Planning and extension guidelines for small-scale cage aquaculture in Asia

Paul Bulcock & Ken McAndrew

As reported in previous issues, a major constraint to the development of caged fish culture by poor communities is the lack of technologies appropriate to their technical, social, economic and institutional context. A 2-year, DFID-funded research project, R7100 *'The Improved Management of Small-Scale Cage Culture in Asia'* was awarded to the Institute of Aquaculture (IoA), University of Stirling, and the Asian Institute of Technology (AIT), Bangkok to address such issues.

Small-scale coastal cage aquaculture as operated in Khanh Hoa province, Vietnam.

Small-scale cage aquaculture and poverty reduction

Cage aquaculture has certain advantages over other aquaculture systems that are potentially important in terms of uptake by rural poor and landless people. The integrity of the cage unit means that large, communal water bodies can be used and, crucially, the ability to culture fish is not reliant on the ownership or leasing of land itself. Hence in theory, where access to a water body can be achieved, landless people can grow fish in cages, and obtain nutrition and income from the fish produced. In addition a common problem in traditional pond aquaculture is that of multiple ownership. This can result in conflict when determining the ownership of the fish produced, resulting in the under-utilisation of the water resource. With cage aquaculture the ownership issue is simple, in that the owners of the cages are the owners of the fish within. Generally fish in cages do not escape, provided a top net is present and the cage remains undamaged. Cages also exclude predators and caged fish are easily managed and harvested.

The culture of fish in cages can therefore be described as a promising aquaculture technology already proven in many other Asian countries. There are however negative connotations to be considered. Cage culture consumes resources such as water, space, seed and feed and may impact upon both the environment through the degradation of the benthos and water column and upon other resource users through competition.

During the lifetime of R7100, the project has addressed and identified the key issues and considerations involved in the implementation of small-scale cage culture in Bangladesh. Through a participatory approach in Bangladesh the project has adopted issues including the role of women in cage culture, social impacts caused by cage culture introduction, appropriate cage design and suitable low risk options. In Vietnam issues such as the sustainable supply of seed and feed items were addressed. Due to the participatory approach and use of promotional pathways supplied by partner institutions in both regions the knowledge generated was rapidly disseminated to farmers.

Final project workshop

For the final component of the project it was intended to form generic guidelines

- Guidelines for the production of small-scale culture extension and training materials
- Guidelines for the assessment of cage culture potential

A regional workshop on research and development strategies for small-scale cage culture was conducted from the 9th-11th of July 2000 attended by 46 delegates including R7100 staff, development workers and government representatives from Bangladesh, Vietnam, Stirling and AIT Here, key issues in cage aquaculture were discussed considering the differing technical, institutional, social and physical environments of inland and marine systems.

Through a combination of group work and plenary discussion the above guidelines were achieved via an assessment of:

- Cage aquaculture potential • Development options for small-scale cage culture
- Tools and methodology used in the Project
- Policy initiatives for sustainable cage culture development

Guidelines for the production of small-scale culture extension and training materials

A key consideration raised regarding this issue was that in order for low input, small scale cage extension to be effective, linkage and collaboration with relevant institutions is paramount. Project R7100

Red grouper cage culture in Vietnam

had experience with a number of institutions in both project locations and as a consequence had access to endemic knowledge, increasing both the speed of research and the identification of the most important topics to beneficiaries. The use of in-built promotional pathways and the participatory nature of the research meant that access to the rural poor was readily achieved and research could work alongside, and be conducted by, potential beneficiaries. This meant that not only was the technology more likely to be tailor made to their needs but those participating were exposed to cage culture, increasing their level of experience. The collaboration with partner institutions also assists in the training of institutional staff and the more rapid dissemination of findings.

The approach adopted by R7100 however, had certain limitations, which became apparent during the course of the research. The use of participatory approaches is limited by both financial and time constraints and the level of experience of stakeholders. Results, as a consequence, may be less quantitative in nature than would be traditionally expected.

Despite such minor problems the combination of research with an existing development project appears to be both effective and appropriate for the production of extension materials regarding small-scale cage culture. Linkage is the key to this approach. It is through collaboration with development, research and government institutions that the speed involved in the identification of constraints and the quality of research and its associated outputs is increased.

Guidelines for the assessment of cage culture potential

In addition to the partnership of research and other institutions, the key to cage culture assessment is a consideration of the social, economic, institutional and environmental context of intended beneficiaries. During the end of project workshop it was decided that the most appropriate mechanism of achieving this was through the production of the following: 1) a checklist of cage culture potential, 2) cage culture profiles, 3) decision trees.

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/m³ cage	7
life of cage	2
financial return/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 m³ per cycle)		
inputs	quantity	$
capital costs/cycle		1.8
seed	200	4.0
feed	80	0.0
labour (day)	26	20.8
outputs	kg	$
fish	24	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.

The use of the checklist, cage culture profiles and decision tree should serve as a guide only for extension workers in discussion with potential cage farmers and not a definite version, as individual criteria will vary between systems, regions and individual farmers.

Small-scale cage aquaculture can help alleviate the gap caused by the increasing demand for fish and the decrease in wild caught fisheries

Through the use of the checklist the decision of whether cage culture is appropriate can be discussed between the potential beneficiary and extension/NGO worker in a manner similar to that of a semi-structured interview. Once the implementation of cage culture has been decided upon, cage culture portfolios can be introduced. Thus an overall picture of inland and marine systems is formed with the decision trees outlining the processes undertaken in making such selections.

Crucial to this and indeed the use of all these tools is that they should serve as a guide only, outlining the principles and processes involved in the decision of whether to adopt cage culture and if so which options would be the most appropriate. They should therefore be reviewed and modified by those utilising them as situations and priorities vary between regions and between individual farmers.

The products from this workshop therefore serve as useful guides for similar research projects and outline the advantages and constraints associated with the approach adopted. They also serve as useful sources of generic information for future policy planners, extension workers and development workers concerned with small-scale cage culture development.

Further details of the proceedings of this workshop can be obtained from Paul Bulcock, R7100 Research Assistant, Malcolm Beveridge R7100 Project Leader, The Institute of Aquaculture, University of Stirling, Stirling. U.K and Kenny McAndrew Project Coordinator, The CARE-CAGES Project, 65 Road 7a, Dhanmondi, 1209, Dhaka, Bangladesh.

Key project outputs include

- Brugere C, McAndrew K. & Bulcock P 2000. Social impacts of cage aquaculture on communities in Bangladesh. Aquaculture Asia, July-Sept. pp 29-33.
- Harnbrey J.B 2000. Global trends in terms of input cost and supply, and market value of marine fin-fish. 1st International Symposium on Cage Culture in Aquaculture in Taiwan, 2nd6'^ November 1999. Asian Fisheries Society - World Aquaculture Society (In press).
- Hambrey J.B. & Tuan L.A. 2000. Status of cage mariculture in Vietnam. Proceedings of the First International Symposium on Cage Aquaculture in Asia, Tungkang Marine Laboratory, Taiwan, 2-6th November 1999. Asian Fisheries Society- World Aquaculture Society (In press).
- Huchette, S.M.H, Beveridge M.C.M. Baird DJ & Ireland M. 2000. The impacts of grazing by tilapias (Oreochromis niloticus L.) on periphyton communities growing on artificial substrate in cages. Aquaculture 186, 45-60.
- Kabir K. M. & Huque Z 2000. Cage design in the CARE -CAGES Project, Bangladesh. CARE - CAGES Project, Dhaka, Bangladesh. 1st International Symposium on Cage Aquaculture in Asia, Tungkang Marine Laboratory. Taiwan, 2-6'' November 1999. Asian Fisheries Society -- World Aquaculture Society (In press).
- McAndrew K., Brugere C., Beveridge M. C. M., Ireland M. J., Tapash R. & Yesmin K. 2000. Improved management of small-scale tropical cage culture systems in Bangladesh: potential benefits of an alliance between an NGO and a western research institute. In: P Edwards. D C Little & H Demaine (eds.) Rural Aquaculture. AIT Bangkok (In press).
- McAndrew K.I., Little D. & Beveridge M.C.M. 2000. Entry points and low risk strategies appropriate for the resource poor to participate in cage aquaculture. Experiences from the CARE-CAGES project Bangladesh. 1st International Symposium on Cage Aquaculture in Asia, Tungkang Marine Laboratory, Taiwan, 2-6th November 1999. Asian Fisheries Society - World Aquaculture Society (In press).