of Fisheries and SIFT.

54 fishers from 9 villages attended the workshop for the dissemination and discussion of the results. The workshop provided a chance for the fishers to voice their concerns about the fishery to politicians, scientists, (government) fisheries managers and non-governmental organisations active in the area. In particular the fishers expressed their opinion that mangrove rehabilitation work carried out by an NGO had destroyed the crab nursery grounds, and had had a negative impact on the stock and its productivity. This point was accepted as a possibility by the relevant organisation, and it is hoped that this will mark the start of a dialogue and process to address the problems and seek solutions. The fishers gave very positive feedback about the workshop and the opportunity to learn more about their fishery and put their points of view across. The overall process is expected to benefit the 9000 fishers involved in the fishery.

The implementation of the Andhra Pradesh case study also built capacity among staff of institutions supplying services to the poor (APDOF, SIFT and UFA) as well as among policy makers (APDOF, SIFT) for the implementation of ParFish, participatory techniques and principles, and co-management. The training workshop in Mangalore broadened this impact to institutions supplying services to the poor and policy makers in the target states of West Bengal and Orissa as well as Kenya and Tanzania in East Africa. In total, 10 people from 9 different institutions in key target countries/areas of the FMSP received capacity building in ParFish. In addition, a further 3 key individuals from institutions supplying services to the poor in non-target areas (Karnataka state, India) received training in ParFish.

[2] Target communities: At least two of:

- Poor people
- Institutions supplying services to the poor
- Employers of the poor
- Policy makers

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

6.1.2 Output OVIs

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

ParFish provides a fisheries management tool that can benefit the poor through the means to realise improved management with the possibility of conducting stock assessments for small-scale fisheries on which the poor are dependent, and for which otherwise carrying out stock assessments is generally not possible due to the lack of data and of resources to collect the necessary data. Stock assessments are a key part of fisheries management, providing information on which to base management decisions relating to any fishing controls, identification of management actions and opportunities for development. Ensuring sustainability of resources is central to protecting resource users' livelihoods, although issues of access, empowerment, and equality are also important. ParFish provides a tool that enables a stock assessment to be carried out rapidly, even where no previous data exist, and encourages and facilitates the participation of poor fishers in the management process.

During this project, ParFish has been further developed, disseminated and promoted to a wide range of institutions and individuals worldwide. FAO and EU have also shown interest in the approach and further partnerships will be explored with both institutions for future development and promotion of the approach.

6.2 Impact of the project

ParFish Purpose-level OVIs:

- By month 5 ParFish toolkit and approach tested outside original case study locations through further field testing in at least 1 location and testing of stock assessment component with data from at least 2 locations

The ParFish Toolkit and approach was successfully tested outside the original case study locations. Field testing with project support took place in the *Scylla serrata* fishery in Andhra Pradesh, India, and independent testing took place in Gabon and in Kenya, although the Kenya case study is yet to complete the interviews.

- By month 5, increased capacity to apply ParFish in at least 5 institutions in the Africa and Asia regions

Increased capacity to implement ParFish has been achieved through the training workshop and case studies. 15 people from 10 different institutions from the South Asia and East Africa regions received training in ParFish at the workshop, surpassing the OVI of 5 institutions. Participants' feedback from the workshop indicated that they had a greater understanding of the overall ParFish process, the use of the ParFish software, how and when it can be applied, and how it can support co-management.

- At least 1 institution implementing ParFish independently by EOP

As a result of the training workshop and the project's promotional activities, several institutions have taken up ParFish to apply in their fisheries. The College of Fisheries, Mangalore is implementing a case study in a fishery in Karnataka state, India; Orissa Department of Fisheries have submitted a proposal for assessment and management for a fishery in Chilika lagoon using ParFish; West Bengal Department of Fisheries is using ParFish in the Kansabati Reservoir, and SFLP will test ParFish on the Kossou Lake

fisheries. The Seychelles Fisheries Authority, together with a PhD student from Newcastle University are testing ParFish in the bêche-de-mer and trap fisheries, and have plans to use it on the outer island schooner fishery; The Galapagos Marine Reserve will apply ParFish in the fishery there to attempt to change the current management system and make it truly participatory.

- By EOP at least 1 institution interested in further support to the ParFish approach.

FAO FishCode-STF project has expressed interest in the ParFish approach (see Annex 3.5), as the only tool currently available that can support stock assessments in data poor small-scale fisheries, a priority in the Strategy for Improving Information on the Status and Trends of Capture Fisheries, and we will be exploring joint proposals for further testing and development with them.

6.3 Further work

What follow up action/research is necessary to further promote the findings of the work to achieve their developmental benefit? What follow up actions might be considered with respect to identified communication pathways?

The development of other models and of a software version for programmers that can be adapted to include different models will be important next steps in the promotion of ParFish. The current model (logistic biomass) serves as a simple introduction to the approach, principles and techniques that is broadly applicable. However, there is demand for an age-based model to be available. We have already explored the possibility of obtaining the relevant information for an age-based model through interviews, which was successful. Follow-up of the Andhra Pradesh case study would include a fishing experiment to gather more information on the stock behaviour, and to develop a co-management system for management of the system, for which there is substantial interest from the fishers. This fishery provides an opportunity to put such a system in place to ensure sustainable management at a time when the stock is not yet over-exploited, which avoids the initiation of a management system having to reduce fishing effort. Application and testing in fisheries with good background data to test and compare the outputs with other stock assessment methods will also be an important step in obtaining support for the approach, so that we have evidence that, where good data exist, ParFish gives comparative results to conventional stock assessment methods. Whilst some communications materials have been developed that are aimed at the target beneficiaries, it is recognised that this is an area that could also be further developed in the future.

Publications and other communications materials

List the publications and other reports, communications materials and other outputs, according to the following categorization:

(a) Peer-reviewed publications (published);
(b) Peer-reviewed publications (in press or submitted);
(c) Non peer-reviewed publications and reports and communications materials;
(d) Verbal presentations & project dissemination and other workshops;
(e) Other types of project output (eg literature reviews, databases, software etc).

(a) Peer-reviewed publications (published);

(b) Peer-reviewed publications (in press or submitted);

(c) Non peer-reviewed publications and reports and communications materials;

Synthesis Paper: Fisheries management decisions with limited resources and data
Flyers
Application and promotion of FMSP Participatory Fisheries Stock Assessment (ParFish) Training Workshop Report
Training materials
ParFish Toolkit (revised, with Training materials)
Report on case study Andhra Pradesh, India
FMSP webpage
Information on Andhra Pradesh Fisheries Department's webpage
Newpaper articles in India
Television news reports on the Kakinada workshop, India
Poster displayed at Climate Change workshop in DFID, at Final Workshop for Guidelines for Designing data collection and sharing systems for co-managed fisheries in Dhaka, Bangladesh
Poster for local distribution in Andhra Pradesh/Kakinada and villages re. the state of the crab fishery
Email correspondence

(d) Verbal presentations & project dissemination and other workshops;

Training workshop
Presentation to Commissioner for Fisheries, Dept of Fisheries Andhra Pradesh
Presentations at workshop in Kakinada to fishers, politicians and scientists
Presentation to European Commission
Contacts
Conversations with FAO (Gertjan de Graaf) and EU about future testing, promotion and uptake of ParFish
Promoted at FAO FishCode workshop

(e) Other types of project output (eg literature reviews, databases, software etc).

Revised version of ParFish Software

7 References cited in FTR Sections 1-7

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8 Project Logframe

Hierarchy of Objectives	Objectively verifiable indicators	Means of Verification	Important Assumptions
Goal			
Existing FMSP research outputs relating to: the contribution of capture and enhancement fisheries to the livelihoods of the poor; fisheries management tools and strategies that could benefit the poor; and, the means to realise improved management, further developed, disseminated and promoted to relevant stakeholders at all levels	1. Information systems to support the co-management of fisheries important to the poor field tested with target groups and institutions in at least three locations in two countries, adapted, and widely promoted (in target countries, international knowledge systems and DFID) by 31 March 2006. 2. Fisheries assessment methods to inform sustainable management for improved livelihood benefits further developed with target institutions in at least two countries, widely promoted (nationally and internationally), by 31 March 2006.	• Programme Management review • Project FTRs • Programme highlights • Publications and other communications materials • Teaching materials • Fisheries management tools • Quarterly and annual reports • FMSP project database • FMSP Website • Correspondence • Requests for manuals and guidelines received • Uptake of research products by target institutions monitored and reported in Annual Report • National statistics and publications • International networks, databases and publications	Policy makers remain receptive to information on fisheries management Government policies continue to support co-management Government policies continue to support pro-poor approaches Target beneficiaries remain receptive to management approaches proposed. Stock enhancement process cost effective and socially appropriate. Target beneficiaries adopt and use strategies
Purpose			
ParFish methodology and approach further field tested, revised and promoted to improve management of small scale fisheries and associated fishery dependent livelihoods.	By month 5 ParFish toolkit and approach tested outside original case study locations through further field testing in at least 1 location and testing of stock assessment component with data from at least 2 locations By month 5, increased capacity to apply ParFish in at least 5 institutions in the Africa and Asia regions At least 1 institution implementing ParFish independently by EOP By EOP at least 1 institution interested in further support to the ParFish approach.	Peer reviewed final report Toolkit Correspondence from target institutions	Capacity to use the methodology exists Continued institutional commitment to participatory management Communities willing to participate in resource management

Outputs	Objectively verifiable indicators	Means of verification	Important assumptions
1: Revised ParFish toolkit produced based on additional field testing of ParFish outside the original case study location.	By month 5 additional case study of ParFish approach (Steps 1-4) complete By month 5, stock assessment component tested with data from field testing in 2 other areas By month 7 results and lessons from case studies and training course (see Output 2) integrated into the ParFish Toolkit	Project reports Revised toolkit Case study report	Collaborating institutions' field testing provides adequate information to revise toolkit Institutions are willing to provide data for testing and to undertake interviews Sufficient capacity exists in collaborating institutions
2: Increased capacity and commitment to use ParFish through wide uptake promotion to fisheries research, management and training institutions	By month 3, at least 10 people trained in ParFish and able to implement the approach By month 7 promotional materials disseminated to at least 15 institutions By EOP ParFish toolkit distributed to at least 30 institutions globally	Participants' feedback forms from training initiatives Participant competency tests Workshop report Communications materials Download registration forms Communications plan updates/ Quarterly and final reports Communication monitoring forms	Targeted institutions willing to take part in training initiatives. Targeted institutions are able to secure sufficient funding to use ParFish approach. The ParFish approach fits with current donor priorities
3: Synthesis of key points and lessons learned from ParFish disseminated via FMSP Project 05/09	By EOP output on the key lessons learned developed and disseminated via FMSP project 05/09	Synthesis product from project 05/09	Appropriate target stakeholders for dissemination are identified

Activities	Milestones*	Assumptions
Output 1: Revised ParFish toolkit produced based on additional field testing ParFish approach outside the original case study location **Budget: £29,492.00**		
1.1 Confirm case study location through communications with collaborators	Case study location confirmed by month 1	A collaborator confirms support and supplies location for case study
1.2 Conduct additional case study focusing on determining management recommendations through field testing of ParFish	**Case study complete by month 5 involving community-level meetings**	Resource users interested in participating in field testing
1.3 Confirm institutions that will field test stock assessment component	Institutions confirmed by month 1	Institutions willing to allow their data to be

		used
1.4 Institutions conduct interviews with fishers	Interviews completed by month 4	Institutions have capacity to conduct interviews independently
1.5 Test stock assessment software using data from 1.3 and 1.4	Stock assessments carried out by month 5	Data can be obtained from partner institutions
1.6 ParFish toolkit revised based on the lessons learned from additional field testing and training course (see output 2)	**Revised ParFish toolkit developed by month 7**	ParFish case studies and training generate relevant lessons for updating toolkit.
Output 2: Increased capacity and commitment to use ParFish through wide uptake promotion to fisheries research, management and training institutions **Budget: £35,085.00**		
2.1 Carry out stakeholder analysis and develop and update communication plan in coordination with other FMSP projects	**Communications plan finalised in collaboration with other FMSP projects by month 2**	
2.2 Training materials developed and incorporated within the ParFish toolkit	Participants identified by month 1 including fisheries research, management and training institutions. Training materials finalised by month 2	Interest in ParFish approach continues
2.3 Training in ParFish undertaken with target institutions	**Training workshop held by month 3**	Participants available to attend workshop
2.4 Integrate lessons from further field testing and training course into communication and promotion materials	Revised communication and promotion materials completed by month 6 (e.g. flyers, email correspondence, policy brief, proposal, WIOMSA newsletter)	ParFish case studies and training generate relevant lessons for updating communication materials
2.5. Communication and promotional materials disseminated	**Project flyers and policy briefs distributed to communication targets by month 7** **Communication materials and ParFish toolkit available on FMSP web-site and relevant links to other web-sites created by month 7** By EOP at least 1 proposal submitted to potential funder for further ParFish development.	Demand for proposals exists
2.6 Distribute guidelines, software and synthesis product to interested parties	**Revised toolkit and software disseminated to institutions by EOP**	Continued interest in ParFish toolkit
Output 3: Synthesis of key points and lessons learned from ParFish disseminated via FMSP Project 05.09 **Budget: £ 5,377.00**		
3.1 Draw out lessons learned in coordination with project 05/09		
3.2 Provide synthesis piece to project 05/09	**Synthesis piece distributed to project 05/09 by month 7.**	Format for synthesis product provided by project 05/09

* Milestones in **bold type** are key milestones

9 Keywords

Fisheries management, stock assessment, Bayesian, participatory, promotion, uptake, communications, East Africa, West Africa, Bay of Bengal.