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Poverty Alleviation and Marine Cage Culture in Vietnam

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Applying the principles of sustainable development in practice in poor but rapidly developing countries is difficult and complex. In particular, rapid population growth leads to intense pressure on natural resources. Sustainable development strategies should alleviate poverty while at the same time reducing or minimising environmental degradation.

Sorting grouper seed.

Pressure on land and water resources in Vietnam is enormous. Only 0.13ha of cultivated land is available per capita of the rural population. Population growth is around 2%. The government has strongly encouraged increased agricultural production, mainly through intensification. For example, rice production grew from 16 to 24 million MT between 1985 and 1995 (FAO 1996), allowing Vietnam to shift from being a major importer, to being a major exporter of rice. Per capita income is still low however. with a national average below US$300 pa and as low as $100pa in the poorest districts. National and provincial development plans therefore increasingly emphasise diversification and increased income. How can this be achieved without further habitat destruction and environmental degradation?

Fisheries and aquaculture are obvious candidates in a country with more than 1,000 miles of coastline and extensive estuarine and intertidal systems. A DFID funded research project was begun early in 1988 whose purpose is to develop sustained small scale cage fish culture in inland and coastal waters. The project has a Bangladesh component (focusing on inland waters) and Vietnam component which focuses on marine cage culture in Khanh Hoa Province. This paper briefly describes the latter.

Major issues and research focus

Tropical marine cage culture is attracting increased attention, partly related to the search for alternatives to shrimp culture. Relatively small-scale and limited production has been underway for many years in Vietnam, based mainly on the fattening of wild seed of various grouper species, and lobster. Production takes place mainly in simple hanging net cages, stocked with wild caught seed, and fed with "trash" fish (Trai & Hambrey 1998). Harvested fish are sold mainly to export markets such as Hong Kong and

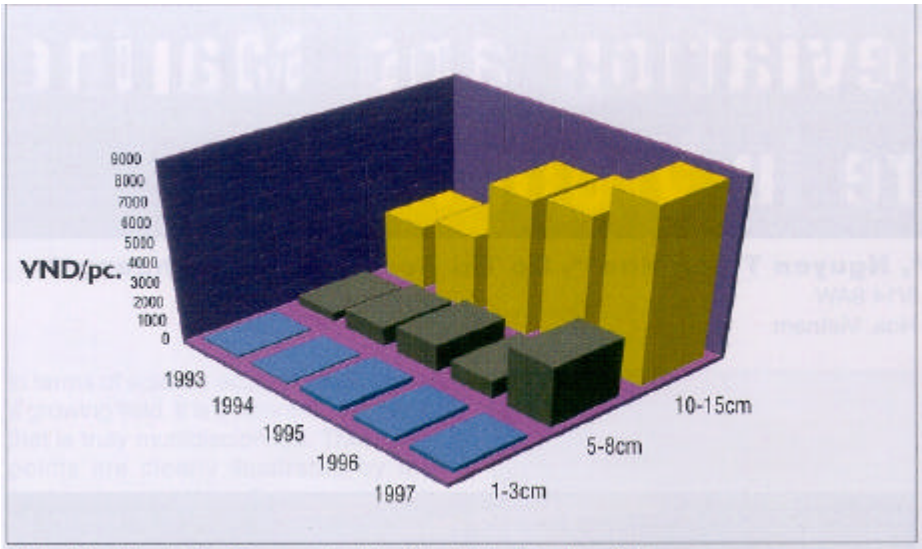

Fig 1: Price Trends for Grouper Seed in Khanh Hoa Province Vietnam (Trai and Hambrey 1988) (1US$=ca.VND11,500).

Sustainability of seed supply

A field study was conducted in early 1998 based on assimilation of existing information, questionnaire survey of fishermen, and catch area ecological survey, to identify the present status and future potential of grouper seed supply, from ecological, technical, and socioeconomic perspectives.

Sixteen main catching areas were identified in the Province through discussions with local fishermen. These were classified into three physical/ ecological types using cluster analysis. These types corresponded closely to conventional definitions of estuary, lagoon and coral reef. Four of the catching areas were classified as estuary, six as lagoon, and six as coral reef.

Taiwan, though there is modest local demand for the restaurant trade. The price of grouper is relatively high: around US$7-8/kg farm gate price.
Five basic questions are being addressed in the research:

1. Is the supply of seed sustainable, and is it sufficient to support a significant industry? What are the alternatives?
2. Is the supply of "trash fish" adequate and sustainable (in terms of sustained yield from the fishery)? What are the alternatives?
3. Does the use of "trash fish" as an aquaculture feed affect the price or availability of low cost nutritious fish for human consumption?
4. Which (if any) of the various options for marine cage culture is most suited to poverty alleviation, in terms of risk, investment, resource and financial characteristics?
5. What are the institutional and economic constraints to, and opportunities for, marine cage culture?

Practical output from the research will include guidelines for planning and extension of small scale marine cage aquaculture.

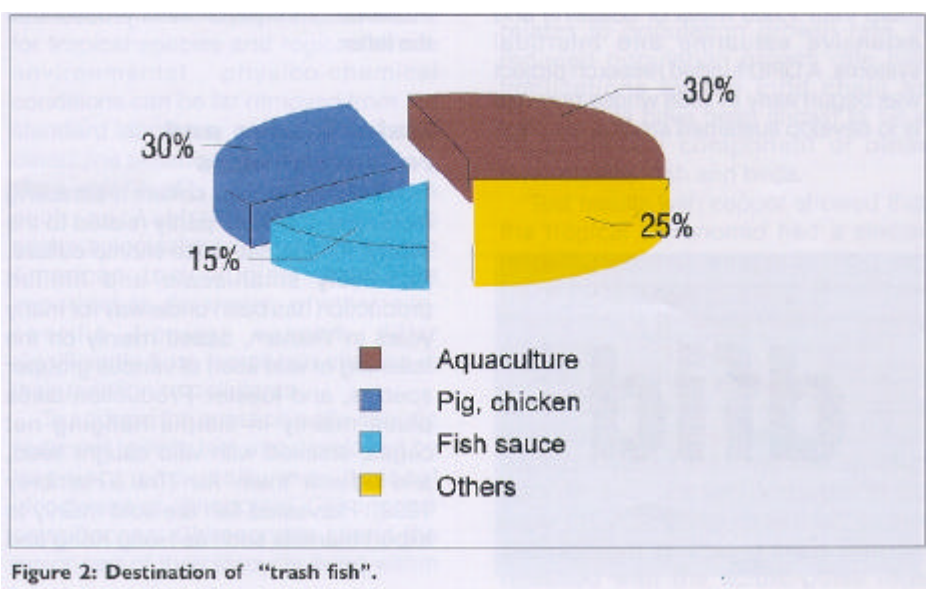

Figure 2: Destination of "trash fish".

There were six "black grouper" species collected: *Epinephelus akaara, E. malabaricus, E. coioides, E. merra, E. sexfasciatus, E. bleekeri* and one "red grouper" *Cephalopholis miniata* which were temporarily held for export. Seed production from these areas was positively correlated with sea grass cover for all species. In the case of *E. coioides* and *E. merra,* sea grass explained 94% of the variation in production, but less in other species. Production in all species was negatively correlated with both depth and salinity. No clear relationship was found with mangrove. However, migratory movements complicate the spatial relationships. According to fishermen, grouper seed, and in particular *E. malabaricus,* migrates from estuary to lagoon to coral reef during the period January to August.

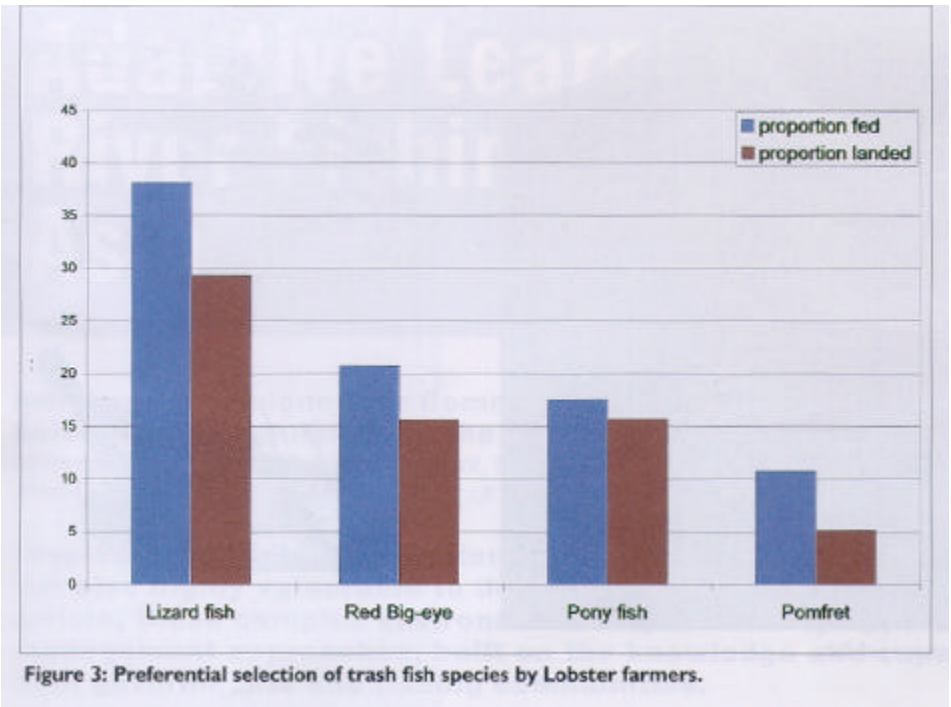

Figure 3: Preferential selection of trash fish species by Lobster farmers.

Total grouper seed production in Khanh Hoa was approximately 200,000 pieces per year, sufficient to meet local demand in the short term, but insufficient to allow for further expansion of the industry. Knowledge of the fishery is inadequate to be able to determine maximum sustainable yield, and this information is unlikely to be available in time to be useful for management purposes. However, price gives a reasonable indication of the relation between supply and demand, and this has increased significantly in recent years for all sizes of fish, suggesting a shortage of supply and the possibility of over-exploitation (Figure 1). Given the ineffective coastal fishery management regime (there is widespread over-exploitation of reefs and mangrove, and use of destructive or harmful fishing gears) over-exploitation, if not already a problem, is likely to become so in the near future. Some further research on catch-effort for the fishery should throw further light on the status of the fishery.

The potential supply of lobster seed is also being assessed roughly from first principles, using area of suitable habitat and natural productivity as indicators of potential seed production.

Consumption and supply of "trash fish"

The market for "trash fish" Aquaculture has become a significant local consumer of trash fish, accounting for 30% of landings (Figure 2) the balance being used for pig and chicken feed, fish sauce and a variety of other uses including human consumption, especially for the poor. Anchovy is the favoured species used for fish sauce. Most trash fish species cost around VND3,000kg (ca US$0.25/kg).

Historic price and quantity data is now being examined to try to determine the impact that demand for trash fish for aquaculture has on price of the different component species/size/quality groups. The nature and extent of trash fish use for human consumption is also being studied.

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Diet composition

Lobster are fed exclusively with fresh whole or chopped fish and shellfish. The most commonly used species/groups for feeding lobster are lizard fish (Saurida spp); red big-eye *(Priacanthus* spp); pony fish *(Leiognathus* spp); pomfret; snails, oyster and cockles; small swimming crab, other crabs and shrimp. Finfish comprises about 70% of the diet, with 30% shellfish. The preferred fish (comprising 38% of fishes in diet) was lizard fish.

Farmers showed active selection of the preferred fish species, using a consistently higher proportion than present in typical trash fish landings (Figure 3), and using a higher proportion of lizard fish in particular, despite the significantly higher price (average VND5000/kg) associated with this species.

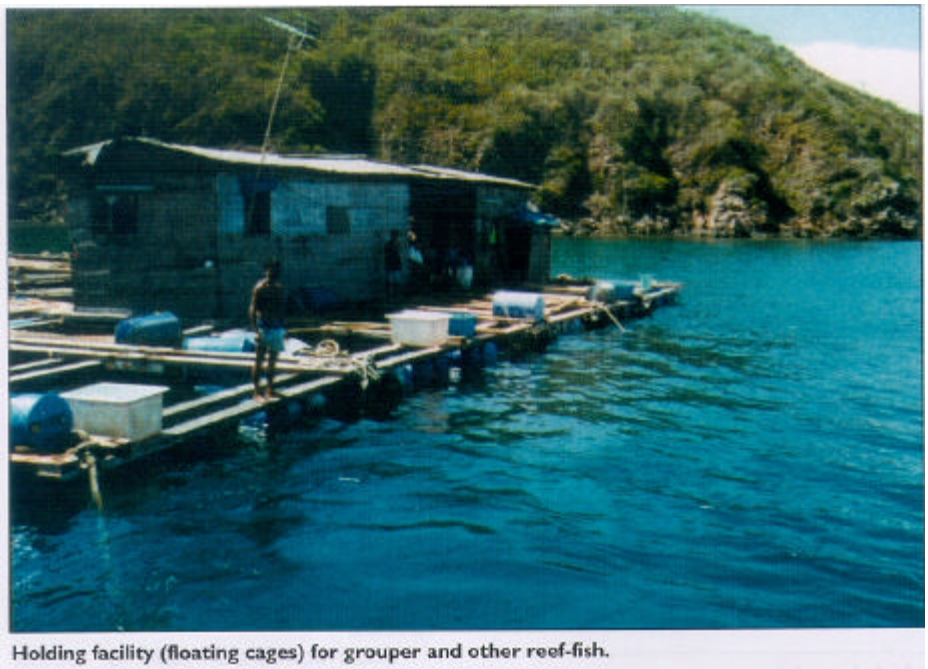
Food conversion ratio for lobster using this diet is high at around 28 (fresh weight basis).

Data is currently being analysed in respect of species used for marine fin-fish aquaculture. Previous studies (Trai 1997) have shown that only whole fresh trash fish are used, and that food conversion ratio in cage culture, averaging 5.9 (fresh weight) is significantly higher than that for pond culture of grouper where average FCR was found to be 4.3. Feed costs comprise around 18% of the farm gate price of grouper.

Technical options, social and institutional issues

A range of existing and possible future options for marine cage culture is being explored in terms of their sustainability and suitability for poverty alleviation. Social and institutional issues are also being addressed through participatory rural appraisal and more formal institutional analysis. More detail on this aspect of the project will be presented in a forthcoming Newsletter of the Aquaculture and Aquatic resources Management Program of the Asian Institute of Technology.

Preliminary Conclusions Cage culture of marine lobsters and finfish in Khanh Hoa province is profitable, and can be undertaken on a small scale. To date it has suffered few disease problems. It therefore has clear potential for the generation of increased income to poor local people. The major



Holding facility (floating cages) for grouper and other reef-fish.

constraints to further development at the present time appear to be:

high cost and probable inadequate supply of wild seed;

lack of access to low interest capital. Trash fish for feeding is still in plentiful supply, but the long-term sustainability of exclusive use of this resource for feeding is questionable, especially in the case of lobster, which exhibits a low food conversion ratio. Alternatives such as mixed or formulated diets, or the use of non-carnivorous species will be explored and compared with existing activities against a range of economic and environmental criteria.

The current supply of wild seed may be neither adequate nor sustainable for the future development of the industry, and either improved coastal resource management, and/or alternative supply from hatchery production would be needed in the long term.

Although hatchery production of grouper seed is possible, and appears to be financially viable on paper, it is difficult and risky, and would require significant investment alongside a co-ordinated development programme. A possible easier alternative is sea bass (Lates calcarifer), which is now routinely produced in hatcheries in Thailand. A general feasibility study is now underway to assess the viability of this option.

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