



# Application and promotion of FMSP Participatory Fisheries Stock Assessment (ParFish)

## Training Workshop Report



St Aloyises College, Mangalore, India  
25 – 29 July 2005



## **Introduction**

Small-scale fisheries provide important contributions to the livelihoods of poor people in developing countries through income and food security. Stock assessments are an important component of managing fisheries, but existing methodologies require considerable historical data on the fishery, which are often lacking especially in developing countries. 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.

Participatory Fisheries Stock Assessment (ParFish) has been developed to fill this gap by providing a resource-efficient and rapid 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 contributes to co-management by involving the resource users in setting management objectives, data collection and management planning.

The previous projects R7947 and R8397 developed the ParFish methodology and a Toolkit to assist users in its implementation, consisting of Guidelines, Software, Software Manual and supporting materials. The projects also resulted in considerable interest in the methodology from a range of institutions. This training workshop run under current project R8464 aimed to increase capacity in ParFish in participating institutions and support its promotion and uptake.

## **Aims of the workshop & Learning objectives**

The aims of the workshop were for the participants to:

- Understand the 6 stages of ParFish and how to implement them;
- Have a greater understanding of stock assessment theory and practice;
- Become familiar with the ParFish Software and analysis;
- Become familiar with various participatory techniques;
- Learn about each other's fisheries;
- Consider how ParFish can be applied in their fisheries;
- Provide feedback to improve and refine the ParFish training course and ParFish methodology.

## **Methods and teaching materials used in the workshop**

The training methods employed in the workshop involved a mixture of lectures, practicals, participatory techniques, group work and discussions and computer practicals. All participants were provided with a copy of the ParFish Toolkit, and other teaching materials provided included an imaginary ParFish case study, and various practical experiments.

## **Participants and Facilitators**

There were 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. The workshop was run by Dr Paul

Medley, Ms Suzannah Walmsley and Dr Narriman Jiddawi (Institute of Marine Sciences, Zanzibar). Dr Keshavanath (College of Fisheries, Mangalore) made organisational and logistic arrangements for the workshop. See Annex 1 for the full list of participants.

## Participants' Expectations and Concerns

Participants were asked to write their expectations and concerns about the workshop on cards, which are summarised as follows:

### Expectations

|                              |  |
|------------------------------|--|
| <b>ParFish general</b>       | <ul style="list-style-type: none"> <li>- Learn and understand ParFish</li> <li>- To know what ParFish is: Methodology, How to apply</li> <li>- To acquaint with the technology where the primary data for stock assessment is lacking</li> <li>- To know about the importance and usefulness of the ParFish software</li> <li>- To know its implementation including the fishers (co-management)</li> <li>- To know how ParFish is helpful in assessment of fish stock</li> <li>- To know what is ParFish and in what way it is useful to the fisheries sector</li> <li>- To know the methodology adopted for this stock assessment</li> </ul> |
| <b>Co-management</b>         | <ul style="list-style-type: none"> <li>- Explore the possibility of implementation of co-management</li> <li>- Future plans follow up</li> <li>- Strategies that can be adopted should not hamper the profession in co-management</li> <li>- Better management practices</li> <li>- To study present level of resources exploitation through ParFish</li> <li>- To guide sustainable fisheries management through ParFish</li> <li>- To provide Mgt advice under uncertainty and encourage co-management</li> </ul>  |
| <b>Software</b>              | <ul style="list-style-type: none"> <li>- To get acquainted with ParFish software</li> <li>- To know the methodological details (Algorithms)</li> <li>- To have more number of programs to make the software popular</li> <li>- To make it more applicable in Par/comparison with other software available</li> <li>- Familiarise with ParFish software</li> <li>- Learn the difficulties experienced in its implementation</li> <li>- Know the basis behind the models used in its operation</li> <li>- To familiarise with the ParFish software tools</li> </ul>  |
| <b>Tools</b>                 | <ul style="list-style-type: none"> <li>- To know best practices of ParFish from Zanzibar</li> <li>- How to do stakeholder analysis</li> </ul>  |
| <b>Specific case studies</b> | <ul style="list-style-type: none"> <li>- To know the results of crab fishery that was done in AP</li> <li>- To apply the technique in an island nation</li> <li>- To understand how ParFish can be used in commercial fisheries</li> <li>- To find ways to get more catch to fishermen</li> </ul>  |

### Concerns

|                              |   |
|------------------------------|---|
| <b>Concept understanding</b> | <ul style="list-style-type: none"> <li>- Implementation schedule</li> <li>- Level of interaction (statistical package)</li> </ul> |
|------------------------------|---|

|  |  |
|--|--|
|  | <ul style="list-style-type: none"> <li>- Clarity of concepts</li> <li>- More statistics – mathematics</li> </ul>   |
| <b>Implementation methodology</b>          | <ul style="list-style-type: none"> <li>- Rest the data generated on crab fishery</li> <li>- Unable to do field work</li> <li>- Adequate financial and logistic support for collection of data from field</li> <li>- Implementation at field level</li> <li>- Positive response for co-management implementation an crab fishery</li> <li>- Data collection, Fisheries development</li> </ul> |
| <b>Reliability and testing</b>             | <ul style="list-style-type: none"> <li>- To manage commercially important fish species exploited heavily</li> <li>- Selection of right software tools for different types of fisheries</li> <li>- Has the technique been tested in any other fisheries</li> <li>- Is it a reliable technique?</li> <li>- The method could lead to subjective conclusions</li> </ul>                          |
| <b>General logistic of workshop</b>        | <ul style="list-style-type: none"> <li>- Time limitation 5 days too short understand ParFish clearly</li> <li>- Home work</li> </ul>   |
| <b>Socio-economic aspects of community</b> | <ul style="list-style-type: none"> <li>- Poorness, Literacy, Drinking, Vulnerability</li> <li>- Poorness, More population, Less income</li> </ul>  |

## Teaching Schedule

A copy of the Agenda for the workshop can be found in Annex 2. A summary of the teaching sessions is provided below.

### Introduction to ParFish

Dr Paul Medley and Ms Suzannah Walmsley gave an introductory lecture to ParFish, explaining the potential application of the methodology, data requirements and data collection, statistical techniques underlying the methodology and the participatory framework. The powerpoint slides can be found in Annex 3.

### Previous experiences of ParFish

Dr Narriman Jiddawi gave a presentation about the experiences of developing and testing ParFish in Kizimkazi, Zanzibar. Mr G. Venkata Raju (Department of Fisheries, Andhra Pradesh) gave a presentation about the experiences of initiating testing of ParFish in the mud crab fishery in the Coringa Mangroves, East Godavari District, Andhra Pradesh. Presentations can be found in Annex 3.

### Introduction to Bayesian Statistics

Dr Paul Medley gave a presentation introducing Bayesian Statistics, uncertainty, probability, decision theory and the theory underlying ParFish. The presentation can be found in Annex 3. Practical and participatory exercises were used to illustrate the concepts, such as estimating the number of oranges in a jar (or lemons in a jug in this case).

### Understanding the context and collecting background information

Suzannah Walmsley introduced the first stage of ParFish, understanding the context and what background information should be collected and where to look for it. An imaginary case study had been developed that brings out various important lessons

that have been learnt in previous testing experiences of ParFish. Participants were split into three groups of four or five, with people from different states in each group, and asked to identify what is already known about the case study fisheries, what extra information they would look for or collect before starting to implement ParFish and where they would look for it or how they would collect it.

Dr Narriman Jiddawi led a session on stakeholder analysis, firstly explaining the background and how to do it. Participants then worked in their groups again to carry out a stakeholder analysis of the case study fishery. A similar process was followed by Suzannah Walmsley for the communications plan and the participants carried out the exercise for the case study.

The groups' work for all the above exercises is presented in Annex 4.

## Data collection techniques

### **Interviews**

The theory and models behind the stock assessment interview and preference interview were explained, and ways of adapting and presenting the questions to the fishers were discussed. Presentations can be found in Annex 4. The use of the binary tree for ranking the preference cards was explained and participants practiced carrying out the interviews on each other.

### **Fishing experiments**

A simulation of a fishing experiment was constructed, using a large cardboard box filled with shredded paper (being the area of the fishery, and the shredded paper being the medium, or water). The objective was to explain the principles behind the use of fishing experiments to estimate parameters of the fish stock in the ParFish Software. 35 ping-pong balls were added to the shredded paper, representing the fish stock, 10 of which had been numbered from 1 – 10. The numbered balls represented tagged fish.

A workshop participant was then asked to be a fisher, and to 'fish' for ping-pong balls for six successive 1-minute periods. During each period, he gathered as many ping-pong balls as he could find, which represented the total catch for each day of the fishing experiment.

The results (numbers of ping pong balls found during each 1-minute session) were then used in a modelling exercise to estimate the initial number of ping-pong balls in the box, or rather, the initial population size of the fish stock. The modelling results are shown below. The estimated initial population size was 34.8 ping pong balls.

|     |             | N0               | q        |          |               |            |  |
|-----|-------------|------------------|----------|----------|---------------|------------|--|
| 0.7 | 38.57143    | 36.6675205       | 34.76361 | 0.003583 |               |            |  |
|     |             |                  |          |          | SS            | 0.00514092 |  |
| Day | No. of Fish | Cumulative Catch | Nt       | CPUE     | Expected CPUE | Squares    |  |
| 1   | 9           | 0                | 34.76361 | 0.15     | 0.124567      | 0.00064682 |  |
| 2   | 5           | 9                | 25.76361 | 0.083333 | 0.092318      | 8.0722E-05 |  |
| 3   | 2           | 14               | 20.76361 | 0.033333 | 0.074402      | 0.0016866  |  |
| 4   | 5           | 16               | 18.76361 | 0.083333 | 0.067235      | 0.00025916 |  |
| 5   | 2           | 21               | 13.76361 | 0.033333 | 0.049319      | 0.00025553 |  |
| 6   | 4           | 23               | 11.76361 | 0.066667 | 0.042152      | 0.00060096 |  |
|     |             | 27               | 7.763612 |          |               |            |  |

## **Software**

A day was spent on the use of the ParFish software. Participants were taken through, step-by-step, the 6 steps of the software, from entering background information, setting up models and drawing posterior samples, checking their data, entering preferences and controls and carrying out the analysis. Each step was explained on the overhead projector and individual support was given to participants throughout. The Turks and Caicos conch data was used as an example. Some participants then moved on to look at the Dimbani data from Zanzibar.

## **Feedback and management planning**

The interpretation of the analysis outputs was explained and ways of feeding back the results to fishers was discussed.

## **Evaluation of the Workshop**

Stage 6, Evaluation of the ParFish process, was discussed.

## **Evaluation of Workshop**

In general, participants felt that their expectations for the workshop had been satisfied. They expressed 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. After being concerned about the reliability and applicability of ParFish at the beginning of the workshop (identified in the Expectations and Concerns exercise), at the final evaluation, participants said they were 90% satisfied that ParFish is applicable and reliable. They also felt that the mathematical background provided was sufficient for software understanding. However, there will often be some participants that would like to go into the underlying models in more depth, and a sub-seminar could be organised on this in future workshops for those interested, while the others continue to practice the use of the software.

Participants felt that the length of the workshop, 5 days, was good, but that more time spent on the software would be useful. The possibility of field work to practice the interviews would also be useful, although this would require a longer workshop. Video footage of carrying out interviews with the fishers (translated / with subtitles) and other data collection activities would be useful for training. Some participants also expressed the need for evidence of the success of co-management and/or the implementation of ParFish for policy makers to adopt the co-management approach.

## Annex 1: Participants list

### Participants list – ParFish Workshop Mangalore 25-29 July 2005

| Name                     | Position                          | Organisation                          | Address   | Email  | Tel  | Checked ? |
|--------------------------|-----------------------------------|---------------------------------------|---|--|--|-----------|
| Dr Satyajit Kumar Bhuyan | Fishery Extension Officer         | Orissa State Fisheries Dept           | Assistant Director of Fisheries (Marine), Kujanga, Jagatsingpur, Orissa | <a href="mailto:satyajit99@rediffmail.com">satyajit99@rediffmail.com</a><br><a href="mailto:satyajit10@yahoo.co.in">satyajit10@yahoo.co.in</a> | 09437 160510<br>06722 236243                     | yes       |
| Subrat Kumar Dash        | Junior Fisheries Officer (Marine) | Dept of Fisheries, Orissa             | Jr Fisheries Officer (Marine), Sector 21, Paradeep (Orissa)             |  | 094371 83412                                     | Yes       |
| P.Sreeramulu             | Fisheries Development Officer     | Andhra Pradesh State Fisheries Dept., | State Institute of Fisheries Technology, Kakinada                       | <a href="mailto:sreeramulupaningipalli@yahoo.co.in">sreeramulupaningipalli@yahoo.co.in</a>   | 9441011836<br>0884 2378552(o)<br>0884 2379836(r) | Yes       |
| B.L.Narasimha Raju       | General Secretary                 | United Fishermen's Association        | Boddu China venkatayapalem-533461<br>East Godavari District (AP)        |  | 9390209023                                       | yes       |
| P.Ram Mohan Rao          | Assistant Director of Fisheries   | AP State Fisheries Dept               | State Institute of Fisheries Technology, Kakinada-2, Andhra Pradesh     | <a href="mailto:rammohanrao_p@sify.com">rammohanrao_p@sify.com</a><br>mohanrrp@hotmail.com   | 98851-44557                                      | yes       |

| Name                | Position                               | Organisation                                 | Address  | Email  | Tel                                | Checked ? |
|---------------------|--|--|--|--|------------------------------------|-----------|
| G. Venkata Raju     | Assistant Director of Fisheries        | AP State Fisheries Dept                      | c/o the Commissioner of Fisheries, Masab Tank, Santhi Nagar, Hyderabad                     | gvraju_fisheries@yahoo.co.in   | 9440814708                         | yes       |
| Stephen W. Ndegwa   | Fisheries Statistical Officer – Marine | Fisheries Dept / Cordio East Africa          | PO Box 90423, Mombasa (80100), Kenya   | <a href="mailto:ndegwafish@yahoo.com">ndegwafish@yahoo.com</a>   | +254 722 659446<br>+254 733_488015 | Yes       |
| Suzannah Walmsley   | Fisheries Consultant                   | Marine Resources Assessment Group Ltd (MRAG) | 18 Queen Street, London W1J 5PN, U.K.  | <a href="mailto:s.walmsley@mrag.co.uk">s.walmsley@mrag.co.uk</a>   | +44 20 7255 7785                   | Yes       |
| Narriman S. Jiddawi | Senior Research Fellow                 | Institute of Marine Sciences (IMS)           | PO Box 668, Zanzibar, Tanzania   | <a href="mailto:jiddawi@ims.udsm.ac.tz">jiddawi@ims.udsm.ac.tz</a><br><a href="mailto:n_jiddawi@yahoo.com">n_jiddawi@yahoo.com</a> | +255 741 259126<br>+255 24 2230741 |           |
| Paul Medley         | Fisheries Consultant                   | Marine Resources Assessment Group Ltd (MRAG) | C/o- 18 Queen Street, London W1J 5PN, U.K.   | paul.medley@virgin.net   | +44 1347 838236                    | yes       |
| Uttam Kr. Panja     | Deputy Director of Fisheries           | Fisheries Dept, Government of West Bengal    | 'Meenbawan' Sepay bazaar, P.O Midnapore, West Bengal                                       | Panja_uttam@sancharnet.in  | 03222 275610<br>9434004342(M)      | Yes       |
| Dr P. K. Jana       | Deputy Director of Fisheries (ME & MS) | Fisheries Dept, Government of West Bengal    | Office of the Joint Director of Fisheries (ME&MS), 60A Colootala Street, Kolkata-73, India | wbjdmems@vsnl.net  | 033 2215 6711                      | Yes       |



| <b>Name</b>        | <b>Position</b>                            | <b>Organisation</b>                         | <b>Address</b>                           | <b>Email</b>         | <b>Tel</b>    | <b>Checked ?</b> |
|--------------------|--|---|--|----------------------|---------------|------------------|
| Dr M. Srinath      | Principal Scientist & Head, FRA Division   | Central Marine Fisheries Research Institute | PBN01603, Cochin 682018                  | mudumby@yahoo.com    | 0484 239 4867 | Yes              |
| Dr R.S.Biradar     | Principal Scientist & Head, FITET Division | Central Institute of Fisheries Education    | Versova, Mumbai 400061                   | rbiradar@hotmail.com | 022 2636 1446 | Yes              |
| Prof. K.S.Udupa    | Professor of Fishery Statistics            | College of Fisheries                        | Darbar Hill, Padil, Mangalore 575007     | udupa47@hotmail.com  | 0824 2243503  | Yes              |
| Prof. N. Jayabalan | Professor of Fishery Biology               | College of Fisheries                        | 1-5 3/26 Darbar Hill, Padil, Mangalore-7 | maljaya2@yahoo.com   | 0824 2432328  |                  |

## Annex 2: Agenda

### ParFish Training Workshop Mangalore, 25 – 29 July, 2005

#### Agenda

| <b>Day 1</b>  |   |                            |
|---------------|---|----------------------------|
| 08.30 – 09.00 | Registration  |                            |
| 09.00 – 09.15 | Opening Ceremony  |                            |
| 09.15 – 10.30 | Introductions<br>Participants' expectations and concerns<br>Brief introduction to ParFish and workshop learning objectives  | PM/SW                      |
| 10.30 – 11.00 | <b>Coffee Break</b>   |                            |
| 11.00 – 13.00 | Introduction to ParFish<br><br>Previous experiences of ParFish<br>- Kizimkazi, Zanzibar (Dr. Narriman Jiddawi, Institute of Marine Sciences, Zanzibar)<br>- Kakinada, Andhra Pradesh (G. Venkata Raju, Department of Fisheries, Andhra Pradesh) | PM/SW<br><br>NJ<br>GR      |
| 13.00 – 14.00 | <b>Lunch</b>  |                            |
| 14.00 – 15.30 | Background to stock assessment and Bayesian Statistics  | PM                         |
| 15.30 – 16.00 | <b>Coffee Break</b>   |                            |
| 16.00 – 17.30 | Practical stock assessment and concepts: key ideas of depletion, biology, modelling and uncertainty.  | PM/SW (oranges in jar etc) |

| <b>Day 2</b>  |   |          |
|---------------|---|----------|
| 08.30 – 10.30 | Stage 1: Understand the Context<br>- Background information<br>- Stakeholder Analysis                         | SW<br>NJ |
| 10.30 – 11.00 | <b>Coffee Break</b>   |          |
| 11.00 – 12.00 | Stage 1 cont.<br>- Communications Planning  | SW       |
| 12.00 – 13.00 | Stage 2: Engaging Stakeholders<br>- Meetings with fishers, key informant interviews and participatory mapping | SW & NJ  |
| 13.00 – 14.00 | <b>Lunch</b>  |          |
| 14.00 – 15.30 | Stage 3: Undertake ParFish stock assessment Planning – what data needs to be collected?                       | PM       |
| 15.30 – 16.00 | <b>Coffee Break</b>   |          |
| 16.00 – 17.30 | Data collection methods I: Stock assessment interviews  | PM       |

| <b>Day 3</b>  |  |                                      |
|---------------|--|--------------------------------------|
| 08.30 – 10.30 | Data collection methods II: Preference interviews                            |                                      |
| 10.30 – 11.00 | <b>Coffee Break</b>  |                                      |
| 11.00 – 13.00 | Data collection methods III:<br>- Catch-effort data<br>- Fishing Experiments | <b>PM.<br/>Computers<br/>needed.</b> |
| 13.00 – 14.00 | <b>Lunch</b>   |                                      |
| 14.00 – 15.30 | Stock assessment techniques:   | <b>PM. Computers</b>                 |

|               |                             |                              |
|---------------|-----------------------------|------------------------------|
|               | Modelling in MS Excel       | <b>needed.</b>               |
| 15.30 – 16.00 | <b>Coffee Break</b>         |                              |
| 16.00 – 17.30 | Modelling in MS Excel cont. | <b>PM. Computers needed.</b> |

|               |  |                          |
|---------------|--|--------------------------|
| <b>Day 4</b>  |  |                          |
| 08.30 – 09.00 | ParFish Software introduction:<br>inputs and outputs to the software                     | PM                       |
| 09.00 – 10.30 | The ParFish Software practical:<br>Data input to Excel and setting up simulation models  | <b>Computers needed.</b> |
| 10.30 – 11.00 | <b>Coffee Break</b>  |                          |
| 11.00 – 13.00 | The ParFish Software practical cont:<br>Importing data and setting up Probability Models | <b>Computers needed.</b> |
| 13.00 – 14.00 | <b>Lunch</b>   |                          |
| 14.00 – 15.30 | The ParFish Software practical cont:<br>Analysis   | <b>Computers needed.</b> |
| 15.30 – 16.00 | <b>Coffee Break</b>  |                          |
| 16.00 – 17.30 | The ParFish Software practical cont:<br>Analysis and interpretation                      | <b>Computers needed.</b> |

|               |   |    |
|---------------|---|----|
| <b>Day 5</b>  |   |    |
| 08.30 – 10.30 | Stage 4: Interpret results and give feedback:<br>Recommendations from the analysis outputs  | SW |
| 10.30 – 11.00 | <b>Coffee Break</b>   |    |
| 11.00 – 13.00 | Stage 5: Initiate management planning:<br>Feeding back results to fishers and building<br>consensus<br>Stage 6: Evaluating ParFish implementation | SW |
| 13.00 – 14.00 | <b>Lunch</b>  |    |
| 14.00 – 15.30 | Planning ParFish implementation back at 'home'  |    |
| 15.30 – 16.00 | <b>Coffee Break</b>   |    |
| 16.00 – 17.30 | General discussion, workshop evaluation and<br>Closing Ceremony   |    |

Evening: Final dinner for participants

## Annex 3: Presentations

### Management Plans

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- Process of developing and implementing a management plan requires institutional support and commitment to co-management

### Evaluation

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- Aims:
  - To assess what the process has achieved and what we have learnt
  - To learn from the experience and improve planning for future assessments
- Process:
  - Discussions with various groups
  - Independent evaluations

### FMSP software

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- CEDA, LFDA, YIELD, ParFish
- [www.fmosp.org.uk](http://www.fmosp.org.uk)

Welcome to the



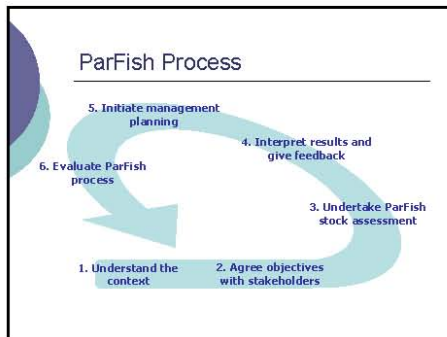
PARTICIPATORY FISHERIES STOCK ASSESSMENT

**Training Workshop**

25<sup>th</sup> -29<sup>th</sup> July 2005  
College of Fisheries, Mangalore



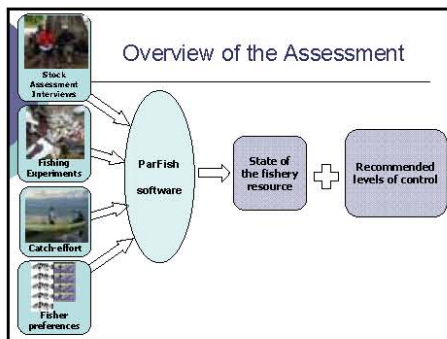
### What is ParFish?

- An approach to stock assessment
- Involve fishers and other stakeholders
- Suitable for small-scale fisheries
- Rapid assessment
- Appropriate for data-poor situations

### ParFish Toolkit

- Guidelines: guidance for carrying out the process, data collection, assessment and management planning
- Software for carrying out the stock assessment and Software Manual

### Learning Objectives

- By the end of the workshop, you will:
  - Understand the 6 stages of ParFish and how to implement them;
  - Have a greater understanding of stock assessment theory and practice;
  - Be familiar with the ParFish Software and analysis;
  - Become familiar with various participatory techniques;
  - Have enjoyed yourself !

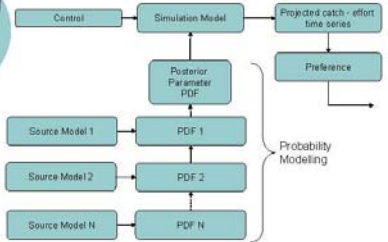
### Other objectives

- Learn about each other's fisheries;
- Consider how ParFish can be applied in your fisheries;
- Provide feedback to us to improve and refine the ParFish training course and ParFish itself.



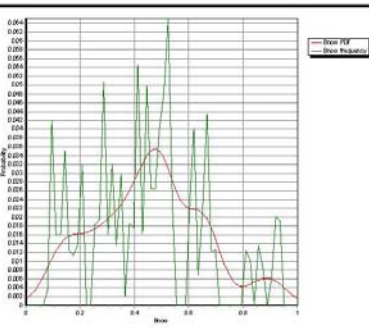
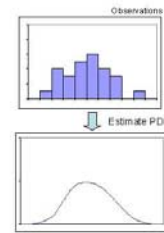
Next: PM/GW

### Software Structure

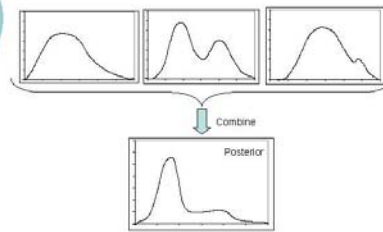


### Generating Parameter Probabilities

- ParFish software takes frequency observations, and estimates the underlying probability distribution from which they were drawn



- Probability density functions from various data sources can be combined into a single 'posterior' PDF



### Conventional and Novel Information Sources

- Current version uses logistic (Schaefer) as simulation model:  $r$ ,  $B_{curr}$ ,  $B_{inf}$  and  $q_j$
- Various data types and sources can be combined e.g.
  - Long term catch-effort data models
  - Interviews
  - Fishing experiments
  - Biological parameters
  - Others?



### Fishing Experiments

- Estimate population size and catchability
- Fishers concentrate their fishing effort in a specific area, catches and effort are recorded
- Complemented by underwater visual surveys of fish population

### Interviews

- Stock assessment interviews gather fishers' knowledge about the resource and provide a starting point for the stock assessment
- Preference interview indicates how much fishers would like or dislike different outcomes of catch and effort

### Utility & Decision Theory

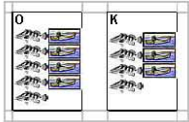
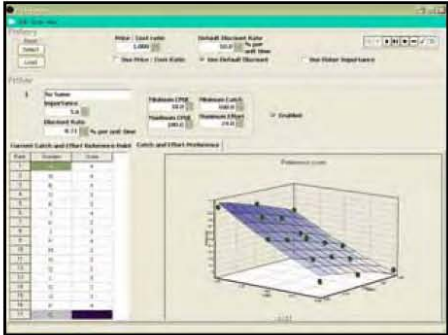
- **Utility** refers to how good something is for someone
- Modelling provides a variety of possible **outcomes** from different decisions
- **Decision Theory** helps us decide which of a set of actions to take, based on their expected utility (probability of happening times cost)
- **Bayes action:** Choose the action which will maximise the expected (average) utility

### Preference Interviews

- Scenario cards - different levels of catch and effort
- Pair-wise ranking then scoring
- Score indicates 'utility'

### Example pairwise comparison

- Keep current work level in the fishery, but get 25% more income/fish, OR
- Keep fishery income the same, but for 25% less time which could be used for other work.





### Outputs of Analysis

- **Output reference points, fishery states etc. as probabilities**
- **Limit and target control levels:**
  - Recommended (target) control levels
  - Limit control levels with acceptable chance of overfishing

### Participatory Framework

- Involve fishers at an early stage
- Helps their acceptance of assessment results
- Participatory framework draws on Adaptive Learning, Participatory Action Plan Development, Consensus Building Methodology, participation literature
- Supports co-management



### Understanding the context

- **Fishery and management context**
- **Stakeholder Analysis**
- **Communications Plan**

➔ Gather background information

### Engaging stakeholders

- Set objectives for the assessment
- Introduce concepts: uncertainty, fish stock dynamics, probability, overfishing
- Participatory techniques





## Feedback and Planning

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- Communicating the results of the assessment to fishers and fisheries management institutions;
- Building consensus on problems and possible solutions for the fishery;
- Developing a management plan or action plan;
- Evaluating the process



parfish  
PARTICIPATORY FISHERIES STOCK ASSESSMENT

Next: Harman



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Next: PM

## Bayesian Approach

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A brief introduction

## Summary

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- Introduction to probability
- Likelihood
- Bayes rule
- Decision theory and utility
- A practical application: ParFish

## Mathematical Probability

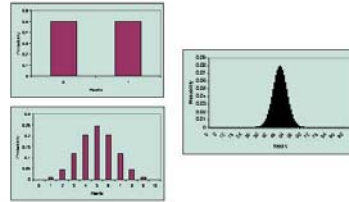
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- Probabilities are between 0 and 1.0
- 0 = Impossible
- 1.0 = certainty
- Probabilities often defined as sets of possible events or outcomes
- A set of exclusive events, one of which must occur, sum to one

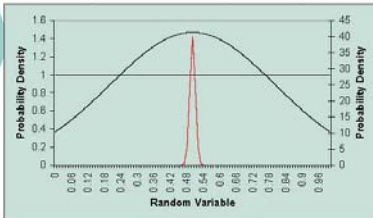
### Subjective Probability

- o People assess a risk even without direct observations
- o Some events we may wish to estimate we do not wish to observe, such as nuclear war or overfishing.

### Discrete → Continuous



### Example Probability Density



### Likelihood

- o Probability when p is known:
  - $\Pr(H) = p$
  - $\Pr(T) = 1-p$
- o Likelihood when H/T is known
  - $\Pr(p \mid H) = p$
  - $\Pr(p \mid T) = 1-p$

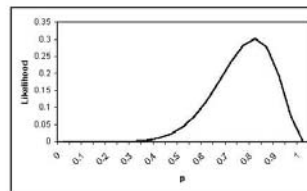
### Binomial Likelihood

$$\Pr(p \mid r \text{ Heads}) = {}^n C_r p^r (1-p)^{n-r}$$

where  ${}^n C_r = \frac{n!}{r!(n-r)!}$

- o  $nCr$  is the number of ways (combinations)  $r$  heads could occur in  $n$  trials.

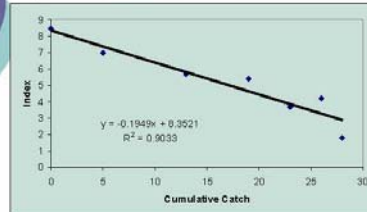
### Likelihood: 8 Heads 2 Tails



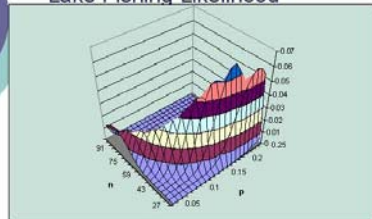
### Fishing Experiment

- Population size on day 0 =  $n$ 
  - We catch  $C_0$  fish on day 0
- Population size on day 1 =  $n - C_0$ 
  - We catch  $C_1$  fish on day 1
- Population size on day 2 =  $n - C_0 - C_1$
- Population size on day  $t$  =  $n - \sum_t C_t$

### Fishing Experiment



### Lake Fishing Likelihood



$$\Pr(p, n | r \text{ Fish}) = {}^n C_r p^r (1-p)^{n-r}$$

### Bayes Rule

- Posterior  $\propto$  Prior \* Likelihood
- $\Pr(p, n | \text{Data}) \propto \Pr(p, n) * L(\text{Data} | p, n)$

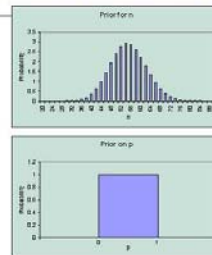
### Updating Using Bayes

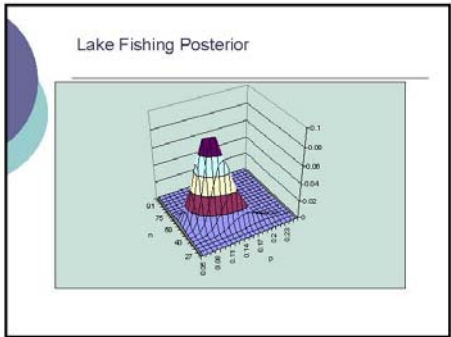
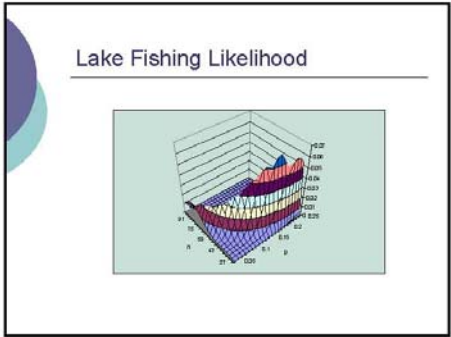
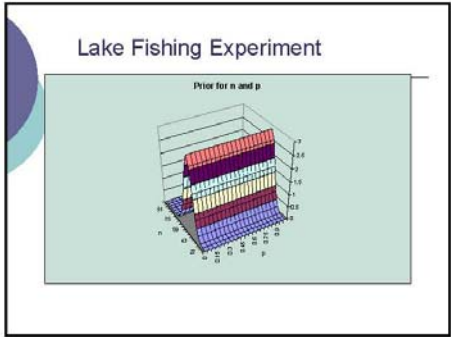
$$\Pr(p, n | \text{Data}) \propto \Pr(p, n) * L(\text{Data1} | p, n) * L(\text{Data2} | p, n)$$

Which gives

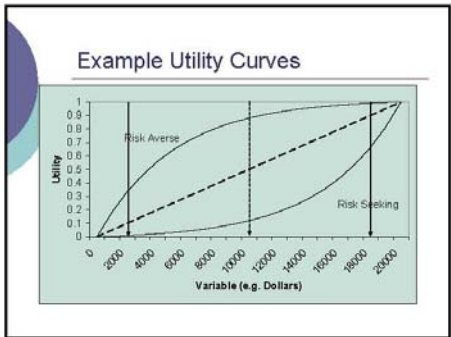
$$\Pr(p, n | \text{Data}) \propto \Pr(p, n | \text{Data1}) * L(\text{Data2} | p, n)$$

### Lake Fishing Experiment





- ### Utility
- o Score cost / benefits of outcomes in one dimension
  - o Not monetary
  - o Used in economics to manage risk
  - o Explains why people enter games where they expect to lose money



- ### Decision Theory
- Combines probability and utility
- o Bayes action: Choose the action which will maximise the expected (average) utility
-

Parfish stock assessment approach on  
Coringa mangrove mud crab fishery  
in Andhra Pradesh

PRESENTATION LAYOUT

- Selection criteria for fishery
- About crab fishery
- General impression of fishers
- Collection of background information
- Preparation and finalization of data collection system
- Interviews and compilation of data
- Problems during interviews
- Relevance of Parfish tools
- Expectations

SELECTION CRITERIA FOR FISHERY

Crab Fishery has been chosen to apply ParFish tools since:

- It is a small fishery
- Easy to take up pilot study
- Needs immediate attention as it is over-exploited
- Easy to understand and communicate to all stakeholders.
- Easy accessibility
- Small group of fishers

ABOUT CRAB FISHERY

- *Scylla serrata*, the mud crab is available in mangrove and is much in demand in the domestic market and fetches a good price, compared to other species of crab.
- The mud crab fishery is an export oriented.
- Crabs stay alive out of water for a maximum of about 72 hours, and are sent to major cities by train and export by airift.
- crabs are packed in bamboo baskets, each basket accommodating about 20-25 kg.
- Types of Gear employed:
  - Rod [Hook]
  - Ring
  - Lines
  - Stake nets

ABOUT CRAB FISHERY

- Peak Season : September – January
- Lean Season : February – August
- No. of Fishing Days :20 per month
- 90% of the berried females in November – December
- 10% berried females throughout the year
- Egg laying period in May month
- Size distribution
  - Small ( about 50 g) – in June & July
  - Medium ( about 150 g) – in August & September
  - Big ( 300 g and above) – in November December

COLLECTION OF BACKGROUND INFORMATION

- Training on stakeholder and situation analysis
- Preparation of key informants formats
- meets with crab fishers in different villages
- visits to fishing grounds
- Met the forest and MS Swaminathan foundation to gather information on the activities taken up for the growth of mangroves
- Information from Fisheries Dept
- BOBP and CMFRI publications

| Name of Village    | Boats | Crab Fishers | Lines | Bats | Stake Size | Boys |
|--------------------|-------|--------------|-------|------|------------|------|
| Pulivalah          | 350   | 1200         | 200   | 1200 | 10         | 1    |
| Chinnavalah        | 50    | 250          | 4     | 250  | 10         | ---  |
| Gadimaga           | 15    | 100          | 1     | 100  | 10         | 6    |
| Kathawa            | 11    | 40           | 10    | 1    | 5          | 3    |
| Lakshmi pathiraman | 20    | 60           | 4     | 9    | 2          | 1    |
| PBV Palau          | 20    | 10           | 1     | 35   | 5          | 8    |
| CBV Palau          | 15    | 65           | 2     | 27   | 2          | 2    |
| Ramanu palau       | 20    | 80           | -     | 20   | 30         | 11   |
| Chelungipeta       | 20    | 40           | -     | 6    | -          | 10   |
| Total              | 521   | 1915         | 222   | 1640 | 77         | 62   |

#### DATA COLLECTION SYSTEM ADOPTED

- Field trials were conducted to finalise the appropriate questionnaire
- Questionnaires prepared in two formats
  - Stock assessment format
  - Preference interview format
- Preference cards prepared
- Cooperation for providing data was sought from fishers
- Targeted to collect data from 100 fishers
- Resource mapping

#### INTERVIEWS AND COMPILATION OF DATA

- Conducted 110 stock assessment interviews
- Conducted 35 preference interviews
- conducted 1 group interview for both stock assessment and preference interviews
- Resource map prepared
- Compiled data in excel sheet
- Poster on status of crab prepared
- Information was kept in website of Fisheries Dept [www.ap-fisheries.org](http://www.ap-fisheries.org)

#### PROBLEMS DURING INTERVIEWS

- Understandability of questions is found to be difficult
- Time taken for interviewing the fisher is tedious
- Fishers are panic to certain questions like recovery time etc,

#### GENERAL IMPRESSION OF FISHERES

- Increase in the no. of boats / fishers (increasing effort)
- Destruction of nursery areas
- Destruction of mangrove areas for shrimp farms and other uses
- Pollution from factories
- Natural disturbances (cyclone, tsunami)
- Cattle no longer allowed to graze on the island resulting in less input of nutrients

#### RELEVANCE OF PARFISH TOOLS

- Appropriate to the present system of data availability
- Rapid assessment
- Inexpensive
- Participatory
- Enhance the capacity building on fishery

#### EXPECTATIONS

- Testing the data on Parfish software
- Interpret the results with fishers
- Feedback from fishers on management options
- Explore the possibilities of Co-management
- Plan for implementation of a pilot project

Welcome to the



**parfish**  
PARTICIPATORY FISHERIES STOCK ASSESSMENT

**Training Workshop**

Day 2

25<sup>th</sup> -29<sup>th</sup> July 2005  
College of Fisheries, Mangalore

**Objectives**

- Context and background
  - What background data to collect; how to obtain background information on the fishery; planning stakeholder engagement
- Engaging stakeholders
  - Meetings with fishers; management objectives
- Data collection options for stock assessment
- Stock assessment interview

**Characteristics of a suitable fishery**

- Sedentary local species (not highly migratory e.g. tuna)
- Fishers responsible for the majority of fishing mortality can be identified
- One or more fishing villages involved (depending on resources)
- Co-management situation or wishing to develop co-management
- Fishery can be spatially defined as a 'management unit'

**But ...**

- Uses tried and tested stock assessment theory and models
- Can be used on any fishery that conforms to the underlying model

**Question:**

---

**What background information do we need about the fishery before we start?**

**How can we get it?**

**STAKEHOLDER ANALYSIS**

---



o Stage 1 of the ParFish Guidelines explains how to assess the context of the fishery in order to frame the stock assessment.

o It is a preparatory stage before undertaking the assessment and involves four main activities:

- o Understanding the fishery;
- o Identifying stakeholders;
- o Therefore: One important aspect in Parfish is to identify which are the individuals or organisations that will be affected by or influenced by fisheries Management

**Who is a stakeholder**

o A **stakeholder** is:

- o someone **affected** (positively or negatively) by the impact of an activity; or
- o someone who can **influence** the process or impact of an activity.
- o Eg fisheries Management

**Why use it?**

- o The aim of ParFish is to be participatory.
- o Therefore it is important that you understand who the key stakeholders are in the fishery in question.
- o A Stakeholder Analysis gives a clear picture of who is, or should be, involved in the process and what influence different groups might have on the process and its impact.
- o Identifying and involving stakeholders at an early stage increases the chance that stakeholders understand and accept the recommendations and can build consensus on improving management of the fishery.

**Why use it?**

- o ParFish will succeed by engaging the right people during the different stages of the process who will collect information, understand the assessment, and plan feasible actions. Therefore it is important to do the process with various stakeholders eg beach recorders, fishers, etc Can keep updating

**What is it?**

Stakeholder Analysis is a way of identifying groups of people and organisations that have a role or an interest in a process, and describing what their involvement or interest is.

Therefore need to do SHA which can help to choose people who will be affected or who have an influence and who could be engaged in various activities

**How to do it**

- o A Stakeholder Analysis could be undertaken as a desk based activity or within a group. It is best to involve lots of people using a participatory approach. The main steps of a stakeholder analysis are:
  - o Draw up a list of all potential stakeholders and classify them (primary or secondary);
  - o List each group's interests;
  - o Assess the potential impact of the process on each stakeholder;
  - o Indicate their relative priority and influence of each stakeholder;
  - o Record your results.

### Classifying Stakeholders

- Stakeholders can be divided into two main groups:
- 1. **Primary stakeholders** are those directly affected by changes in the fishery and management arrangements e.g. those that benefit from or are adversely affected by an activity. Usually they live in or very near the resources in question.
- 2. **Secondary stakeholders** include all other people and institutions with an interest or intermediary role in the fishery or area being considered.

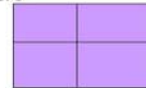
### List each group's interests

For each stakeholder group, list their interests in relation to the process and its objectives. Remember that each group may have several objectives and roles in the process.

### Assess the potential impact of the process on each stakeholder

- Assess whether the process will potentially have a positive or negative impact on each stakeholder group. Try using the following symbols:
- + potential positive impact
- - potential negative impact
- +/- possible positive and negative impacts in different circumstances
- ? uncertain

- Indicate the relative priority and influence of each stakeholder
- Take a sheet and divide into four chambers



Indicate the relative priority and influence of each stakeholder

**Influence** is the power which stakeholders have over the process – how much can stakeholders persuade or manipulate (coerce) others into making decisions or doing things?

**Priority** is the importance given by the ParFish process to satisfying the needs and interest of each stakeholder

- (H-L) High priority - High influence
- (L-L) Low priority - Low influence
- (L-H) Low priority - High influence
- (H-H) High priority - High influence

### Priority and influence matrix for the Stakeholder Analysis

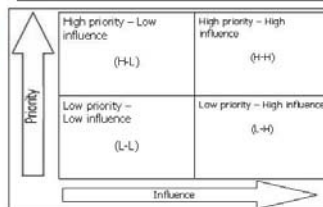


Figure 7. Priority and influence matrix for the Stakeholder analysis

o **Top right-hand square - high priority and a high influence.** It will be important to build good working relationships with these stakeholders to ensure an effective coalition of support for project implementation.

o **Top left-hand square - high priority and low influence.** These stakeholders are most important to consider. The process may need to make a special effort to keep them involved and to consider the impacts on them. Examples could include poorer fishers who rely on other boat owners or fish buyers.

o **Bottom left-hand square - low priority and low influence.** These groups should be kept informed, but are not a priority to be actively involved.

o **Bottom right-hand square - low priority and high influence.** These remain relatively unaffected themselves by the process and its impacts. If supportive, they may be very useful in building support, but if not then care should be taken to avoid these stakeholders diverting or disrupting the process, with negative impacts for primary stakeholders.

**An example of a table that can be used to record the Stakeholder Analysis**

| Stakeholder                   | Interests   | Likely impact of Fisheries | Priority - Influence |
|-------------------------------|---|----------------------------|----------------------|
| <b>Primary Stakeholders</b>   |   |                            |                      |
| Fishers                       | <ul style="list-style-type: none"> <li>Continuing to catch fish in the future</li> <li>Having a say in how the fishery is managed</li> <li>Not all fishers may benefit from management action</li> <li>Management may recommend reduction of effort which would have negative impact in short term</li> </ul> | +/-                        | H-L                  |
| Other community members       | <ul style="list-style-type: none"> <li>Being able to buy fish</li> </ul>  | +                          | L-L                  |
| <b>Secondary Stakeholders</b> |   |                            |                      |
| Ministry of Fisheries         | <ul style="list-style-type: none"> <li>Achievement of targets</li> <li>Better fisheries management</li> <li>Co-management</li> </ul>  | +/-                        | H-H                  |
| Donors                        | <ul style="list-style-type: none"> <li>Promoting good management practices</li> </ul>   | +                          | H-L                  |

**Stakeholder engagement plan**

| Stakeholder                                      | Skills / Assets  | Potential involvement  |
|--|--|--|
| Fishers within Koon-lab region                   | Knowledge of and day-to-day contact with the resource.   | Stages 2 - 6: Involvement in interviews, meetings and assessing management options.  |
| Fisheries Dept for Zanibar                       | Staff include beach recorders.<br>Responsible for fisheries management and approval of management plans. | Stages 3 - 6 and kept informed. Beach recorders assist data collection (interviews & fishing equipment).<br>Fisheries Statistician involved in collating catch and effort data.<br>Involvement in approving and implementing a management plan.<br>Need to be kept informed of process to assist buy-in. |
| Research Institute - Institute of Marine Science | Computer hardware and stock assessment skills.   | Stages 3 - 4: Involvement in coordinating fishing equipment and carrying out the analysis and interpretation of the results.<br>Also due to relationship with fishing communities able to facilitate community meetings.   |
| Menai Bay Marine Protected Area                  | Responsible for fisheries management in the area and local patrols.                                      | Stages 3 - 5: Involvement in supporting implementation of management plans.<br>Involvement in data collection to increase support for process and outcomes.  |

**Communications plan**

- Identify the communications objective for each stakeholder
- Define communications messages for each stakeholder
- Assess appropriate materials for each stakeholder
- Define communication channels
- Define monitoring indicators

**Key informant interviews**

- Who are key informants?
- What can you find out from key informant interviews?
- How do you prepare one?
  - Who, when, where, what?

### Engaging stakeholders

- Techniques for collecting background information also help involve stakeholders

### Meetings with fishers

- Concepts
  - Why management is important
  - Why stock assessment is needed
  - Fish stock dynamics and behaviour
- Participatory mapping
- Problem census

### What data is needed?

- Interviews
- Catch-effort data
- Fishing experiments
- Other data

Welcome to the



### Training Workshop

Day 3

25<sup>th</sup> -29<sup>th</sup> July 2005  
College of Fisheries, Mangalore

### ParFish Process



### Stock Assessment Interview

- o The time, catch and effort units need to be identified and used consistently for all interviews.
  - Month, weight/numbers, days fishing
- o The total effort in this fishery over the last year ( $f_{t,i}$ ).
- o For each interviewee:
  - Identify each interviewee's main gear, then last years CPUE ( $q_{t,i,j}$ ) and this year's CPUE ( $q_{t,i}$ ) for each gear.
  - A catch rate range for the unexploited stock ( $U_{t,i,j}$ ).
  - The time for recovery ( $T$ ).

### Step 1

- o The individual catch rates are regressed towards the mean of the sample. For the  $j$ th fisher:

$$[\hat{q}B_i]_j = ([qB_i]_j + (\sqrt{N} - 1)\bar{q}B_i) / \sqrt{N}$$

where  $\bar{q}B_i$  = mean CPUE of the interviews

### Step 2

- o Estimate current state of stock based on ratio of current to unexploited catch rates:

$$\hat{q}B_\infty = \frac{U_l + U_h}{2}$$

$$B_{now} = \frac{\hat{q}B_i}{\hat{q}B_\infty}$$

### Step 3

- o For each fisher, calculate the intrinsic rate of increase ( $r$ ) by solving the non-linear projection equation for the unknown  $r$ :

$$X_1 = X_0(1+r(1-X_0)) \dots X_T = X_{T-1}(1+r(1-X_{T-1}))$$

$$X_0 = \frac{\hat{q}B_i}{\hat{q}B_\infty}, X_T = \frac{U_l}{\hat{q}B_\infty}, \text{ and } \hat{q}B_\infty = \frac{U_l + U_h}{2}$$

### Step 4

- o With  $r$  defined, catchability can be estimated from the current catch rate and effort adjusted for stock change due to production and catch:

$$\hat{q} = \left( \frac{(\hat{q}B_{t-1} - \hat{q}B_t)}{S} + r \hat{q}B_{t-1} \left( 1 - \frac{\hat{q}B_{t-1}}{\hat{q}B_\infty} \right) \right) / f_{t-1} \hat{q}B_{t-1}$$

### Step 5

- o Unexploited biomass can be estimated from  $(U_l + U_h)/2$  and the estimate of  $\hat{q}$ .

$$B_\infty = \frac{\hat{q}B_\infty}{\hat{q}} = \frac{(U_l + U_h)}{2\hat{q}}$$

### Getting Utility

- o Contrast two variables to obtain function shape
- o Primary variables are catch (income) and effort (work done)
- o Rank various outcomes defined as combinations of variable values
- o Score relative difference between outcomes

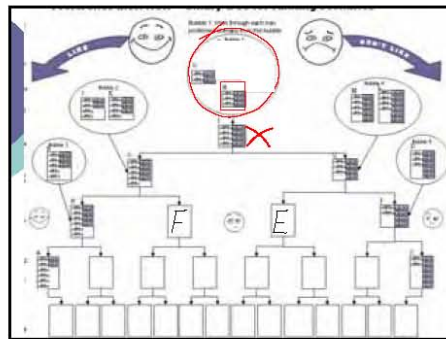
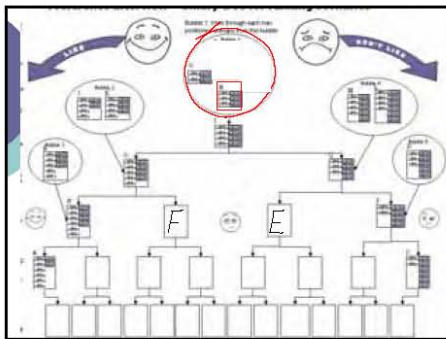
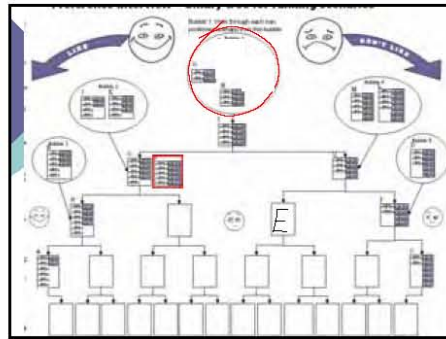
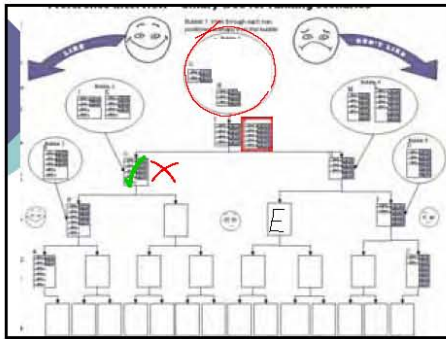
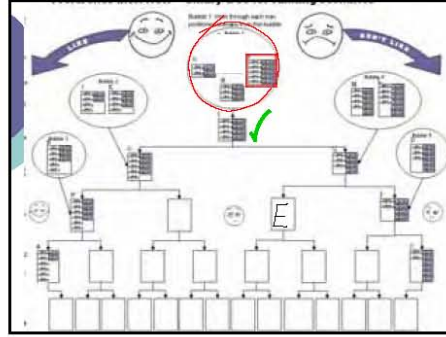
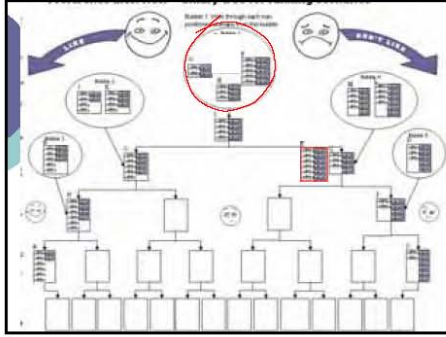
### Preference Interviews

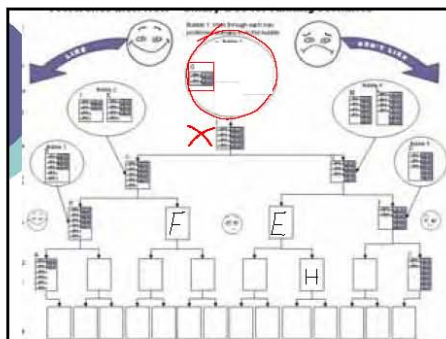
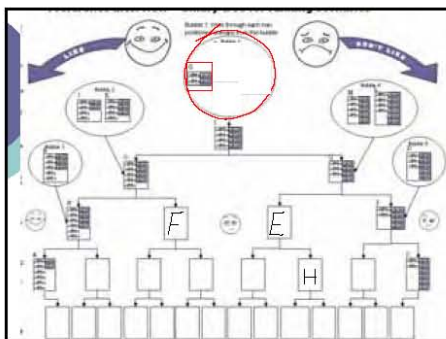
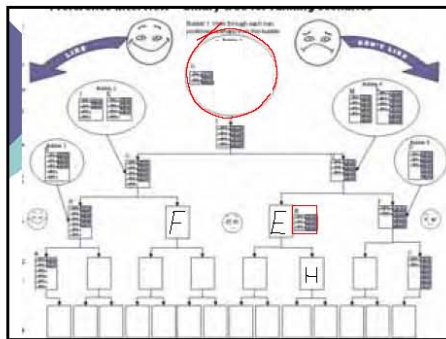
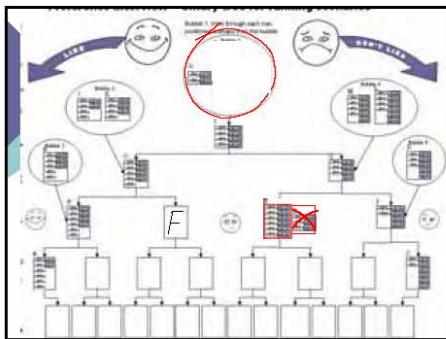
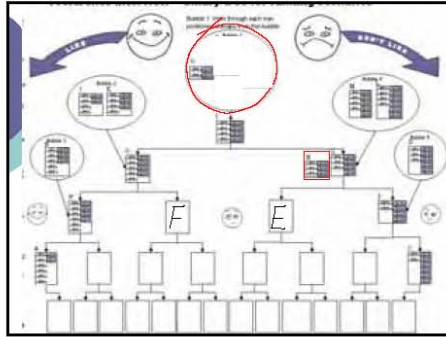
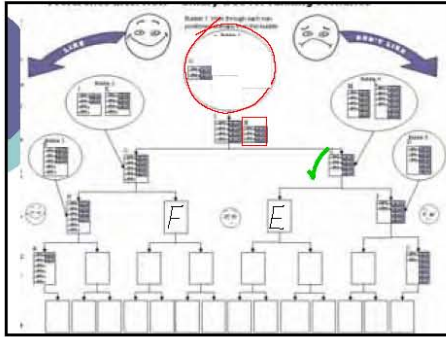
- Scenario cards - different levels of catch and effort
- Pair-wise ranking then scoring
- Score indicates 'utility'

### Example pairwise comparison

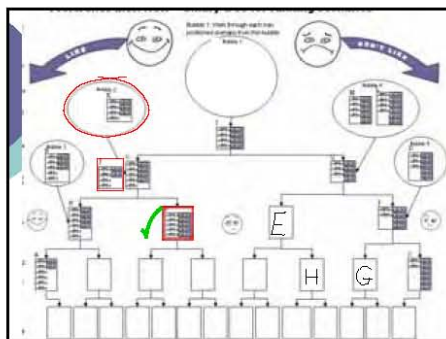
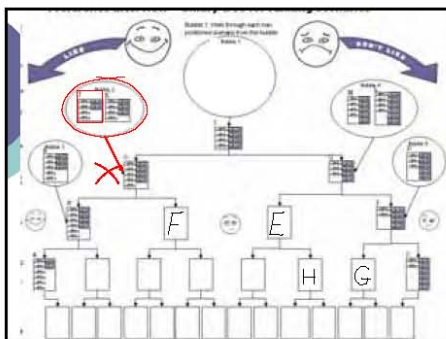
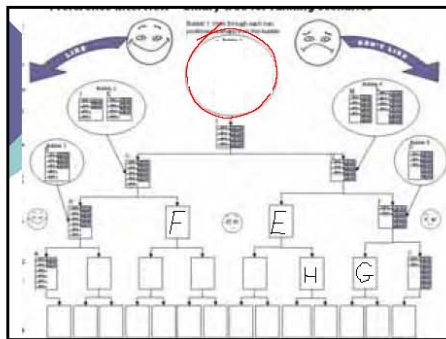
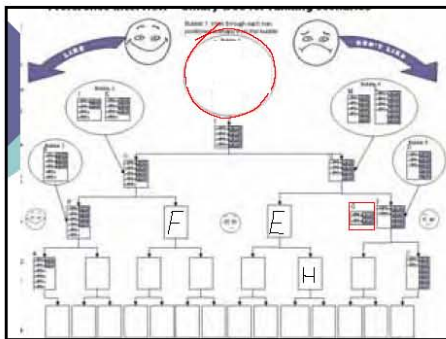
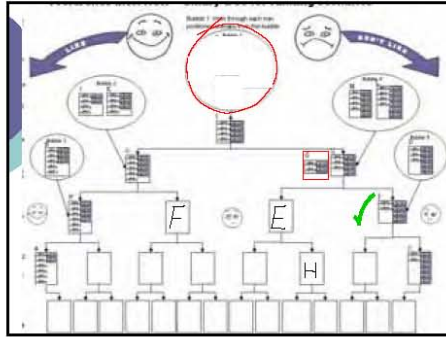
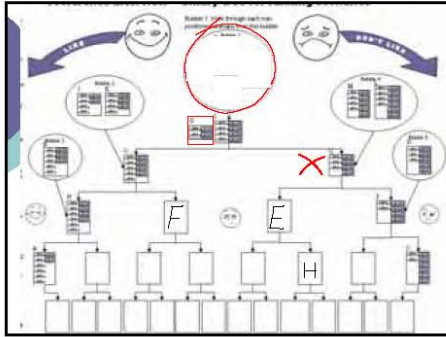
- Keep current work level in the fishery, but get 25% more income/fish, OR
- Keep fishery income the same, but for 25% less time which could be used for other work.

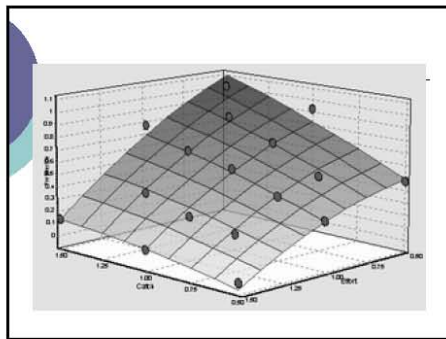
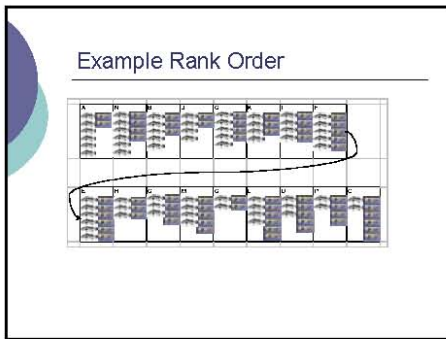
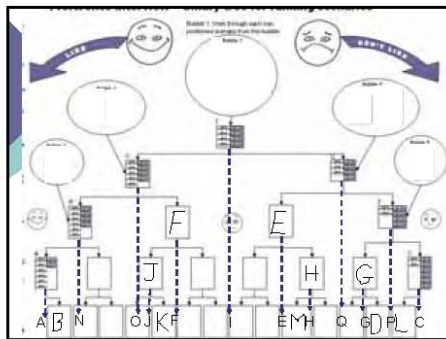
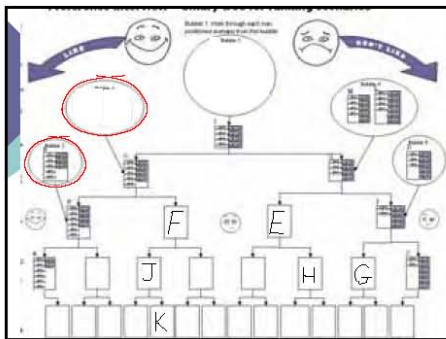
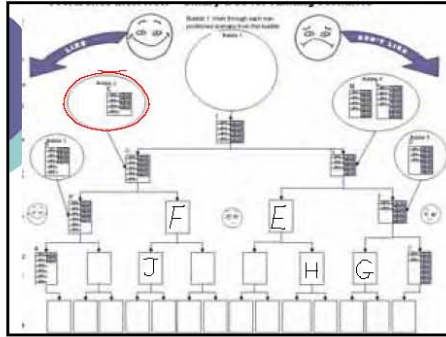
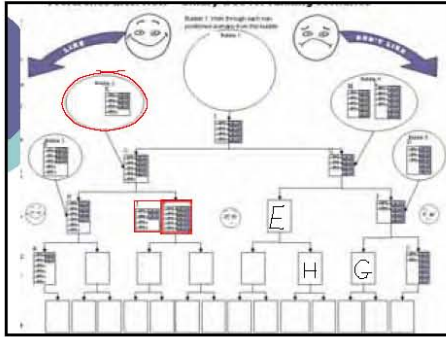


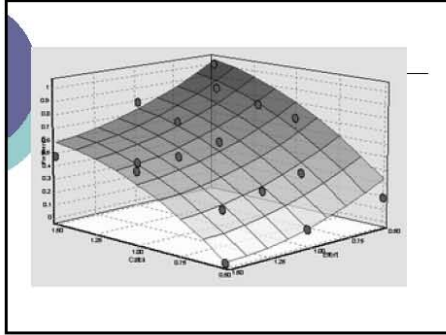












Welcome to the



**parfish**  
PARTICIPATORY FISHERIES STOCK ASSESSMENT

**Training Workshop**

Day 5

25<sup>th</sup> -29<sup>th</sup> July 2005  
College of Fisheries, Mangalore

**Giving feedback on the results**

- Important so that fishers understand the results
- Understanding is necessary for co-management

**Review the ParFish assessment**

- Recap on how the assessment was carried out
  - Interviews
  - Fishing experiments
  - Catch-effort data

**State of the Stock**


- Review concepts
- Chance that the stock is overfished
  - recap uncertainty, oranges, number of people that would believe it is overfished
- Is more information needed?
  - What information?

**Recommended controls**

- Levels of control relative to current situation
- Target control i.e. would be preferred by fishers
- What the expected impact on CPUE would be
  - Use of preference cards
- Compare scientific vs. fisher information

**Prioritising issues and developing an action plan**

- Workshop process, participatory, all relevant stakeholders involved
- Identify the issues and problems in the fishery, considering the assessment results
- Prioritise and identify possible solutions
- Plan for implementation



## Management Plans

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- Process of developing and implementing a management plan requires institutional support and commitment to co-management



## Evaluation

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- Aims:
  - To assess what the process has achieved and what we have learnt
  - To learn from the experience and improve planning for future assessments
- Process:
  - Discussions with various groups
  - Independent evaluations



## FMSP software

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- CEDA, LFDA, YIELD, ParFish
- [www.fmsp.org.uk](http://www.fmsp.org.uk)

## Annex 4: Group exercises

### Background information on ParFish case study

After reading the case study the participants were requested to identify the information they would need to do ParFish and where will they get that information

#### GROUP 1

| Information needed   | Source of data   |
|--|--|
| Population in each village- men, women, children, migratory fishers<br>Number of fishers- Active/ Part time/ Migratory<br>Particulars on crafts and gears, Number and types<br>Annual catch statistics, species, gear, craft<br>Seasonality, peak, lean<br>Biology of important fishery<br>Market information Local and export)<br>Management issues if any<br>Infrastructure<br>Other livelihood opportunities<br>Stakeholders involved<br>Organisation involved<br>Conflict measurement measures | Published material<br>Group interviews<br>Fisheries department<br>Market people<br>NGOs<br>Hoteliers<br>Cooperatives |

#### GROUP 2

| Information needed   | Source of data   |
|--|--|
| Other livelihoods- Agriculture, Animal husbandry, Tourism<br>Handicraft,<br>Types of gear hook and line, traps, nets<br>Type of fisheries-mixed pelagics, demersal, octopus<br>Organisation involved fisheries department, NGO,<br>Cooperative society<br>Financier-NGO<br>Fishing conflict between Net and trap fisher, large vessels from outside vs local traditional, visiting fishers vs locals,<br>Between villages<br>Future scope –scuba diving by men on reefs<br><b>Infrastructure</b> | Village elders<br>Fisheries department<br>Village elders<br>Fishers (men, women)<br>Other stakeholders |
| Group 2<br><b>Background elaborated by Group--</b> 4 villages, Fishery important livelihood activity<br>Nearest market (Kanosh),done by women, nearby tourist Hotel (Octopus), exports<br>Control by village elders<br>There is Major road for Kanosh, Minor road for Demosa graded, Tourist lodge   |  |

### GROUP 3

| Information needed  | Source of data   |
|---|--|
| Frame survey<br>Number of fishers<br>No of craft and gears<br>Spatial distribution of fishery<br>Information on species composition<br>Information on actual effort<br>Information on management regime | Published material<br>Other organisations<br>Research and Academic organisations, NGOs, CDOs, Fisheries department, cooperative societies<br>Key informants, fishers other stakeholders<br>Primary data collection<br>Money lenders, financier<br>Internet<br>Maps |
| <b>Is the fishery suitable for ParFish?</b> (Fishery 3 which is localised and sedentary is suitable but fishery one and two which are mixed gear and migratory arte not suitable )                      |  |

### STAKEHOLDER ANALYSIS

#### Stakeholders analysed

#### Stakeholders' interests and influence

The participants were then asked to categorise the stakeholders into Primary and Secondary stakeholders and write what interests each has in the fishery and in ParFish and whether ParFish is expected to have a positive or negative impact on them.

### GROUP 1

| Stakeholder   | Interests   | +ve or-ve impact |
|---|---|------------------|
| <b>PRIMARY</b>                                      |   |                  |
| Fishers   | Catching fish sustainable                                   | +                |
| Purchaser   | Regular supply  | +/-              |
|   |   |                  |
| Fish trader/Vendor                                  | Collection and transport of fish                            | +/-              |
| Consumers   | Availability of quality product                             | +/-              |
| Financier   | Regular income  | +/-              |
| Fisheries Department                                | Sustainability<br>Socio economic development                | +                |
| <b>SECONDARY</b>                                    |   |                  |
| Craft makers<br>Gear makers/Vendors<br>Scuba makers | Continued work/business/income                              | -/+              |
| Researchers   | Data analysis   | ?                |
| Hotelier  | Business  | +/-              |
| Village leaders                                     | Village harmony   | +/-              |
| Tourists  | Entertainment   | ?                |
| Policy makers                                       | Sustainability/Socio economic upliftment                    | +                |
| Coops   | Welfare   | +                |
| NGO   | Capacity building<br>Alternate employment<br>Savings/thrift | ?                |

## GROUP 2

| Stakeholder   | Interests  | +ve or-ve impact                  |
|---|--|-----------------------------------|
| <b>PRIMARY</b>  |  |                                   |
| Local Fishers<br>Traders<br>Dpt of fisheries                      | Catching fish<br>earning livelihood<br>marketing<br>profits<br>Management<br>Sustainability<br>Welfare | +<br>+<br>+<br>-/+<br>+<br>+<br>+ |
| Exporters<br>Migratory fishers<br>Large fishing vessels<br>owners | Marketing (overseas), profits<br>Livelihoods, Catching fish, Catching<br>fish, profits                 | -/+<br>-/?<br>-                   |
| <b>SECONDARY</b>  |  |                                   |
| NGO<br>Hoteliers<br>Tourists                                      | Resource sustainability<br>Business<br>Fish food   | +<br>+<br>+                       |
| Co-op<br>Crafts and gear makers<br>SCUBA- markers                 | Livelihood<br>Management<br>Business<br>Business   | +<br>+<br>-/+<br>-/+              |
| Financial Institutions  | Credit facility  | +/-                               |
| Village leaders   | Income, management<br>Dispute settlement   | -, -<br>+                         |
| Villagers<br>Consumers  | Economics of village<br>Food   | +<br>+                            |

## GROUP 3

| Stakeholder   | Interests  | +ve or-ve impact |
|---|--|------------------|
| <b>PRIMARY</b>                                      |  |                  |
| Fishers<br>trap<br>net<br>hook and lines<br>octopus | Continue fishing<br>sustainable catch rates<br>livelihood security<br>alternative employment                               |                  |
| Fish traders (including<br>women)                   | Regular supply<br>Higher marketing margin<br>Less marketing channels   |                  |
| Consumers   | Regular supply<br>Accessibility<br>Cost<br>Quality   |                  |
| Boat/Net Makers                                     | Increased fishing activity   |                  |
| Fuel suppliers                                      | Regular fishing without break  |                  |
| Fishing cooperatives                                | Higher productivity<br>Greater participation in fishing<br>Socioeconomic welfare and<br>members<br>Avoidance and middlemen |                  |
| Large vessel operators                              | Increased resource utilisation   |                  |
| <b>SECONDARY</b>                                    |  |                  |



|                       |   |  |
|-----------------------|---|--|
| Migrant fisher        | Higher productivity   |  |
| Hotels and restaurant | Regular and timely supply of fish at reasonable rate and of good quality        |  |
| Tourists              | Quality of fish<br>Pristine ecosystem<br>cleanliness                            |  |
| NGOs                  | Enhance microfinancing system<br>Welfare activities                             |  |
| Fishery Department    | Evolve management strategies<br>Data collection<br>Ensuring livelihood security |  |
| Scuba supplier        | Increased octopus fishery   |  |

The participants then categorised the stakeholders according to their priority and influence each would have on ParFish

|  |  |   |
|--|--|---|
| <b>P<br/>R<br/>I<br/>O<br/>R<br/>I<br/>T<br/>Y</b> | <b>Group 1</b>   |   |
|  | <b>H-L</b><br>Fishers<br>Purchasers<br>Fish traders  | <b>H-H</b><br>Fishery Department<br>Policy makers           |
|  | <b>L-L</b><br>Consumer<br>Financier<br>Makers of crafts and gears<br>Tourists<br>Hoteliers | <b>L=H</b><br>Village leaders<br>NGO<br>Fisher cooperatives |
|  | <b>INFLUENCE</b> ----->----->  |   |

|  |   |   |
|--|---|---|
| <b>P<br/>R<br/>I<br/>O<br/>R<br/>I<br/>T<br/>Y</b> | <b>Group 2</b>  |   |
|  | <b>H-L</b><br>Fishers<br>traders<br>exporters<br>NGOs<br>Craft and gear makers<br>Consumers | <b>H-H</b><br>Fisheries Department<br>Cooperatives<br>Money lenders |

|  |   |   |
|--|---|---|
| <b>P<br/>R<br/>I<br/>O<br/>R<br/>I<br/>T<br/>Y</b> | L-L<br>Migratory fisher<br>Hoteliers<br>Tourists<br>SCUBA makers<br>Villagers | L=H<br>Large vessel owners<br>village leaders |
|  | <b>INFLUENCE</b> ----->----->   |   |

|  |   |   |
|--|---|---|
| <b>P<br/>R<br/>I<br/>O<br/>R<br/>I<br/>T<br/>Y</b> | <b>Group 3</b>  |   |
|  | H-L<br>Fisher traders<br>Consumers<br>Hotel suppliers<br>Hotels and restaurants | H-H<br>Fishers<br>Fishery cooperatives<br>NGOs        |
|  | L-L<br>Boat and net makers<br>Migrant fisher<br>Tourists<br>SCUBA suppliers     | L=H<br>Large vessel operators<br>Fisheries Department |
| <b>INFLUENCE</b> ----->----->                      |   |   |

## COMMUNICATIONS PLANNING

### GROUP 1

| Stakeholders                    | Fishers  | Fish Traders                            | Fisheries department   | NGOs/CBOs                          |
|---------------------------------|--|---|--|------------------------------------|
| <b>Communication objectives</b> | To understand ParFish process<br>Need for S.Ass<br>Data collection methods<br>Results and management | What and why ParFish<br>Data collection | Understand ParFish tools, approach and application<br>Data collection and interoperations of results | Application of Par fish assessment |
| <b>Communication message</b>    | Present state of fish stock through  | Present Yield                           | Planning and management options  | Capacity building                  |

|                               |  |  |  |  |
|-------------------------------|--|--|--|--|
|                               | ParFish Results from Data  |  |  |  |
| <b>Communication material</b> | Village level meetings, posters, handouts, mass media                                      | Meetings, handouts   | Training, workshops, publishing material, software | Posters, handouts                        |
| <b>Communication channels</b> | NGOs. CBOs Fisheries Dpt (extension), Village meetings. Fishermen's cooperatives societies | Fisheries Dpt, NGOs. CBOs/Associations                     | MRAG website                                       | Fisheries Department                     |
| <b>Monitoring indicators</b>  | Meetings attendance and distribution of publicity material                                 | Meetings attendance and distribution of publicity material | Implementation                                     | meetings arranged , number of attendance |

### GROUP 3

| <b>Stakeholders</b>             | <b>Fishers</b>  | <b>Fish Traders</b>   | <b>Consumers</b>                                    | <b>Co-op Soc</b>                                  |
|---------------------------------|---|---|---|---|
| <b>Communication objectives</b> | To understand importance of ParFish to fishery management           | Sustainable fish supply will be ensured by management through ParFish | Ensuring regular fish supply and easy accessibility | Par fish will increase cooperation in the village |
| <b>Communication message</b>    | Guidelines for fisheries management plan and results of ParFish     | Inform results and utility of ParFish                                 | Sustainable management ensures sustainable supply   | Success story of co-management                    |
| <b>Communication material</b>   | Interactive meetings, posters, pamphlets, audio video, street plays | Pamphlets and meetings  | Posters and Pamphlets                               | meetings, reports, interviews                     |
| <b>Communication channels</b>   | NGOs. Co-op Societies, Fisheries Dpt, Local bodies                  | NGOs. And traders organisations                                       | Radio, TV advertisement                             | Direct meetings                                   |
| <b>Monitoring indicators</b>    | Attendance in meetings  | Intensity of trading activities                                       | Consumer preference? Behaviour                      | Increase in membership and activity               |

|                                     |                |
|-------------------------------------|----------------|
| <b>Example provided by Suzannah</b> |                |
| <b>Stakeholders</b>                 | <b>Fishers</b> |

|                                 |   |
|---------------------------------|---|
| <b>Communication objectives</b> | To understand ParFish process<br>Why stock assessment and management are important<br>Data collection<br>Results of the assessment and management options |
| <b>Communication message</b>    | ParFish is a way of understanding the stock<br>-Results of the assessment   |
| <b>Communication material</b>   | Newspapers, meetings, Posters ,Road/street plays  |
| <b>Communication channels</b>   | Via NGOs/CBOs/Cooperative Societies   |
| <b>Monitoring indicators</b>    | Number of fishers at meetings<br>Number of posters distributed etc  |