The Improved Management of Small-Scale Cage Culture in Asia (DFID Research Project R7100): Final Workshop

9th – 11th July 2000

CARE Guest House, Road 7A, Dhanmondi, Dhaka, Bangladesh

Contents

Session 3: A Review Of Tools And Methodologies.

Session 4: Policy Initiatives For Sustainable Cage Culture Development

Executive Summary

The two-year, DFID-funded CAGES-II Project R7100, 'The Improved Management of Small-Scale cage Culture in Asia', is due for completion in August 2000. The purpose of the project is to develop sustained small-scale cage fish culture in inland and coastal waters through improved understanding of the social, institutional and resource environment of resource poor groups. Two Asian countries, Bangladesh (inland systems) and Vietnam (marine), were studied with this workshop bringing together both sides of the project together with representatives of collaborative institutions, government departments and universities. Addressing the overall aim of producing guidelines for the planning and extension of cage aquaculture in Asia a combination of group work and plenary discussion was conducted producing the following outputs. 1) An assessment of cage aquaculture potential, 2) Development options for small-scale cage culture, 3) A review of tools and methodologies and 4) Policy initiatives for sustainable cage culture development. Key issues raised were the use of outputs as a guide to be adapted to regional circumstances to facilitate farmer and extension worker discussion and not as a rigid methodology. The degree of linkage between development, research and government institutions was also considered a crucial factor in benefiting the research and development of cage culture at the local, regional and national level and vital in affecting the future policies by both development and government institutions.

BACKGROUND

Cage aquaculture is one of the fastest growing methods of farmed fish and crustacean production in Asia. Because it utilises publicly owned resources, requires small amounts of capital investment and has a rapid return on investment, it is an option for resource poor farmers. However, there are many issues to be resolved concerning beneficiaries, technologies, methods and policies, as well as the most appropriate approaches to research.

The purpose of the two-year, DFID-funded CAGES-II Project R7100 is to develop sustained small-scale cage fish culture in inland and coastal waters through the improved understanding of the social, institutional and resource environment of resource poor groups. Guidelines for the planning and extension of small-scale aquaculture are required as stated with the project's Logical Framework Appendix (1) to be achieved via the use of an end of project workshop.

This workshop aimed to pull together research and development practitioners from Bangladesh, Vietnam, the UK and Thailand who were working in aquaculture development and who had specific interests in cage aquaculture. The aim being to produce a toolkit for field extension staff to encourage sustainable development of this sector of the rural economy.

WORKSHOP ORGANISATION

The three-day workshop consisted of various sessions, which comprised formal presentations, group and plenary sessions and a field visit to a cage culture project (see Appendix 2 for detailed timetable). Attended by 46 delegates from Bangladesh, the U.K, Thailand and Vietnam representing NGOs, government departments and academic institutions the workshop had a wide multi-disciplinary array of knowledge at its disposal, utilised in the compilation of this report

REPORT STRUCTURE

This report outlines the guidelines required, via four outputs;

1. The assessment of cage culture potential
2. The production of development options
3. A review of the research tools and methodologies used in project R7100
4. Policy initiatives for sustainable cage culture development

For each section an outline of the methodologies involved and the intended outputs are given, followed by the outputs themselves and relevant appendixes.

1. ASSESSMENT OF CAGE AQUACULTURE POTENTIAL

Chair Paul Bulcock

Objective

?? to identify categories of possible constraints to farmer uptake;

?? to identify particular constraints within the categories;

?? to develop an appropriate ranking and scoring system(s) to assess cage culture potential.

Output

?? A checklist/scoring system for NGOs and extension workers that can serve as a basis for identification of potential beneficiaries and technology packages.

Method

?? initial presentation outlining the aim and intended outputs of this session;

?? plenary discussion session to identify categories of constraints and opportunities

?? small group-based discussions to identify constraints and opportunities;

?? presentations and plenary discussions on small group findings;

?? small group-based discussions to identify ranking and scoring systems

?? presentations and plenary discussions on small group findings.

Introduction

Past attempts to use cage culture for the benefit of the rural resource poor have failed primarily due to the inadequate consideration of the social, technical, economic and institutional context of potential beneficiaries. Extension workers and development projects must give consideration to these particular factors and in discussion with farmers decide whether cage culture is appropriate to their situation and needs. The aim of this component of the project was to identify the main categories of constraint that would form the backbone for discussion.

Output

The main categories identified by the participants as crucial to the discussion process between the farmer and extension worker the extension officer when assessing the potential for small-scale cage culture were identified and grouped under the four types outlined below

?? Needs Assessment
?? Site Selection
?? Inputs
?? Outputs

Within each category, individual criteria were identified, and it is through a consideration and discussion of these criteria that the farmer and extension worker can determine the validity of small-scale low input cage culture. Using this, or a similar checklist based upon it, it is hoped that an informed decision on the validity of cage culture as an alternative Income Generating Activity (IGA) can be made.

It was decided that it would be unsuitable to rank or score the constraints and criteria as farmer priorities and situations vary; rather they should serve as a 'basis for discussion'. From the use of this checklist combined with the farmer's knowledge of his environment, livelihood and local resources the farmer and extension worker can determine whether cage culture is both an appropriate and viable IGA. Following this, a consideration of the profiles outlined in section 2 can be made identifying which, if any, are most suited to the circumstances of farmers.

A checklist for NGOs and extension workers

Needs Assessment

Key Constraints	***Criteria***
Target group selection	?? Depends on criteria of project
The level of interest in cage culture expressed by the farmer	?? The lack of alternative aquaculture options ?? The level of demand for fish and amount of supply ?? The level of alternative employment options

Site Selection

Key constraints	***Criteria***
Access	?? Cost of access ?? Security of tenure
Suitability	?? The year round level of water ?? The water quality ?? Access to input and output sources
Vulnerability	?? The susceptibility to climate hazards ?? Proximity of cages to household[1] ?? The level of security provided by other community members[2]

[1](Bangladesh) The risk of poaching increases with distance of cages from household
[2](Bangladesh) Single women operators suffer more theft

Inputs

Key constraints	***Criteria***
Finance	?? The level of access to capital and operating costs[3]
Labour	?? The Household division of tasks[4] ?? Community division of tasks ?? The seasonal division of labour
Knowledge and Skills	?? The current level of skills and knowledge i.e. the level of farmers experience ?? The amount of access to skills and knowledge i.e. extension services.
Cage Materials	?? Local availability ?? Quality and cost of these materials
Seed	?? Local availability ?? Quality and cost of these materials
Feed	The level of access to: ?? Natural feed sources ?? Kitchen by-products ?? Agricultural by-products ?? Village waste ?? Other by-products, such as hotel and abattoir wastes
Competition	?? The degree of competition for these inputs with other resource users and the potential conflicts which may arise.

[3]Less important in Bangladesh than Vietnam where costs are lower and as project works through NGOs most farmers have access to micro-credit. However financial management by farmers of loans is considered a problem. As farmer generally more than is required and finds repayment difficult.

[4](Bangladesh) Children participate in feed gathering, Women feed preparation and application, Men marketing and selection of fingerlings

Outputs

Key Constraints	***Criteria***
Markets	?? Intended market for product[5] and access to markets
Environmental	?? Is the environmental capacity suitable and what will the effects of this activity on it[6]
Social	?? Will a positive or negative change in livelihood and social status be produced

[5]The sale of live fish is common and can result in higher returns.

[6]Fish escapes are common and the impacts of non-indigenous species e.g. *Oreochromis niloticus* should be considered. Benthos degradation should be determined, such as the production of Hydrogen Sulphide (H_2S) in permanent water bodies and increasing the risk of fish kills. Other potential resource conflicts should also be addressed such as the introduction of cages or navigation and other livelihoods such as fishermen. Consideration of alternative uses of inputs such as feed and the effects of an increase in demand should also be considered.

2. DEVELOPMENT OPTIONS FOR SMALL-SCALE CAGE CULTURE

Chair Malcolm Beveridge

Objective

?? to develop an understanding of the resources necessary to the sustained development of cage aquaculture for resource poor farmers in rural Asia.

Output

?? a series of cage profiles of small-scale marine and freshwater cage culture, based on Vietnam and Bangladesh;

?? decision trees to help identify cage culture packages appropriate to on-farm and environmental resources of the rural poor.

Method

?? initial presentation outlining the aim and intended outputs of this session;

?? group-based (4) discussions to identify Outputs 1 and 2 for both marine and freshwater cage systems;

?? presentations and plenary discussion of outputs.

Cage Profiles

Introduction

Once cage aquaculture has been identified as a potential benefit via discussion centred on the checklist described in Section One, the selection of a cage culture technology that fits an individual's needs can be made. In order to assist future planners and development workers in this task summary profiles were constructed for inland and coastal systems Appendices (2i; 2ii) and from a consideration of the major constraints outlined in the checklist decision trees were produced Appendix (2iii; 2iv and 2v).

Summary profiles of cage culture systems currently used in Asia

The profiles, Appendix (2i) and Appendix (2ii) summarise key features of different cage aquaculture systems currently in use in Asia. The information on each sheet is derived from practical examples drawn from different parts of the region. All quantities and values have been scaled to $1m^3$ of cage volume.

?? The information is indicative only: the actual figures (both production parameters and financial values) are snapshots of the current situation in Bangladesh and Vietnam and vary widely according to local circumstances.

?? The Tables Are Informed Estimates of Average Performance, Based on Project Data, Discussions with Farmers and Discussions with CARE and UoF Technical Staff. Actual Costs and Returns, and the Relative Attractiveness of Different Cage Culture Options, will vary Widely According to the Cost, Availability and quality of Labour, Seed and Feed; the Nature and Size of the Local Market; and the Knowledge and Skill of Farmers.

?? The profiles should therefore serve as a basis for discussion and the values and figures should be examined critically and adapted accordingly.

?? Only the major necessary costs of capital investment (cages only), seed, feed and labour are included. Other costs (such as equipment, medicines, fuel etc) are likely to vary enormously from location to location and according to the scale of enterprise. The returns given are therefore generally higher than would be achieved in practise.

?? The inland (Appendix 2i) and coastal (Appendix 2ii), profiles are considered under into five main sections Key features, Input/Outputs, Risk Profiles, Market Outlook and notes Appendix (2).

Appendix (2) Summary features of cage profiles.

These brief summary profiles can be sub-divided into five groups:

1) Key features

This section is largely self-explanatory, and summarises key features in terms of site requirements, start-up costs, markets, and risk.

?? **For *temperature and salinity* three figures are given: the upper and lower values of the range within which commercial rates of growth can take place and the optimum value.**

?? **For *water quality requirement* three ratings are given: low, medium and high. Almost all fish grow better in high water quality, but some fish are more tolerant of low water quality – at least in the short term. Low water quality is defined here as water with oxygen content regularly <3 mg/l, low transparency (<5 cm) (high concentrations of nutrients; high organic matter loadings). Medium water quality is defined as water with 3-5 mg/l oxygen; transparency <30 cm. High water quality is defined as >5 mg/l oxygen, transparency >30 cm.**

?? ***Capital costs* are related to costs of materials and size of cage.**

?? ***Profit* is the difference between input costs and sales revenue. In practice profit would normally be less than this figure, since only costs of labour, feed, and seed are considered.**

?? ***Gross margin* This represents the net money generated by the operator once inputs are accounted for, excluding labour and cage depreciation. The major factor influencing decisions concerning small-scale cage culture is gross margin versus labour input and investment risk.**

?? ***Return on labour* is the labour rate (U.S $/day) that would reduce profit to zero. It is an indication of how much of the revenue generated is available to pay for labour.**

?? ***Scale* issues. What are the most likely immediate effects of expansion on cage culture profile?**

2) Input/Output

?? **The investment in terms of feed, seed and labour required for a typical system and the resulting returns in terms of production and potential financial returns**

3) Risk Profiles

?? ***Risk rating.*** **This is a composite index based on an assessment and consideration of the following factors: the prevalence and impact of diseases, the length of the production cycle, minimum start-up capital required, profit margin, price variation and payback period.**

?? ***Length of the production cycle*** **(months) is an indicator of financial risk. A shorter cycle means that the capital invested is at risk for a shorter period of time. Where more than one cycle is possible in a year (depending on availability of water and the temperature regime) this implies a more regular income.**

?? ***Minimum start-up capital*** **gives an indication of the minimum total capital and working capital investment required before the first crop is harvested. This includes only the cost of the cage and the working capital requirements in terms of feed and seed for the first crop. The figure is based on the smallest viable system currently in use. It should be noted that operators of such small systems (with low labour productivity) may find it difficult to compete with larger enterprises (with high labour productivity) as production increases and prices (typically) fall. Effective organisation of small-scale producers may help to overcome this problem.**

?? ***Profit margin*** **is the ratio of profit to sales revenue, and is an important indicator of vulnerability to falling product price or rising input costs. In Bangladesh this is given for systems including and excluding labour costs, as cage culture activities are often incorporated into household activities, affording little opportunity costs.**

?? ***Payback period*** **This represents the number of production cycles required to pay off the start-up investment, assuming that all gross margin earnings were used for this purpose.**

4) Market outlook

?? **A brief overview of the *market* is provided in terms of the strength of demand in national and international markets. If the market is large and international, prices are likely to remain fairly stable despite increased aquaculture production. If the market is small and specialised, significant aquaculture production is likely to depress prices.**

5) Notes

?? **Notes identify the principle assumptions made regarding the formation of these profiles with respect to capital costs, seed, feed and labour.**

?? **Notes include outlines of why in Bangladesh examples of profit margin and payback period are given including and excluding labour.**

Appendix 2i. Cage culture profile for inland systems [1]

CAGE CULTURE PROFILE
Tilapia culture, Bangladesh, commercial feed

location	**Bangladesh**	**cycles/yr**	**2**
cage size	**1 m3**	**risk**	**low**
species	***Oreochromis niloticus***	**return**	**medium**

Key features

environmental requirements	
salinity	**0-20 ppt**
water quality	**>low**
temperature	**>25**
investment cost	
capital costs	**7**
capital costs/m^3 cage	**7**
life of cage	**2**
financial returns/cycle	
profit/m3	**1**
gross margin/m3	**12**
return on labour	**1**
Scale issues	**increase in no. of cages will reduce labour requirements**

Input/output profile (per m^3 per cycle)

inputs	**quantity**	**$**
capital costs/cycle		**1.8**
seed		**4.0**
feed		**10.0**
labour (day)	**14**	**10.8**
outputs	**kg**	**$**
fish		**28.0**
organic matter	**/**	
nitrogen	**/**	
total costs per crop		**26.6**
total revenue per crop		**28.0**

Risk profile

disease incidence	***low***
length of production cycle (months)	**3.5**
minimum start-up capital ($)	**21**
investment in one crop ($)	**27**
profit margin (%)	**5**
profit margin (excluding labour) (%)	**44**
price variation	**low**
payback period (cycles)	**14.5**
payback period(excluding labour) (cycles)	**1.7**
comment	**disease may increase**
overall	**low**

Market outlook

local	**medium**
national	**low**
international	**low**

Notes

Capital costs, Cost of cage materials only
Seed, hatchery reared, 90% survival
Feed, Commercial pellets when available
Labour is calculated at agricultural rates of 40 Tka /day ($ 0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

[1] ***The profiles are estimates of average performance based on project data, discussions with farmers, and with CARE staff. Actual costs and returns and the relative attractiveness of different cage culture options will vary widely according to the cost, availability and quality of labour, seed and feed, the nature and size of the local market, and the knowledge of the farmer.***

CAGE CULTURE PROFILE

Tilapia culture, Bangladesh, natural and commercial supplemental feed

location	Bangladesh	*cycles/yr*	2
cage size	1 m3	*risk*	low
species	*Oreochromis niloticus*	*return*	medium

Key features	
environmental requirements	
salinity	0-20 ppt
water quality	>low
temperature	>25
investment cost	
capital costs	7
capital costs/m^3 cage	7
life of cage	2
financial returns/cycle	
profit/m3	1
gross margin/m3	17
return on labour	1
Scale issues	increase in no. of cages will reduce labour requirements

Input/output profile (per m^3 per cycle)		
inputs	quantity	$
capital costs/cycle		1.8
seed		4.0
feed		4.0
labour (day)	19	15.0
outputs	kg	$
fish		26.0
organic matter	/	
nitrogen	/	
total costs per crop		24.8
total revenue per crop		26.0

Risk profile	
disease incidence	*low*
length of production cycle (months)	3.5
minimum start-up capital ($)	15
investment in one crop ($)	25
profit margin (%)	5
profit margin (excluding labour) (%)	63
price variation	low
payback period (cycles)	12.0
payback period(excluding labour) (cycles)	0.9
comment	disease may increase
overall	low

Market outlook	
local	medium
national	low
international	low

Notes

Capital costs, Cost of cage materials only

Seed, hatchery reared, 90% survival

Feed, Commercial pellets when available plus locally available items

Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

CAGE CULTURE PROFILE
Tilapia culture, Bangladesh, natural feed

location	**Bangladesh**	**cycles/yr**	**2**
cage size	**1 m3**	**risk**	**low**
species	***Oreochromis niloticus***	**return**	**low**

Key features	
environmental requirements	
salinity	**0-20 ppt**
water quality	**>low**
temperature	**>25**
investment cost	
capital costs	**7**
capital costs/m^3 cage	**7**
life of cage	**2**
financial returns/cycle	
profit/m3	**-3**
gross margin/m3	**18**
return on labour	**1**
Scale issues	**increase in no. of cages will reduce labour requirements**

Input/output profile (per m^3 per cycle)		
inputs	**quantity**	**$**
capital costs/cycle		**1.8**
seed	**200**	**4.0**
feed	**0**	**0.0**
labour (day)	**26**	**20.8**
outputs	**kg**	**$**
fish		**24.0**
organic matter	**/**	
nitrogen	**/**	
total costs per crop		**26.6**
total revenue per crop		**24.0**

Risk profile	
disease incidence	***low***
length of production cycle (months)	**3.5**
minimum start-up capital ($)	**11**
investment in one crop	**27**
profit margin (%)	**-11**
profit margin (excluding labour) (%)	**76**
price variation	**low**
payback period (cycles)	**-4.3**
payback period (excluding labour) (cycles)	**0.6**
comment	**disease may increase**
overall	**low**

Market outlook	
local	**medium**
national	**low**
international	**low**

Notes
Capital costs, Cost of cage materials only
Seed, hatchery reared, 90% survival
Feed locally available items
Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

CAGE CULTURE PROFILE

Grass carp culture, Bangladesh, fed a supplemental commercial feed

location	**Bangladesh**	**cycles/yr**	**1**
cage size	**1 m^3**	**risk**	**low**
species	***Ctenepharyngodon idella***	**return**	**medium**

Key features	
environmental requirements	
salinity	**0 ppt**
water quality	**high**
temperature	**>25**
investment cost	
capital costs	**7**
capital costs/m^3 cage	**7**
life of cage	**3**
financial returns/cycle	
profit/m3	**2.4**
gross margin/m3	**33**
return on labour	**1**
Scale issues	**increase in no. of cages will reduce labour requirements**

Input/output profile (per m^3 per cycle)		
inputs	**quantity**	**$**
capital costs/cycle		**1.8**
seed	**/**	**12.0**
feed	**/**	**3.0**
labour (day)	**30**	**24.0**
outputs	**kg**	**$**
fish		**50.0**
organic matter	**/**	
nitrogen	**/**	
total costs per crop		**40.8**
total revenue per crop		**50.0**

Risk profile	
disease incidence	***low***
length of production cycle (months)	**8**
minimum start-up capital ($)	**22**
investment in one crop ($)	**41**
profit margin (%)	**17**
profit margin (excluding labour) (%)	**65**
price variation	**low**
payback period (cycles)	**2.5**
payback (excluding labour) (cycles)	**0.7**
comment	**disease may increase**
overall	**low**

Market outlook	
local	**medium**
national	**low**
international	**low**

Notes

Capital costs, accounts for costs of cage materials
Seed, Hatchery reared, 90% survival.
Feed, High protein sources incurs high cost unless local alternative sources can be found
Labour An increse in the number of cages per enterprise will greatly reduce labour rerequirements
Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

CAGE CULTURE PROFILE
Grass carp culture, Bangladesh, fed a natural feed

location	**Bangladesh**	**cycles/yr**	**1**
cage size	**1 m^3**	**risk**	**low**
species	***Ctenepharyngodon idella***	**return**	**medium**

Key features

environmental requirements	
salinity	**0 ppt**
water quality	**high**
temperature	**>25**
investment cost	
capital costs	**7**
capital costs/m^3 cage	**7**
life of cage	**3**
financial returns/cycle	
profit/m3	**3.3**
gross margin/m3	**35**
return on labour	**1**
Scale issues	**increase in no. of cages will reduce labour requirements**

Input/output profile (per m^3 per cycle)

inputs	**quantity**	**$**
capital costs/cycle		**1.8**
seed	**/**	**12.0**
feed	**/**	**1.0**
labour (day)	**40**	**32.0**
outputs	**kg**	**$**
fish		**50.0**
organic matter	**/**	
nitrogen	**/**	
total costs per crop		**46.8**
total revenue per crop		**50.0**

Risk profile

disease incidence	***low***
length of production cycle (months)	**8**
minimum start-up capital ($)	**52**
investment in one crop ($)	**47**
profit margin (%)	**7**
profit margin (excluding labour) (%)	**71**
price variation	**low**
payback period (cycles)	**6.2**
payback (excluding labour) (cycles)	**0.6**
comment	**disease may increase**
overall	**low**

Market outlook

local	**medium**
national	**low**
international	**low**

Notes

Capital costs. accounts for costs of cage materials
Seed. Hatchery reared. 90% survival.
Feed. High protein sources incurs high cost unless local alternative sources can be found
Labour An increse in the number of cages per enterprise will greatly reduce labour rerequirements
Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

Silver barb culture, Bangladesh fed a commercial feed.

location	**Bangladesh**	*cycles/yr*	**2**
cage size	**1 m^3**	*risk*	**low**
species	***Puntius gonionotus***	*return*	**medium**

Key features	
environmental requirements	
salinity	**0 ppt**
water quality	**high**
temperature	**>25**
investment cost	
capital costs	**7**
capital costs/m^3 cage	**7**
life of cage	**2**
financial returns/cycle	
profit/m3	**7**
gross margin/m3	**18**
return on labour	**1**
Scale issues	**increase in no. of cages will reduce labour requirements**

Input/output profile (per m^3 per cycle)		
inputs	**quantity**	**$**
capital costs/cycle		**1.8**
seed		**7.0**
feed		**10.0**
labour	**14**	**10.8**
outputs	**kg**	**$**
fish		**36.0**
organic matter	**/**	
nitrogen	**/**	
total costs per crop		**29.6**
total revenue per crop		**36.0**

Risk profile	
disease incidence	***low***
length of production cycle (months)	**3.5**
minimum start-up capital ($)	**24**
investment in one crop ($)	**30**
profit margin (%)	**19**
profit margin (excluding labour) (%)	**49**
price variation	**low**
payback period (cycles)	**3.4**
payback period (excluding labour) (cycles	**1.3**
comment	**disease may increase**
overall	**low**

Market outlook	
local	**medium**
national	**low**
international	**low**

Notes

Capital costs, Cost of cage materials only
Seed, hatchery reared, 90% survival
Feed, Commercial pellets when available
Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

CAGE CULTURE PROFILE

Silver barb culture, Bangladesh fed a natural feed, plus supplemental commercial feed.

location	Bangladesh	*cycles/yr*	2
cage size	1 m^3	*risk*	low
species	*Puntius gonionotus*	*return*	medium

Key features	
environmental requirements	
salinity	0 ppt
water quality	high
temperature	>25
investment cost	
capital costs	7
capital costs/m^3 cage	7
life of cage	2
financial returns/cycle	
profit/m3	4
gross margin/m3	20
return on labour	1
Scale issues	increase in no. of cages will reduce labour requirements

Input/output profile (per m^3 per cycle)		
inputs	quantity	$
capital costs/cycle		1.8
seed		7.0
feed		2.0
labour (day)	19	15.0
outputs	kg	$
fish		30.0
organic matter	/	
nitrogen	/	
total costs per crop		25.8
total revenue per crop		30.0

Risk profile	
disease incidence	*low*
length of production cycle (months)	3.5
minimum start-up capital ($)	16
investment in one crop ($)	26
profit margin (%)	16
profit margin (excluding labour) (%)	66
price variation	low
payback period (cycles)	3.4
payback period (excluding labour) (cycles)	0.8
comment	disease may increase
overall	low

Market outlook	
local	medium
national	low
international	low

Notes

Capital costs, Cost of cage materials only
Seed, hatchery reared, 90% survival
Feed, naturally available items when available plus suppl commercial feed
Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

CAGE CUTURE PROFILE

Silver barb culture, Bangladesh, fed a natural feed.

location	**Bangladesh**	**cycles/yr**	**2**
cage size	**1 m^3**	**risk**	**low**
species	***Puntius gonionotus***	**return**	**medium**

Key features	
environmental requirements	
salinity	**0 ppt**
water quality	**high**
temperature	**>25**
investment cost	
capital costs	**7**
capital costs/m^3 cage	**7**
life of cage	**2**
financial returns/cycle	
profit/m3	**-3**
gross margin/m3	**18**
return on labour	**1**
Scale issues	**increase in no. of cages will reduce labour requirements**

Input/output profile (per m^3 per cycle)		
inputs	**quantity**	**$**
capital costs/cycle		**1.8**
seed		**7.0**
feed		**0.0**
labour (day)	**26**	**20.8**
outputs	**kg**	**$**
fish		**26.0**
organic matter	**/**	
nitrogen	**/**	
total costs per crop		**29.6**
total revenue per crop		**26.0**

Risk profile	
disease incidence	***low***
length of production cycle (months)	**3.5**
minimum start-up capital ($)	**14**
investment in one crop ($)	**30**
profit margin (%)	**-12**
profit margin (excluding labour) (%)	**68**
price variation	**low**
payback period (cycles)	**-4.3**
payback period (excluding labour) (cycles)	**0.8**
comment	**disease may increase**
overall	**low**

Market outlook	
local	**medium**
national	**low**
international	**low**

Notes

Capital costs, Cost of cage materials only
Seed, hatchery reared, 90% survival
Feed, naturally available items when available
Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

CAGE CULTURE PROFILE

Pangas culture, Bangladesh, commercial feed.

location	**Bangladesh**	**cycles/yr**	**1**
cage size	**1 m^3**	**risk**	**low**
species	***Pangasius sutchii***	**return**	**medium**

Key features	
environmental requirements	
salinity	**0 ppt**
water quality	**high**
temperature	**>25**
investment cost	
capital costs	**7**
capital costs/m^3 cage	**7**
life of cage	**3**
financial returns/cycle	
profit/m3	**28**
gross margin/m3	**52**
return on labour	**2**
Scale issues	**increase in no. of cages will reduce labour requirements**

Input/output profile (per m^3 per cycle)		
inputs	**quantity**	**$**
capital costs/cycle		**2.3**
seed		**7.0**
feed		**54.0**
labour (day)	**30**	**24.0**
outputs	**kg**	**$**
fish	**35**	**115.0**
organic matter	**/**	
nitrogen	**/**	
total costs per crop		**87.3**
total revenue per crop		**115.0**

Risk profile	
disease incidence	***low***
length of production cycle (months)	**9**
minimum start-up capital ($)	**68**
investment in one crop ($)	**87**
profit margin (%)	**24**
profit margin (excluding labour) (%)	**49**
price variation	**low**
payback period (cycles)	**2.4**
payback period (excluding labour) (cycles)	**1.3**
comment	**disease may increase**
overall	**medium**

Market outlook	
local	**medium**
national	**low**
international	**low**

Notes

Capital costs. accounts for costs of cage materials
Seed, Hatchery reared, 90% survival.
Feed, High protein sources incurs high cost unless local alternative sources can be found
Labour An increse in the number of cages per enterprise will greatly reduce labour rerequirements
Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

CAGE CULTURE PROFILE

Pangas culture, Bangladesh supplemental commercial feed.

location	**Bangladesh**	**cycles/yr**	**1**
cage size	**1 m^3**	**risk**	**low**
species	***Pangasius sutchii***	**return**	**medium**

Key features	
environmental requirements	
salinity	**0 ppt**
water quality	**high**
temperature	**>25**
investment cost	
capital costs	**7**
capital costs/m^3 cage	**7**
life of cage	**3**
financial returns/cycle	
profit/m3	**18**
gross margin/m3	**50**
return on labour	**1**
Scale issues	**increase in no. of cages will reduce labour requirements**

Input/output profile (per m^3 per cycle)		
inputs	**quantity**	**$**
capital costs/cycle		**2.3**
seed		**7.0**
feed		**27.0**
labour (day)	**40**	**32.0**
outputs	**kg**	**$**
fish		**86.4**
organic matter	**/**	
nitrogen	**/**	
total costs per crop		**68.3**
total revenue per crop		**86.4**

Risk profile	
disease incidence	***low***
length of production cycle (months)	**9**
minimum start-up capital ($)	**41**
investment in one crop ($)	**68**
profit margin	**21**
profit margin (excluding labour) (%)	**58**
price variation (%)	**low**
payback period (cycles)	**2.3**
payback period (excluding labour) (cycles	**0.8**
comment	**disease may increase**
overall	**medium**

Market outlook	
local	**medium**
national	**medium**
international	**low**

Notes

Capital costs, accounts for costs of cage materials
Seed, Hatchery reared, 90% survival.
Feed, High protein sources incurs high cost unless local alternative sources can be found
Labour An increse in the number of cages per enterprise will greatly reduce labour rerequirements
Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

CAGE CULTURE PROFILE

Grass carp culture, Bangladesh, nursing.

location	**Bangladesh**	**cycles/yr**	**1**
cage size	**1 m^3**	**risk**	**low**
species	***Ctenepharyngodon idella***	**return**	**medium**

Key features	
environmental requirements	
salinity	**0 ppt**
water quality	**high**
temperature	**>25**
investment cost	
capital costs	**7**
capital costs/m^3 cage	**7**
life of cage	**4**
financial returns/cycle	
profit/m3	**-11.2**
gross margin/m3	**12**
return on labour	**0.6**
Scale issues	**increase in no. of hapas will reduce labour requirements**

Input/output profile (per m^3 per cycle)		
inputs	**quantity**	**$**
capital costs/cycle		**1.8**
seed		**6.0**
feed	**/**	**4.0**
labour (day)	**30**	**24.0**
outputs	**kg**	**$**
fish		**50.0**
organic matter /		
nitrogen /		
total costs per crop		**35.8**
total revenue per crop		**24.0**

Risk profile	
disease incidence	***low***
length of production cycle (months)	**8**
minimum start-up capital ($)	**17**
investment in one crop ($)	**36**
profit margin (%)	**-49**
profit margin (excluding labour) (%)	**51**
price variation	**low**
payback period (cycles)	**-1.4**
payback (excluding labour) (cycles)	**1.4**
comment	**disease may increase**
overall	**low**

Market outlook	
local	**medium**
national	**low**
international	**low**

Notes

Capital costs, accounts for costs of cage materials

Seed, Hatchery reared, 90% survival.

Feed, High protein sources incurs high cost unless local alternative sources can be found

Labour An increse in the number of cages per enterprise will greatly reduce labour rerequirements

Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

CAGE CULTURE PROFILE

Pangas culture, Bangladesh nursing

location	**Bangladesh**	**cycles/yr**	**2**
cage size	**1 m^3**	**risk**	**low**
species	***Pangasius sutchii***	**return**	**medium**

Key features	
environmental requirements	
salinity	**0 ppt**
water quality	**high**
temperature	**>25**
investment cost	
capital costs	**8**
capital costs/m^3 cage	**8**
life of cage	**2**
financial returns/cycle	
profit/m3	**59**
gross margin/m3	**71**
return on labour	**5**
Scale issues	**increase in no. of cages will reduce labour requirements**

Input/output profile (per m^3 per cycle)		
inputs	**quantity**	**$**
capital costs/cycle		**2.0**
seed		**40.0**
feed		**7.0**
labour (day)	**15**	**12.0**
outputs	**kg**	**$**
fish		**120.0**
organic matter	**/**	
nitrogen	**/**	
total costs per crop		**61.0**
total revenue per crop		**120.0**

Risk profile	
disease incidence	***low***
length of production cycle (months)	**9**
minimum start-up capital ($)	**55**
investment in one crop ($)	**61**
profit margin (%)	**49**
profit margin (excluding labour) (%)	**59**
price variation	**low**
payback period (cycles)	**0.9**
payback period (excluding labour) (cycles)	**0.8**
comment	**disease may increase**
overall	**medium**

Market outlook	
local	**medium**
national	**low**
international	**low**

Notes

Capital costs, accounts for costs of hapa materials
Seed, Hatchery reared, 90% survival.
Feed, High protein sources incurs high cost unless local alternative sources can be found
Labour An increse in the number of cages per enterprise will greatly reduce labour rerequirements
Labour is calculated at agricultural rates of 40 Tka /day ($0.8). In practice, food gathering is often undertaken by children and or adults during the period of wage labour shortage.

Appendix 2ii. Cage culture profiles for marine systems[2]

CAGE CULTURE PROFILE
Grouper culture Vietnam: single small cage

location	*Vietnam*		*cycles/yr*	*1*
cage size	*13.5*	*m3*	*risk*	*low/medium*
species	*Epinephelus bleekeri*		*return*	*high*

Key features	
environmental requirements	
salinity	>25ppt
water quality	high
temperature	25-30
investment cost	
capital costs[1]	250
capital costs/m^3 cage	19
life of cage	4
financial returns/cycle	
profit/m3	24
gross margin/m3	30
return on labour	5
Scale issues	expansion leads to significant increases in return related mainly to more efficient utilisation of labour

Input/output profile (per m^3 per cycle)		
inputs	quantity	$
capital costs/cycle		4.6
seed	10	4.0
feed	48	9.6
labour (day)	6	6.1
outputs	kg	$
fish	8	48.0
organic matter	8	
nitrogen	2.1	
total costs per crop		24.3
total revenue per crop		48.0

Risk profile	
disease incidence	*low*
length of production cycle (months)	8
minimum start-up capital ($) 1	516
investment in one crop ($) 1	329
profit margin (%)	49
price variation	low-medium
payback period (years)	0.8
comment	disease may increase
overall	low/medium

Market outlook	
local	medium
national	medium
international	good in short/medium term

Notes	
[1] capital costs	One 13.5m^3 cage. This is the smallest type of operation currently found in Khanh Hoa
for a single cage	
seed	wild caught seed stocked at 150g; 80% survival
feed	trash fish caught locally or purchased in market
labour requirements	75 days/cycle typically used in Khanh Hoa; less for larger enterprises; feeding , (1 times/day); cage cleaning (removal of fouling).

[2] ***The profiles are estimates of average performance based on project data, discussions with farmers, and discussions with CARE staff. Actual costs and returns, and the relative attractiveness of different cage culture options, will vary widely according to the cost, availability and quality of labour, seed and feed, the nature and size of the local market, and the knowledge of the farmer.***

CAGE CULTURE PROFILE

Lobster rearing Vietnam: single small cage and small seed (50 g)

location	**Vietnam**	**cycles/yr**	**0.75**
Cage size	**13.5 m^3**	**risk**	**medium**
species	**Macrobrachium rosenbergii**	**return**	**high**

Key features	
environmental requirements	
salinity	**29-34**
water quality	**high**
temperature	**20-30**
investment cost	
enterprise capital costs	**292**
capital costs/m3 cage	**22**
life of cage	**4**
financial returns/cycle	
profit/m3	**78**
gross margin/m3	**100**
return on labour	**5**
scale issues	**expansion leads to significant increases in return related mainly to more efficient utilisation of labour**

Input/output profile ***(per m^3 per cycle)***		
inputs	**quantity**	**$**
capital costs/cycle		**7.2**
seed	**10**	**20**
feed	**191**	**38**
labour	**20**	**22**
outputs	**kg**	**$**
fish	**6.6**	**165**
organic matter		
nitrogen		
total costs per crop		**87**
total revenue per crop		**165**

Risk profile	
disease incidence	**low**
length of production cycle (months)	**18**
minimum start-up capital ($) [1]	**1375**
investment in crop ($)	**1180**
profit margin (%)	**47**
price variation	**low**
payback period (years)	**0.4**
comment	**disease may increase**
overall	**low/medium**

Market outlook	
local	**small, expanding**
national	**medium, expanding**
international	**excellent in short and long term**

Notes

[1] **capital costs for a single cage**	**One 13.5m^3 cage. This is the smallest type of operation currently found in Khanh Hoa**
seed	**wild caught seed stocked at 50g; 60% survival**
feed	**trash fishor shellfish caught locally or purchased in market**
labour requirements	**270 person days/cycle typically used in Khanh Hoa; less for larger enterprises; feeding (2 times/day); cage cleaning (removal of fouling)**

CAGE CULTURE PROFILE

Lobster rearing Vietnam: single small cage and large seed (200 g)

location	**Vietnam**	**cycles/yr**	**1**
Cage size	**13.5 m^3**	**risk**	**medium**
species	***Panulirus ornatus; P hormarus***	**return**	**very high**

Key features	
environmental requirements	
salinity	**29-34**
water quality	**high**
temperature	**20-30**
investment cost	
enterprise capital costs	**292**
capital costs/m3 cage	**22**
life of cage	**4**
financial returns/cycle	
profit/m3	**109**
gross margin/m3	**119**
return on labour	**8**
scale issues	**expansion leads to significant increases in return related mainly to more efficient utilisation of labour**

Input/output profile ***(per m^3 per cycle)***		
inputs	**quantity**	**$**
capital costs/cycle		**5.4**
seed	**10**	**45**
feed	**255**	**51**
labour	**14**	**15**
outputs	**kg**	**$**
fish	**8.8**	**220**
organic matter		
nitrogen		
total costs per crop		**111**
total revenue per crop		**220**

Risk profile	
disease incidence	**low**
length of production cycle (months)	**12**
minimum start-up capital ($)[1]	**1796**
investment in crop ($)	**1504**
profit margin (%)	**49%**
price variation	**low**
payback period (years)	**0.2**
comment	**disease may increase**
overall	**low/medium**

Market outlook	
local	**small, expanding**
national	**medium, expanding**
international	**excellent in short and long term**

Notes	
[1]**capital costs for a single cage**	**One 13.5m^3 cage. This is the smallest type of operation currently found in Khanh Hoa**
seed	**wild caught seed stocked at 200g; 80% survival**
feed	**trash fish and shellfish caught locally or purchased in market**
labour requirements	**180 days/cycle typically used in Khanh Hoa; less for larger enterprises; feeding (2 times/day); cage cleaning (removal of fouling)**

CAGE CULTURE PROFILE

Seabass rearing Vietnam: feasibility model

location	**Thailand**	**cycles/yr**	**1**
Cage size	**13.5 m^3**	**risk**	**medium**
species	***Lates calcarifer***	**return**	**medium/low**

Key features	
environmental requirements	
salinity	**10-34**
water quality	**medium**
temperature	**20-30**
investment cost	
enterprise capital costs	**250**
capital costs/m3 cage	**19**
life of cage	**4**
financial returns/cycle	
profit/m3	**0.1**
gross margin/m3	**6.1**
return on labour	**1.1**
scale issues	**expansion leads to significant increases in return related mainly to more efficient utilisation of labour**

Input/output profile ***(per m^3 per cycle)***		
inputs	**quantity**	**$**
capital costs/cycle		**4.6**
seed (pc)	**40**	**6.0**
feed (kg)	**84**	**16.8**
labour (day)	**6**	**6.1**
outputs	**kg**	**$**
fish	**14**	**34**
organic matter		
nitrogen		
total costs per crop		**34**
total revenue per crop		**34**

Risk profile	
disease incidence	**medium**
length of production cycle (years)	**9**
minimum start-up capital ($) [1]	**703**
investment in crop ($)	**453**
profit margin (%)	**0.2%**
price variation	**medium**
payback period (years)	**312.5**
overall	**medium**

Market outlook	
local	**small, steady**
national	**slow expansion**
international	**medium, slow expansion**

Seabass prices (farm gate) are currently $2/kg or less in Vietnam, corresponding to a loss. However, with some domestic market development and access to international markets a farm gate price of $2.5+ should be possible.

Notes	
[1]capital costs for a single cage	**One 13.5m^3 cage. This is the smallest type of operation currently found in Khanh Hoa**
seed	**hatchery seed at 12cm. Current Thai price around US$.15 each**
feed	**trash fishor shellfish caught locally or purchased in market**
labour requirements	**assuming same labour requirements as for grouper. In practice may need more regular feeding**

Appendix 2 iii. Decision Trees

Introduction

Discussion between the farmer and the extension officer should form the basis of whether to use decision trees in the selection of cage systems. The decision trees outlined describe the thought process in greater detail for both inland systems [Appendix (2iv)] and in more general terms for coastal cage culture in Bangladesh [Appendix (2v)] and Vietnam [Appendix (vi)]. Again, the criteria for assessment and priorities of the farmer will vary greatly from region to region as well as from farmer themselves and should only serve as a guide and not as a definitive version.

Freshwater Inland Systems

The main criteria involved in the decision making process were identified as level of access to a waterbody i.e. whether limited or open, including the level afforded to female participants, the level of experience of participants the amount of capital available and seed supply. An example of how these criteria lead to the selection of particular systems through the use of a decision tree is shown in Appendix (2iv) based on the following considerations.

?? Access includes consideration of access for females. If only limited access is available then farming co-operatively is assumed more appropriate, this also means capital and input costs can be shared reducing the level of risk. If no access is available then cage culture is not appropriate.

?? If an individual's knowledge of cage culture is relatively low then the best option is the grow-out of fish; if it is greater, then more options are available (Hatchery/Nursery/Grow-out). If working co-operatively then skills can be shared leading to the adoption of a greater range of options.

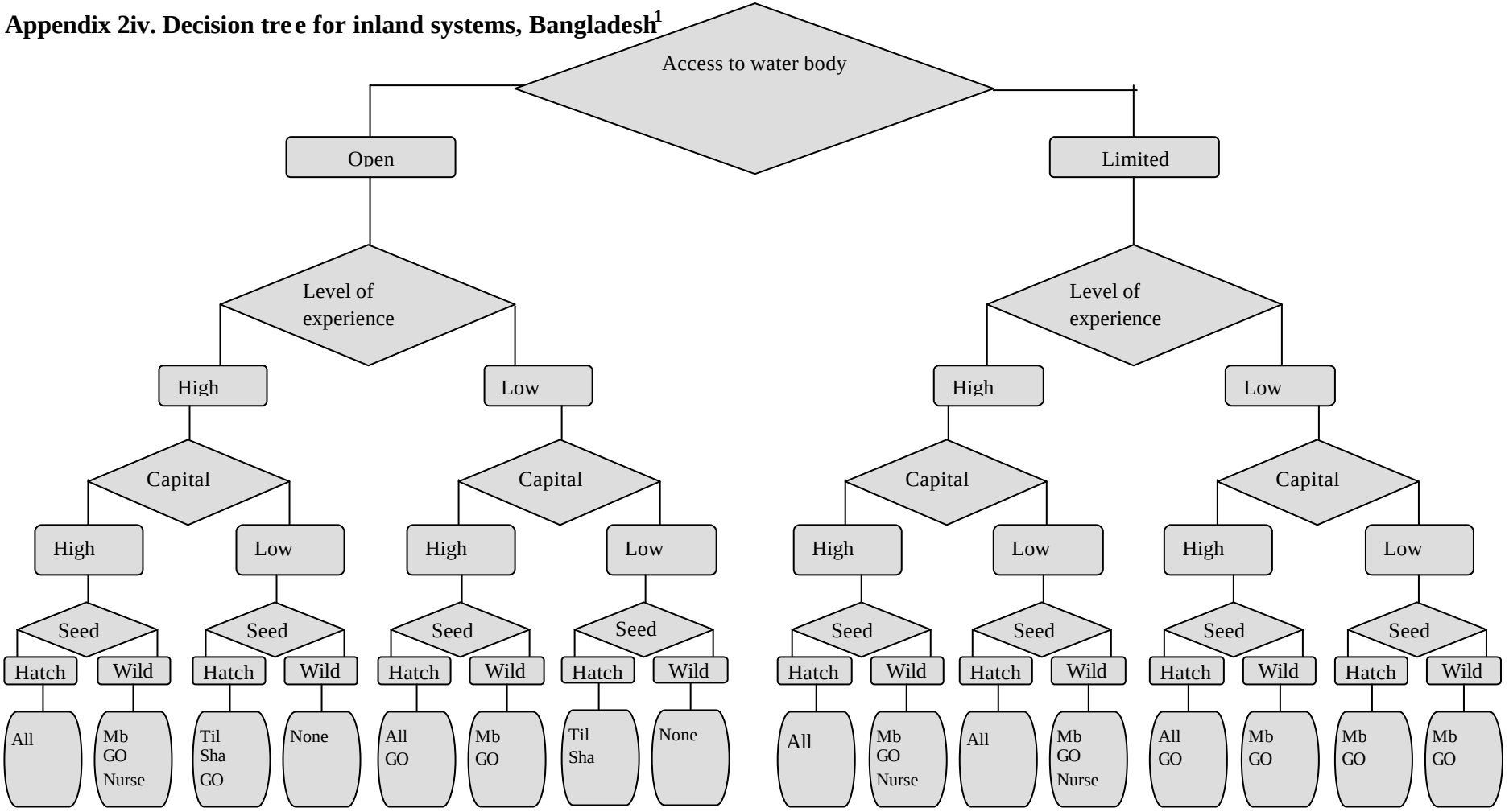
?? If an appropriate level of finance is available then high input species can be considered, if finance is limited then low input should be considered.

?? Both wild caught and hatchery seed are available in Bangladesh, but access to these sources could be limited by both location and finance.

Marine Coastal Systems

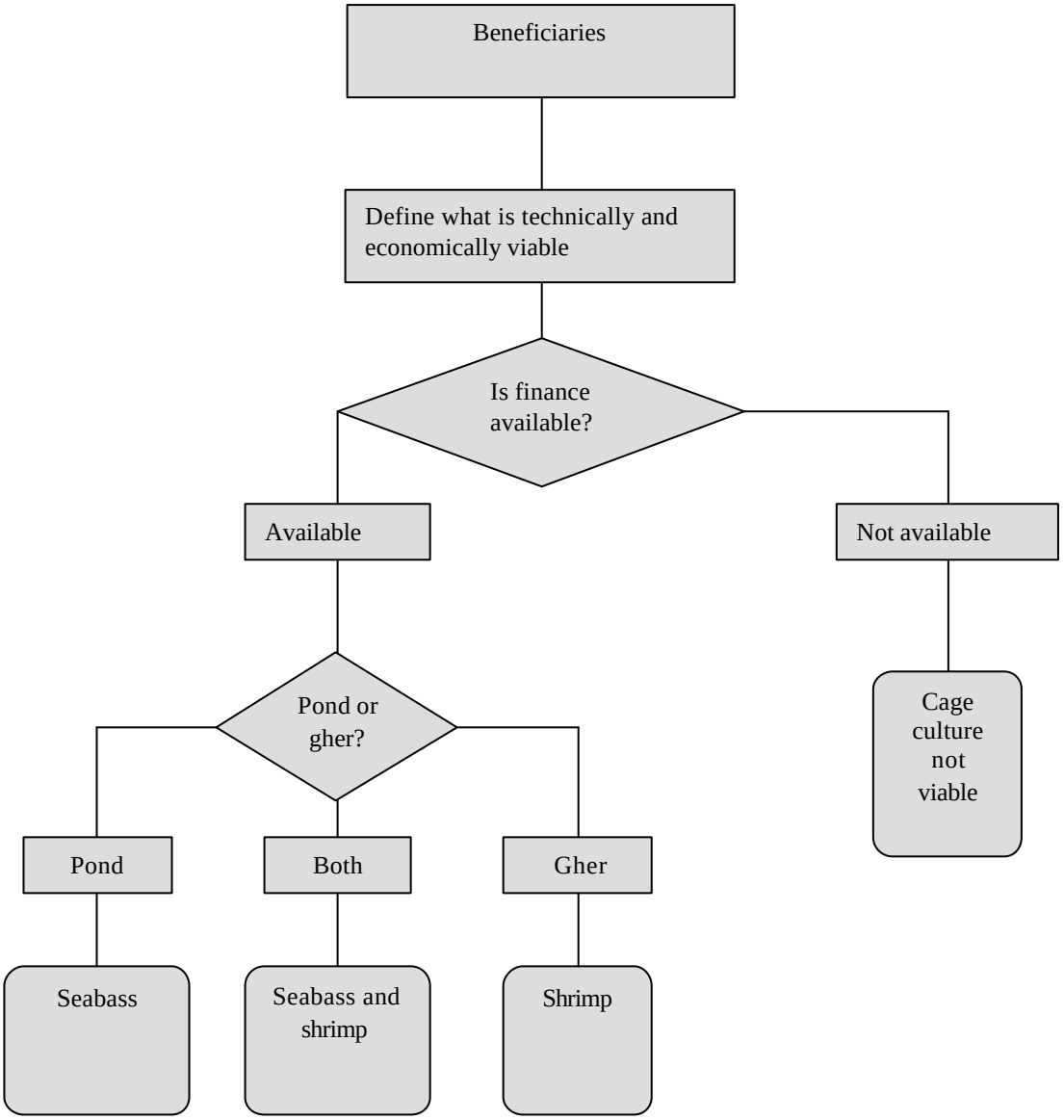
?? There are many practical and social aspects regarding access and control of coastal water bodies in Bangladesh and Vietnam that need to be discussed and resolved through use of the checklist (Section 1) before implementing the use of a decision tree. In Vietnam, the main question was then assumed to be with regard to access to finance Appendix (2vi). This contrasts with the situation in Bangladesh where access to finance is supplied through the micro-credit schemes of NGOs and the investment costs themselves are much lower than in Vietnam, although these criteria may differ from farmer to farmer.

Appendix 2iv. Decision tree for inland systems, Bangladesh[1]

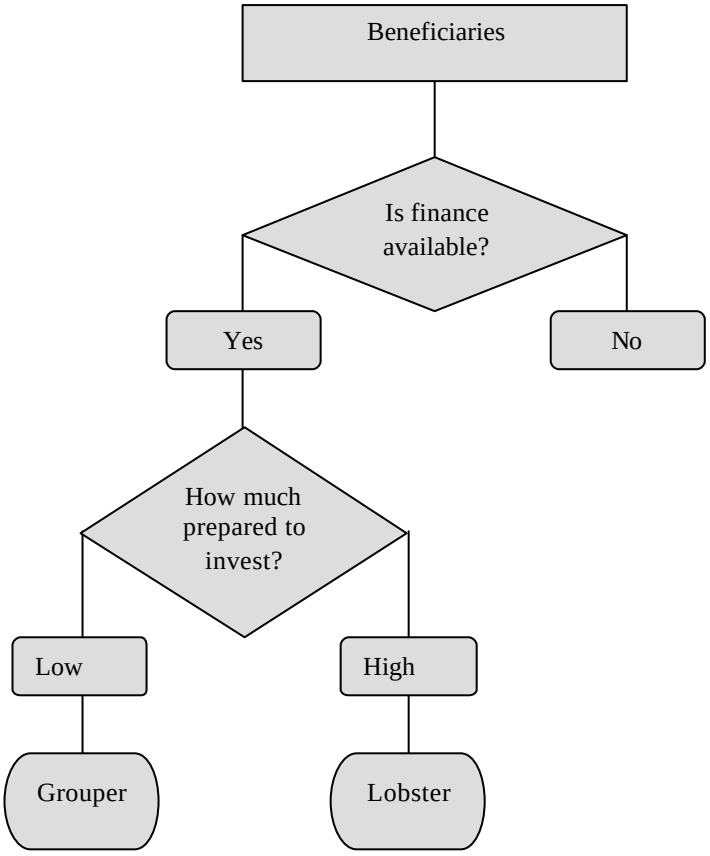


[1]GO:Grow-out, Nurse:Hapa nursing of fingerlings or postlarvae, All:*M.rosenbergii, Pangasius sutchii,/pangasius Oreochromis niloticus, Puntius gonionotus* growout & *M. rosenbergii and P. sutchii/pangasius nursing, Mb:Macrobrachium rosenbergii*, Til:Tilapia *(Oreochromis niloticus)*, Sha:Sharputi *(Puntius gonionotus)*, Hatch:, Hatchery reared seed, Wild: Wild caught seed.

Appendix 2v. Decision tree for coastal cage aquaculture, Bangladesh.



Appendix 2vi. Decision tree for coastal cage culture, Vietnam



3. REVIEW OF TOOLS AND METHODOLOGIES USED IN PROJECT R7100

Chair Kenny McAndrew

Objective

?? to review tools / methodologies used during project R7100 for identification of researchable constraints and communication of results to farmers and to produce recommendations for future projects in Asia.

Output

?? a critical review of tools and methodologies;

?? guidelines for the researcher, NGOs and extension workers on where, why, who and how various approaches are most appropriate.

Method

?? three presentations were made

?? Bangladesh Paul Bulcock
?? Vietnam Tuan/Thuong
?? General considerations John Hambrey

?? plenary discussion of extension methodologies and production of guidelines.

Introduction

Project R7100 utilised a range of research methods and approaches during the two-year lifetime that can now be assessed in terms of their effectiveness in benefiting both the research process and the rural resource poor. The recommendations are intended to benefit similar research and development projects throughout Asia.

Output

The research approaches adopted by the Bangladesh and Vietnam components of R7100 are outlined in Appendix (3 i) and Appendix (3 ii) and detail the benefits and constraints of these approaches.

The group discussions that followed the presentations raised the following main points concerning the research methods utilised. Comments and suggestions for the improvement of the research process were made and are also summarised below.

Critical review of tools

- **Participatory on-farm technical trials are a valuable way of gaining an indication of the validity of the option under examination and also serve to build the capacity of those involved. However due to the inevitable compromises in experimental design and the largely qualitative nature of the results generated, it was recommended that complementary on-station or other research be considered.**

- **The use of participatory rural appraisal and rapid rural appraisal is essential in yielding crucial baseline information at the individual, community and regional level and raising topics for further research. The use of both techniques also not only increases awareness in communities on the role of research but also reduces tensions between community members and resource users. PRA is more beneficial in this respect due to the longer timeframe and its ability to raise awareness of the issues among different groups of resource users.**

- **The use of these tools can therefore be said to incorporate an element of training or *'capacity building'* among beneficiaries and those associated or collaborating with the research project. Indeed training can be seen as a vital component of the research process especially when carried out alongside an existing development project. This element of training could be expanded to include relevant NGOs and Government Officers.**

- **Within Vietnam it is difficult to discern - apart from the capacity building of intended benefactors - where the advantages of the participatory rural appraisal conducted lie over rapid rural appraisal due to a decreasing return in knowledge on time invested.**

- **The research process in Bangladesh would have benefited from the topics and approaches adopted in Vietnam, such as how cage culture compares with alternative livelihoods.**

- **It was thus concluded that the ideal research approach may be a combination of the techniques utilised in both Bangladesh and Vietnam, incorporating on-farm trials, participatory and rapid rural appraisal approaches.**

- **Linkage with other development, research and government organisations, as occurred within the present project, in which there was collaboration with the University of Fisheries, Vietnam, the Asian Institute of Technology, the CARE CAGES project and NFEP-2, Bangladesh, is vital. Collaborative efforts not only ensure a greater impact of research outputs in terms of beneficiaries but also add value to the research process. Further links with other national research institutions and government institutions, such as fisheries departments, would both increase the amount of expertise and disseminatory pathways available.**

Guidelines for the researcher, NGOs and extension workers.

- **The use of tools outlined in this section concentrated on research methods at the beneficiary level, in this case the rural resource poor and women, rather than the traditional approach of formulating research in isolation, followed by dissemination: a top-down approach. When time and resources allow, participatory rural appraisal should be utilised to obtain a more complete overview of the situation of these intended beneficiaries, through the use of direct and semi-structured interviews and group of exercises, especially when the intention is to build capacity rather than collect information.**

- **When time and resources are limited rapid rural appraisal should be used. Rapid rural appraisal is also particularly useful when working with existing development organisations, where research is demand led, identifying opportunities and constraints on which more focused research can be directed.**

- **Where time and resources allow, linkages should be formed with other research and development institutions in order to share expertise and findings and take full advantage of existing frameworks and adding value to the research process identifying research needs and rapid dissemination of findings. Linkages are also likely to benefit the formulation of policy initiatives, as will be discussed in section 4.**

- **If linkage to other institutions is secured, participatory methods such as on-farm research involving the rural poor in the development of suitable technologies can be utilised.**

Appendix 3. A Review of the Tools and Methodologies conducted by the Bangladesh component of Project R7100.

Paul Bulcock

Cage aquaculture is a relatively novel concept in Bangladesh with a brief and mostly unsuccessful history. Previous attempts at introducing the technology had failed, primarily due to the wholesale transfer of technology from other regions. To be successful cage culture must be appropriate to the technological, economic, social and institutional context of cage operators, in this instance the rural resource poor. The DFID funded research project R7100 'The Improved management of small-scale tropical cage culture' is concerned with identifying opportunities and constraints concerned with these issues, assisting the CARE-CAGES project and further focusing research to be of benefit to the rural resource poor.

One of the key issues in the failure of a research project to benefit the lives of the rural poor is connected to the absence of the intended beneficiaries from the research process. As it is working with an existing development project, R7100 has a rapid and targeted pathway for the dissemination of research findings and hence avoids this constraint. Non-governmental organisations (NGOs) can be considered to be the driving force behind the development of cage aquaculture in Bangladesh. Through CARE's CAGES project the capacity of smaller NGOs to develop and disseminate small-scale cage aquaculture technology has been strengthened. There exists a synergy in the relationship between CAGES and the regionally based NGOs. CAGES has strong technical staff and a training capability which, when coupled with the NGOs abilities to work with groups of rural households, creates a mechanism where cage aquaculture can be developed more quickly and information shared on a wider scale than if agencies were operating independently of one another. The partnership between a diverse range of organisations seems to be an effective one for developing and disseminating of aquaculture technology. The process is in marked contrast to past efforts that focused on developing cage aquaculture packages then disseminating them: a top down approach. The innovative approach adopted by CAGES works to the advantage of R7100 which can utilise the existing framework to identify research needs, conduct research and disseminate the results to those most in need. This is in contrast to traditional methods of communication between researchers and farmers that have tended to focus on a top down approach where research findings developed in isolation from intended beneficiaries are disseminated. Utilising this framework project R7100 conducted its research using two main approaches, on-farm trials and social surveys for each the benefits and constraints to the research process and the rural resource poor will be described.

On – farm trials

CAGES collaborates with local NGOs, in originally five, but now six, regions throughout Bangladesh Barisal, Comilla, Dhaka, Jessore and Syhlet and Natore. In each region NGOs were selected to collaborate on these trials, devised by R7100 in conjunction with TOs and NGOs. On-farm trials were then carried out by cage operators themselves in field situations, overseen by CAGES Technical Officers (TOs) and NGO staff. As trials were conducted by operators in field situations they were intended to offer a more realistic assessment of the technical and economic

validity of an option rather than being a piece of disassociated research. Trials initially encompassed a wide range of topics and from the assessment of their performance, key research topics were identified. As these trials were participatory in nature and funded by the CAGES the size of the trials was limited and generally consisted of a qualitative simple one or two cage assessment or an examination of the feasibility of an option rather than a quantitative assessment. The main topics addressed by such trials were the selection of local resources in cage culture such as seed, feed and cage materials and new techniques such as hapa breeding and nursing of postlarvae and fingerlings.

The benefits to the research process are in the participatory nature of the trials in which there is a realistic, assessment of the option. However the lack of quantitative data is a constraint to reporting due to the simple nature of the trial (lack of repetition; lack of true controls, etc), due to financial constraints and lack of experience by NGO staff and farmers. Ideally such trials would be complemented by benefited by research farm trials where replicates and different treatments can be examined. However the isolation of the trials from intended beneficiaries should be considered.

The benefits to the rural resource poor are already evident as materials such as Mritinga bamboo, originally examined by R7100, has been adopted by beneficiaries throughout Bangladesh. The simple qualitative problem of these trials is overcome by the collation and cataloguing of trials by CAGES staff. Using this catalogue, the performance of options can be reviewed by TOs and NGO staff. Through the strength of number of trials on similar topics an indication on the suitability of the option for adoption by the rural resource poor is derived. The capacity of the rural resource poor participating in these trials is also increased although if a trial fails this could lead to an unfavourable impression in those unfamiliar with cage culture.

Social surveys

To complement these essentially technical on-farm trials, the social context of small-scale cage culture was investigated in order to further focus and clarify research needs. Through social surveys the following three topics were examined:

1. The reasons for continuation and abandonment of cage culture
2. The role of gender in small-scale cage culture
3. The impact of cage culture on the community

All three topics aimed to identify the constraints and opportunities raised by the implementation of cage culture by the rural resource poor and serve to identify strategies leading to its sustained adoption by targets, including women. Rapid Rural Appraisal was conducted in three villages selected by TOs in the regions CAGES operates. Included was one village where cage culture had been implemented relatively recently, (less than one year). To examine the role of gender and reasons for cage culture continuation and abandonment in each village three households were interviewed. The majority of data on gender issues were obtained via semi-structured interviews. Information was triangulated with key informants – in particular with staff from NGOs involved in the project and CARE-CAGES field staff.

The interview followed a checklist of open-ended questions designed to gather qualitative data. In most cases, husbands and wives were interviewed separately. However in a number of instances, cultural restrictions meant that a wife could not be interviewed separately from her husband, even when the team of interviewers comprised a woman. To ensure consistency, the same interviewer and CARE Technical Officer carried out all interviews and notes were taken by another CARE staff member, acting only as an observer. To minimise the risk of intimidation to the villagers, no other persons were present during the interview.

To examine the impacts of cage culture meetings were pre-arranged with villagers and mapping exercises conducted. The use of communal resources and the impact cage culture had on these uses was then described. Of particular interest to project R7100 was the identification of conflicts of interest that would require further research in order to facilitate the adoption of cage culture by CAGES targets.

The surveys were vital to the research process identifying socio-economic opportunities and constraints on which further research could be based, such as the isopod disease constraint in Jessore region.

For the rural resource poor the benefits are derived from a combination of information disseminated to CAGES on the topics covered on which policies and development options can be based. Benefits also occur through the training of NGO and CAGES staff in social survey methodology enabling further research to be conducted outwith the lifetime of the research project. The findings of these further surveys can then be compared to the initial baseline.

The in-built institutional pathway

As reported R7100 works with an existing development project the CARE-CAGES project and hence has access to the in-built framework of working with Partner NGOs (PNGOs) to reach benefactors. Information is therefore exchanged between the research process and benefactors in a two-way manner to the mutual benefit of both groups and also the development project with which a synergy exists with the research process. Figure (1).

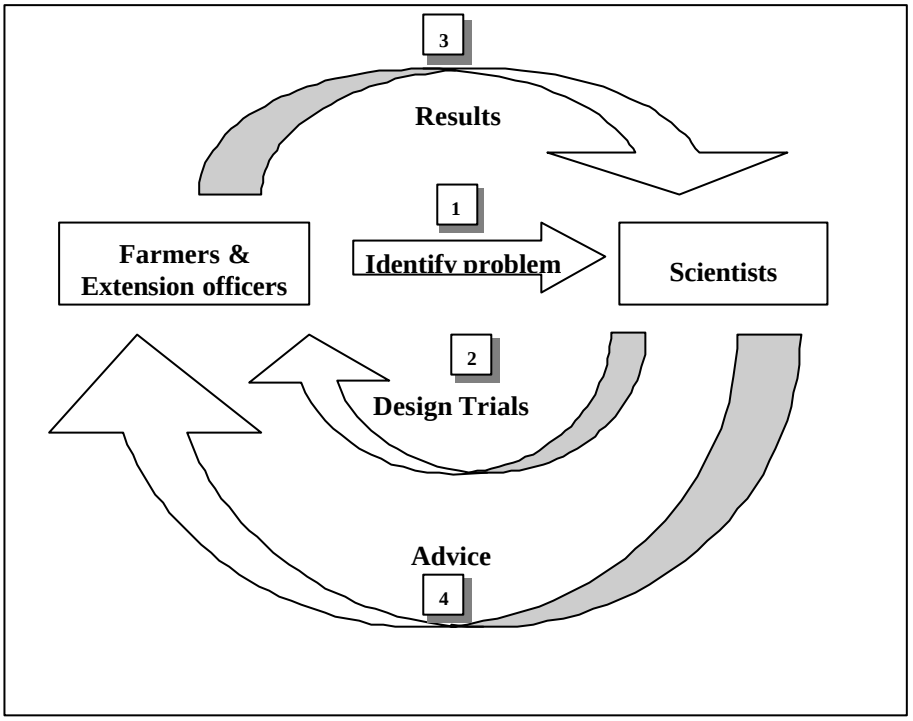


Figure (1) The research framework of the Bangladesh component of Project R7100.

Targets are therefore reached rapidly with disseminatory material such as the hapa-rearing pamphlet of which 10, 000 have been printed and are currently being disseminated.

Summary

The type of research conducted by R7100 can be described as demand-led, responding to the needs of the rural resource poor and women to which they have access through an existing development project and its institutional pathway. The benefits to the research process include identification of opportunities and constraints of interest to the farmers such as lower risk and hapa rearing technologies and disease constraints of which further research and training can be conducted. The mainly qualitative information gained using a combination of participatory methods can then be disseminated rapidly to benefactors.

The rural resource poor also benefit through a combination of awareness in cage culture brought about by village surveys and technical training by on-farm trials. The training and experience gained by NGO and CAGES staff by participation in these method will also continue to benefit the rural poor.

Appendix 3i. A Review of the Tools and Methodologies conducted by the Vietnam component of Project R7100.

John Hambrey

The research process conducted by the Vietnam component of project R7100 differs in its approach from the Bangladesh project segment. Not only is research concentrated in larger marine systems but rather than research being demand led to the needs of the farmer participatory rural appraisal of the issues that face the rural resource poor in Vietnam was conducted. Examining whether the development of cage culture for poor farmers would address their livelihood needs. Unlike in Bangladesh it did not intervene in the current aquaculture or attempt to develop new technologies.

Utilising participatory rural appraisal techniques such as semi-structured questionnaires the following questions were addressed.

1. Development context
?? Who would be the beneficiaries?
?? To what resources did they have access?
?? What was the potential for support from institutions?
?? Seed
?? What was the supply of seed?
?? Was it sustainable?

2. Feed
?? Was the supply of feed sustainable?
?? Would increasing the use of trash fish for feed adversely affects the poor?

3. Technical/economic assessment
?? Would grouper culture address the needs and aspirations of the beneficiaries as opposed to other income generating operations?

4. Market
?? Was the market sustainable at a local, national or international level?

The Research Process

The research process began with selection of potential beneficiaries from the poorest people of coastal villages, both those already involved in aquaculture and those not. After a rapid rural appraisal, participatory rural appraisal was carried out on the following lines Table (1).

Table (1) The methods utilised by the Vietnam component of R7100.

	Seed supply	Feed supply	institutional arrangement	Livelihoods	Economics	Markets
SSI with individuals	?	?	?	?	?	?
SSI with groups	?	?	?	?	?	?
Direct interviews	?	?				?
Diagrams	?	?	?	?	?	?
Field surveys	?	?				?
Association analysis	?					
Financial analysis	?			?	?	
Market analysis						?

From these methods it was found that whilst the development of grouper cage culture had arrested, lobster culture was expanding rapidly due to the higher potential returns and the demands of an international market. This gave rise to concerns as to whether these systems were both economically and environmentally sustainable.

The major source of feed for cage culture was found to be trash fish, which is part of secondary catches with no apparent human food market. However, there was found to be some overlap between the use of trash fish for cage culture and other uses, particularly pig feed and use by local people. Initially cage fish production was found to use 30% of available trash fish but this is now estimated at 60%. The supply of trash fish was recognised as a finite resource and whilst sustainable at present levels could become limited with further expansion of cage culture.

Stocking densities were currently low so there was little disease problem and environmental impact was limited, as profits were high there was no pressure to increase stocking density.

The researchers felt that they did not gain significantly more information from the participatory rural appraisal process, than they with utilising rapid rural appraisal, apart from developing their understanding through longer contact with the participants. However participants, the rural resource poor benefit from these exercises by developing their own capacity for assessing problems and opportunities.

Summary

Although different in its approach the tools utilised by the Vietnam component of R7100 benefits both the research process and the rural resource poor identifying

opportunities and constraints through participatory rural appraisal. This not only identifies areas for further research projects such as the use of feed materials but also increases the awareness of seed and feed use, market selection and livelihood considerations amongst the rural resource poor.

4. POLICY INIATIVES FOR SUSTAINABLE CAGE CULTURE DEVELOPMENT

Chair John Hambrey

Objective

?? to develop an understanding of the role of policy in influencing the development of sustainable small-scale cage culture among the rural poor in the coastal marine and inland environments and to propose measures that may be considered at local and national policy levels.

Output

?? summary of key issues in cage aquaculture development in Asia;

?? summary of key issues in cage aquaculture in Vietnam and Bangladesh;

?? identification of key policies that may influence uptake and sustainability of cage culture by resource poor farmers in Bangladesh and Vietnam;

?? recommendations for future cage aquaculture development.

Method

?? presentation 1 – introduction to key constraints in cage culture in Asia (Malcolm Beveridge);

?? presentation 2 – review of cage aquaculture in Vietnam (John Hambrey)

?? presentation 3 – review of cage aquaculture in Bangladesh (Kenny McAndrew)

?? presentation 4 –critique(s) of cage aquaculture (open)

?? presentation 5 – summary presentation of key issues still to be addressed in Asia;

?? plenary discussion and formulation of guidelines.

Introduction

Although cage aquaculture is relatively new in Bangladesh and other countries in the Region it is generating considerable interest resulting in its rapid expansion throughout Asia. The expansion increases the likelihood of adverse environmental impacts. Appropriate policies require to be introduced and enforced to ensure that cage aquaculture remains a sustainable livelihood for the rural resource poor. Key issues in cage aquaculture development in Asia were identified and policy level recommendations to influence the sustainable development of cage culture among the resource poor were made.

Key issues in cage aquaculture in Asia

China, the Philippines and Indonesia can currently be considered as the biggest producers of caged fish within Asia and production continues to increase. The main reasons for expansion are that it is a relatively cheap and accessible income-generating activity, cages are easy to construct and provide a rapid return on investment. As the level of income flow increases operations can be quickly developed as operators build and stock extra cages. Cage aquaculture in Bangladesh is relatively novel, aquacultural activities having largely focused on pond and rice-fish systems such as *ghers*. Although there have been various attempts over the past twenty years to initiate cage aquaculture, it has only expanded significantly in the last three through the CARE CAGES project. There are currently approximately 5000 cages producing over 76 000 kg of fish in Bangladesh.

Expansion of cage aquaculture can create problems for both extensive and intensive types of production:

Access to water bodies

?? Social constraints, such as limited access afforded to some women due to cultural norms.
?? Power struggles between traditional users of the resource, including transportation and agriculture.
?? Tension between fish farmers and fishermen as cage culture impinges on traditional fishing grounds.

Environmental issues

?? Over-expansion in stationary water bodies may cause increasing waste organic matter with a high oxygen demand depleting oxygen levels and resulting in fish death, as has been illustrated by cage culture in the Philippines, Indonesia and China.
?? Marine sediments can become polluted with excess fee, especially in sheltered areas, impacting negatively not only on cage culture but other resource users.
?? The use of non-indigenous species can impact on indigenous fish species.

With the development of cage culture therefore, there may be a need for regulation, both to maintain the feasibility of access to cage culture for the resource poor and to keep production levels within environmental capacity. With the increasing intensification and production levels, however, the question of how to develop sustainable cage culture also needs to be addressed.

Key issues in cage aquaculture in Vietnam

Marine cage culture has a huge potential for production and for income generation for poor farmers in Vietnam. Here the key issues are:

Access to water bodies

?? This is not a major problem although there are sometimes local difficulties.

Access to inputs

?? There is currently insufficient seed to maintain expansion. Development of hatcheries needs to be encouraged by government institutions, NGO and donors.

?? Current feed sources (i.e. trash fish) are finite. Prices may increase, jeopardising the financial viability of the industry. New feed sources need to be identified.

?? Finance is available but needs to be better linked to aquaculture development.

Capacity

?? The poorest are the last to benefit from training, information and extension services. Extension services and information materials need to be improved and made available to poor farmers.

Management and regulation

?? The formulation of the correct management regimes regarding cage culture at various levels are the most important strategies to implement before the expected expansion of cage culture in Asia occurs. Such examples include the national monitoring of disease outbreaks and local regulation of pollution..

?? Prices for lobster and grouper are currently high but the market is limited. Therefore management should address issues such as marketing, perhaps identifying new species for production, new markets and the reduction of production coasts. However the latter point may adversely affect poor farmers operating and relying upon single cages and therefore not benefiting from economies of scale.

?? The expansion of cage culture will therefore require regulation to protect water quality, prevent destructive disease outbreaks, maintain bio-diversity and to maintain and expand markets to prevent the oversupplying of markets.

Key issues in cage aquaculture in Bangladesh

The CAGES project currently involves approximately 400 households operating 5000 cages, often in remote areas. Working through partner NGOs means direct contact with participants. The project is poverty focused: 33% of participant are considered landless and 58% of all participants are women who are able to incorporate cage culture with their daily routine and establish sites close to the homestead. Key issues are:

Access

?? This issue is becoming increasingly important. In some cases access initially available from landlords was later withdrawn. In theory there is free legal access to public water bodies but in reality access is often controlled by powerful local interests. The use of local NGOs can help alleviate these constraints.

Finance

?? The start-up costs are low - generally about $10 to construct and stock a cage - with credit generally available through local NGOs or money lenders. Credit however may not be available to the very poorest groups, although they can become involved in activities such as feed preparation, guarding and net making.

Seed

?? Many hatcheries exist within Bangladesh both private and government. However there are few nurseries, so access to fingerlings can be limited. Expansion of nurseries needs to be encouraged.

Feed

?? The CAGES project recently removed the subsidies it issued for feed costs and as a consequence the types of ingredients are now diversifying as operators integrate cage culture into other household activities utilising items such as vegetable and kitchen waste and there has been interest in vermiculture to produce worms as suitable feed items.

Cage materials

?? The costs of construction have recently been reduced by the implementation of cages made from locally available bamboo.

Environment

?? Small-scale cage culture is a low input method of fish production and as the water bodies are not utilised all year round so benthic degradation is not thought to be a problem and there have been minimal disease incidents. However, intensification of production methods has been seen in other countries as farmers gain confidence and as cash flow increases. It is recommended that the situation be kept under review. There is also concern about the issue of escaped fish. However, cage culture utilises the same non-indigenous species as pond culture and as ponds flood may be a more secure system. Cage culture of more invasive, competitive top predators should be discouraged.

Marketing

?? Live fish can increase the price of the product by 20–30% and should be encouraged.

There is increasing evidence that secondary adoption by richer farmers who have observed the success of project participants is occurring, which needs to be assessed and monitored. The guiding principle must be to try to ensure that cage culture is a sustainable activity for poor farmers.

Identification of key policies to influence the uptake and sustainability of cage culture by resource poor farmers in Bangladesh and Vietnam.

?? **As mentioned in section 3, the key to influencing the uptake and sustainability of cage culture in Asia by the rural resource poor is to adopt policies that encourage stronger and more extensive linkages between farmers and research and local and national development institutes and government departments via increasing awareness of cage culture. Through its linkages to, and collaboration with, a development project and regional NGOs, Project R7100 has demonstrated that it is both possible and of benefit to the rural poor.**

?? **Such links with development agencies could influence policies with local and national NGOs, providing access to micro-credit and thus removing financial constraints and improving financial management through training. These NGOs are also involved in other IGAs such as fingerling production and wild fry collection. Hence, integrating cage culture with their existing framework would be of immense benefit, reducing input constraints. The monitoring of cage culture impact could also be facilitated through these links at the local and regional level through the use of local discussion forums.**

?? **Links and collaboration with government departments are vital in influencing decisions at government level. Proposed policies included the allocation or zonation of waterbodies by government to cage culture practises for the rural resource poor. While an Integrated Coastal/Inland Water-body Management approach is recognised as the best approach to addressing such issues, it is recognised as impractical in many contexts, given the extent and degree of pressure on resources and the lack of skills and finance. Although research is required prior to establishing guidelines for cage culture development, somewhere between 1 and 5% of the surface of a water-body was proposed as probably being sufficient to prevent adverse environmental impacts and conflicts with other resource users. While it was recognised that catching of wild fry generates employment for the poor it must be monitored.**

Recommendations for future cage aquaculture development

- **From a review of these key issues members of government and university institutions, NGO and development organisations and R7100 researchers produced the following recommendations.**

- **Environmental degradation of permanent water-bodies and coastal areas must be given consideration. Environmental conditions can be monitored by observation of the water and benthos using methods as simple as a Secchi disk to monitor turbidity of the water column or smell and visual tests of benthic muds to examine for the presence of hydrogen sulphide (H_2S) or anaerobic conditions. In inland seasonal waterbodies this problem is alleviated in the dry season when the benthic muds are allowed to recover. In permanent water-bodies or in coastal areas farmers should be encouraged to periodically move their cages to allow areas to recover.**

- **Alternate feed sources such as kitchen waste, agricultural by products, earthworms or under-utilised by-catch should be considered and promoted to reduce costs and environmental impacts of cage culture.**

- **Concerning the use of non-indigenous species, cage aquaculture must not only operate within any legislative framework currently in place (for example, by not rearing tilapia in Kaptai lake, Bangladesh) but also try to influence policies through dialogue with government departments. Tilapia are an appropriate species for cage culture by the rural poor and their use should be considered as they offer a good return on a low investment especially in the absence of other species and where they are currently used in other systems such as ponds. However, there remain concerns in some areas about their impacts on indigenous fish communities and on fisheries.**

- **The use of indigenous hatchery reared species to alleviate the pressure on wild caught fry should be considered whenever possible, although it is recognised that this requires training in hatchery and nursing skills. These initiatives however can only occur through greater co-ordination between government and NGO sectors.**

- **Greater exchange of information and collaboration between regional and national development projects and the NGO sector is essential to ensure maximum positive and minimum negative impacts from the implementation of cage culture. This could be facilitated through regional or national forums on aquaculture where cage culture practises and legislation are on the agenda.**

5. DISCUSSION

From the combination of group and plenary discussions many points of interest have been raised regarding the appropriate use of small-scale cage culture as a mechanism to reduce the poverty of the rural resource poor. Participatory approaches were seen to have been of benefit the research process and the rural resource poor

Guidelines for the production of low-input, low-output cage culture extension and training materials have been identified. Key to this is a participatory approach to research with existing institutions utilising in-built pathways for the identification of research topics and dissemination of research findings. To increase the quality of the outputs and to add value to the research process a greater degree of linkage should be sought as this increases both the amount of knowledge available and number of beneficiaries reached. The level of linkage is also critical in attempting to affect policies concerning small-scale cage culture at the NGO development or government level.

Guidelines for planners, policy makers, and development specialists, to assess potential for low-input low-output cage culture within social economic and institutional environment, and improve selection of technological options have been produced. These take the form of a checklist for aquaculture potential, cage culture profiles and decision trees serving as a basis of discussion between farmers and extension workers. These are not a definitive guide covering all small-scale cage culture in Asia but rather serve as a basis for discussion that can be used to generate guidelines which can be adapted to particular regions, situations and individuals. The process allows decisions to be made on whether cage culture is appropriate or not and to choose the most appropriate system.

Appendix 6. The timetable for Project R7100 workshop

	Sun 9th July	**Mon 10th July**	**Tues 11th July**
8-9	Agreement on Agenda and approach Introduction to Session 1: Assessment of cage aquaculture potential	Introduction to *Session 2:* Development options for cage culture potential *Session 2*: parallel groups on generic profiles (inland/marine) and decision trees	Introduction to *Session 4* Policy issues in cage culture *Session 4*: presentation 1 (introduction; MB) Session 4: presentation 2 (Vietnam; JH)
9-10	*Session 1*: parallel groups on checklist	*Session 2*: parallel groups on generic profiles (inland/marine) and decision trees	*Session 4*: presentation 3 (Bangladesh; KM/MB) *Session 4*: presentation 2 (Key issues; KM/MB) *Session 4*: any other presentation
10-11	*Coffee* *Session 1*: checklist discussion	***Coffee*** Session 2: parallel groups on generic profiles (inland/marine) and decision trees	*Coffee* *Session 4*: Identification of key issues
11-12	*Session 1*: parallel groups on checklist Session 1: checklist discussion	Session 2: discussion of generic profiles (inland/marine) and decision trees	*Session 5*: OPEN DICSUSSION
12-1	***LUNCH***	***LUNCH***	***LUNCH*** ***FIN***
1-2	Afternoon cage visit Approx 4 hours	Introduction to *Session 3*: Development and communication techniques *Session 3*: Presentation 1 (Bangladesh PB)	
2-3		**Tea** *Session 3*: Presentation 2 (Vietnam (Tuan/Thuong) Session 3: Discussion and Recommendations	
3-4		*Session 3*: Discussion and recommendations	
4-5			

Appendix 6i. List of Delegates Attending Project R7100 workshop

Forename	Surname	Designation	Institution
Syed	Arifuzzaman	APO	CAGES Dhaka
Dr Gias Uddin	Ahmed	Professor	FF BAU Mymensigh
Dr Khan Kamaluddin	Ahmed	Senior Scientific Officer,	BFRI Rangamati
Asma Akhter(Munni)	Akhter	APO	CAGES Comilla
Naseem Ahmed	Aleem	APC	CARE-CAGES
Wadud	Ali	APO CAGES	CARE-Barisal
Md. Barkot (Bokul)	Ali	Director	DJKS Dulai Pabna
Md. Abdul	Alim	TO (Aqua) GOLDA Jessore	CARE Khulna
Md. Golam Rasul	Arman	Secretary	VDDC
Md. Ebadur Rohman	Badal	Executive Director	RAC Bangladesh
Shyamal Kanti	Barman	TO (T&E)	CAGES Jessore
Taslima	Begum	TO	CAGES Dhaka
Malcolm	Beveridge	Stirling University	Stirling Scotland
S M Ishaque	Bhuiyan	DFO Barisal	DOF Barisal
Paul	Bulcock	Stirling University	Stirling Scotland
Didarul Anam	Chowdhury	Technical Co-ordinator	CARE-Bangladesh
Sukanta	Chakma	Program Co-ordinator	Green Hill
Sonatan	Chakma	Co-ordinator	Green Hill
Bibhash	Chakraborty	TO (T&E)	CAGES Rangamati
Gopal	Datta	TO (Aqua)	CARE- GOLDA
Tarun Kumar	Ghosh	TA Jessore	CARE-CAGES
John	Hambrey	Nautilus Consultants	Edinburgh, UK
Anwar	Hossain	TA Barisal	CARE-CAGES
Zakir	Hossain	TO	CAGES Barisal
Md. Robiul Awal	Hossain	Scientific Officer	BFRI RS Chandpur
Dr. Rezaul	Hasan	Professor	BAU, Mymensingh
Rezaul	Haque	TO (M&D)	CAGES CBHQ
Sk Md. Ziaul	Huque	PDO (PTD)	CARE-CAGES
Md. Rafiqul	Islam	TO	CARE-CAGES
Faruqul	Islam	Co-ordinator	ITDG-Bangladesh
Nurul	Kabir	TO	CAGES Comilla
Gazi Md.	Kashif	AA	CARE-CAGES
Moksada	Khanam	AA CAGES	CARE-CAGES
Md. Abdul	Latif	APO	CAGES Natore
Md. A. Goffar	Mondol	APO (PTD) CARE Jessore	CARE-CAGES
Kenny	McAndrew	CAGES PC	CARE-Bangladesh
Nurun	Nahar	TO (Trg)	CARE-CAGES
Khairul Bashar	Mian	TA Comilla	CARE-CAGES
Dr.	Rahmatulah	Professor	BAU, Mymensingh
Alamgir	Rahman	PDO (Trg)	CARE-CAGES
Anisur	Rahman	AO (Fin)	CAGES CBHQ
Md. Abdur	Razzaque	TO (T&E)	CAGES Jessore
Jules	Sparrey	Reporter	
Ta Khak	Thoung	University of Fisheries	Nha Trang Vietnam
Le Anh	Tuan	University of Fisheries	Nha Trang Vietnam
Dr. Abdul	Wahab	Professor	BAU, Mymensing