Consultation on Social Feasibility of Coastal Aquaculture

Madras, India
November 26 - December 1, 1984

NATIONAL SWEDISH BOARD OF FISHERIES
AND THE BAY OF BENGAL PROGRAMME

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CONSULTATION ON SOCIAL FEASIBILITY OF COASTAL AQUACULTURE
Madras, India
26 November - 01 December, 1984

Organized jointly *by*

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PREFACE

The Consultation on Social Feasibility of Coastal Aquaculture, reported in this document, was organized jointly by the small-scale fisheries project of the Bay of Bengal Programme (BOBPI and the National Swedish Board of Fisheries (NSBF).

The small-scale fisheries project of the Bay of Bengal Programme is funded by SIDA (the Swedish International Development Authority) and executed by FAO (Food and Agriculture Organization of the United Nations). It covers five countries bordering the Bay of Bengal – Bangladesh, India, Malaysia, Sri Lanka and Thailand. It is a multi-disciplinary project, active in craft, gear, aquaculture, extension, information and development support. The project's main goals are to develop, demonstrate and promote appropriate technologies and methodologies to improve the conditions of small-scale fisher-folk in the BOBP's member countries.

The NSBF acts as an "institutional consultant" to SIDA in matters related to fisheries development. The tasks of the NSBF in its cooperation with SIDA are to offer advice; carry out studies for strategy development; planning and evaluation of fisheries projects plus technical backstopping during implementation; purchase of equipment, and recruitment of consultants and field personnel.

In 1983, SIDA requested NSBF to review the status of aquaculture in developing countries and the potential for its development and for Swedish support to the sector. The study not only showed clearly the potential of this growing sector but also that aquaculture techniques and development projects were not always socially feasible in terms. of the benefits accruing to the intended beneficiaries.

The Consultation originated from a proposal endorsed by the 8th meeting of the Advisory Committee held in Chaka, January 1984. The proposal was based on the growing need to understand the social implications of coastal aquaculture which emerged from the experiences of countries in the region and from BOBP activities which had shown that though technically and economically feasible methods of aquaculture could be evolved, their social feasibility was not always ensured. BOBP and NSBF therefore agreed to organize the consultation as a joint activity. Thirty-five participants – scientists. aquaculturists, planners and administrators from the region and representatives of international organizations (ICLARM, SEAFDEC, ADB and ODA) – attended the consultation.

There was a week of lively discussion on ail aspects of the subject. As anticipated, due to the complexity of the subject and the varied backgrounds of the participants, a consensus was not arrived at *on* all aspects. However, the consultation highlighted a number of problems and opportunities regarding social feasibility.

Social feasibility of coastal aquaculture is a new and difficult discipline. The Consultation, naturally, could not conclusively answer the question : How to design aquaculture projects? This report is essentially meant as a basis for further discussion and work in the field. Its conclusions and recommendations will, hopefully, give planners, administrators and decision makers, both in developing countries and in donor agencies, an idea of the right questions to be asked when designing socially feasible coastal aouaculture projects.

We would like to thank all participants for their valuable inputs and efforts to make the Consultation a success. In particular we would like to thank Dr Ian Smith of ICLARM for preparing and presenting the keynote address, the resource persons for preparing the case studies and the Secretary of the Consultation, Mr Rathindra Nath Roy, for organizing and executing the Consultation. We would also like to thank Dr P Dehadrai, Development Commissioner of Fisheries, Government of India, for inaugurating the Consultation and taking part in it.

Finally, we wish to acknowledge SIDA's generous financial support to the Consultation

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SUMMARY

Various ideas, methods, strategies and questions concerning social feasibility, discussed at the consultation, are listed below. Development agencies can choose from this list, those ideas and strategies that are appropriate from the standpoint of their *policies,* the *countries* they operate in, the *projects* they are concerned with, and the *communities* they cater to.

1. *When* is a *project socially* feasible?

   A project is socially feasible when :

   - its benefits reflect the felt and actual needs of the people it sets out to help;
   - the benefits actually reach the people they are meant for;
   - the project does *not* exclude others in the region besides the target group and tries to answer their just needs. This minimizes the social conflict that often ensues from helping some and not others;
   - the distribution of benefits is equitable;
   - the project involves the people in deciding objectives and priorities, in planning and implementation;
   - the effort begins where people are at but does not keep them there. The project should consider and respect existing traditions, mores and attitudes in important areas like seasonal behaviour, leisure time use, sax-caste labour divisions, and cultural taboos while designing the effort, *to* ensure minimal conflict at entry;
   - the development should be self-sustaining. It should not develop a state of dependency on the project.

2. *Coastal aquaculture* for *whom?*

   There is too much focus at present on projects and technologies, and insufficient concern about the overall strategies which would lead to the development of coastal communities. Development agencies should shift their emphasis from the development of technologies to the development of people; in this case from the development of fisheries to the development of fisherfolk.

   SIDA, for example, views aquaculture in the context of rural development and has a clearly stated rural development strategy that defines the target as the socially and economically weaker sections of the population.

   The SIDA strategy recommends that a majority of the benefits should flow to the specific target group but it does not suggest that all the others should be excluded as that would be neither socially feasible nor just. The strategy focusses on resource growth through people's participation. It works towards greater *economic and* social *equality, better access to services for all, greater influence on* decision *making,* especially in the political arena; it promotes self-sustaining development and requires the community to get involved in the process by organizing itself and taking independent decisions.

3. *Technologies should be evolved only after target groups are identified.*

   Development agencies, especially those that evolve and transfer technologies, often have no idea or knowledge of the *particular* communities to whom the technology will be extended to. Target communities are selected on the basis of prevailing government policies or even for the convenience of the concerned development agency – and invariably *after* the technology is ready for extension and transfer.

4. *Questions to be asked before deciding on the technology and process of extension.*

   An agency should ask certain questions before it decides "which technology" and the "process of extension".

   - For whom is the effort?
   - Do we know them and about them?
   - Do they know us, and understand why we are trying to assist them in their development?
   - What are their stated needs and how do they prioritize their needs?
   - Are the causes of their problems known to them and to us?

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- How is the community organized socially and commercially to carry the new technologies into the mainstream of its life?
- What are the people willing to do for and by themselves?
- Do we understand the communities' concept of advantage?
- Will one particular technology ensure equitable spread of benefits or would a range of technologies be required?
- What constitutes 'appropriate' technology for the community in terms of its social, cultural and political attitudes and mores?
- Are we (the agency) committed to (and will the people) participate in the planning, choice and development of technologies and implementation?
- Keeping in mind the existing social and power structures in the community, who will get which benefits and why?
- How, if at all, can we ensure that those who need the benefits the most get them while reducing social tension and conflict along the way?

In the very process of asking these (sometimes difficult) questions, the planners of the agency will begin to put into practice socially feasible projects, for the questions and their answers would not only help in the selection of technologies and programme but, more importantly, suggest means and methods of developing and transferring such technologies.

5. *The need for a mediating agency to take part in project negotiations of behalf of target populations.*

Governments, development agencies and funding agencies communicate freely with each other, negotiate objectives and considerably influence each other's decisions. But the target population rarely has the ability and the means to participate in the negotiations and influence them. There may be a need for some form of a mediating agency to ensure such participation. Non-governmental service agencies and people's movements could take up the mediation role.

6. *Development agencies should reorder their organizational structure. . . .*

Concern for socio-economic aspects of development is usually the responsibility of the extension department which often comes into the picture *after* the scientists, technologists, economists and administrators have selected, developed, tested and convinced themselves about the technology.

The new socially feasible approach would require the agency to build into its structures a group concerned with understanding and working with the community. They will have an opportunity to affect basic policy and literally write the briefs for the scientists and technologists on the kind of technology to be evolved. Such a group would also look after extension and work with the community. Ideally, such a group would study social feasibility, plan for it, programme it and evaluate the social impact of programming. This is an important and difficult task – impossible unless the organization as a whole believes in the concept and supports it.

7. *Instruments should be developed to implement the social feasibility approach.*

A few instruments should be developed to help agencies to operationalize the social feasibility approach. They could be :

- A community status and needs statement, which could be used by the agency at the stage of negotiating the objectives and methods of the project ;
- A socio-economic impact statement, to help in the preliminary selection of technology and in deciding whether the scheme will be socially feasible at all ;
- In-process social impact appraisals, to monitor the social impact along the way and to indicate mid-course corrections;
- A socio-economic audit at the end of the project to guide future efforts of the agency, and to make the agency accountable for its efforts and impacts; and,

The development of rapid cost-effective appraisal techniques that save time and money without compromising on the quality of analysis.

8. *Social feasibility is a contradiction in terms. (Dissenting view)*

Underdevelopment can only be understood in terms of the social, political and economic structures in society that expropriate and channel benefits to the few at the cost of the many. For any 'real' development, these structures will have to be addressed and reordered. Such reordering will be resisted, the process will generate social conflict.

Thus a process that sets out to develop people in a 'socially feasible' manner is a contradiction in terms for the only way it would be 'socially feasible' would be by not 'really' developing people.

REPORT OF THE CONSULTATION ON SOCIAL FEASIBILITY OF COASTAL AQUACULTURE

Background

Late in November 1984, 35 aquaculturists, project administrators, government officials, social scientists, international donor agency representatives, bankers and representatives of fisherfolk came together in Madras, and spent six days exchanging experiences in coastal aquaculture, especially in terms of those social and cultural factors that affect the success of such projects. The idea was to arrive at recommendations on how this type of fishery technology could be used so as to benefit the socially and economically weaker segments of society.

The Consultation on the Social Feasibility of Coastal Aquaculture was organized by the National Swedish Board of Fisheries (NSBF) and the Bay of Bengal Programme of the FAO (BOBP) and brought together participants from Bangladesh, England, India, Malaysia, the Philippines, Sri Lanka, Sweden, Thailand and international agencies such as the ADB, ICLARM, ODA and SEAFDEC."

Why social feasibility?

The NSBF and BOBP were concerned about certain trends that they had begun to discern from experience with aquaculture in general and coastal aquaculture in particular. This concern led to the Consultation. The main issues were :

– Aquaculture tends to be a complex enterprise and often requires considerable capital. This makes it more accessible to the upper social and economic groups, which tends to concentrate incomes and wealth in the hands of the few instead of distributing it amongst the more needy, as several development programmes set out to do.

– The products of aquaculture, like shrimp, fish and shellfish are expensive and often beyond the reach of those who toil to produce them, and who need it to enhance their nutrition. So the products find their way to those who can absorb the high prices – urban and export markets.

– In spite of technical viability and economic (or, at least financial) feasibility, some aquaculture projects have failed to meet the social equity and development needs of the very communities that the programmes set out to help.

In spite of all these problems, aquaculture has great promise, and it is necessary to understand social factors and, more importantly, to devise socially feasible means of utilizing a valuable resource. With fish supplies dwindling as limits to capture fisheries are reached, many countries are viewing aquaculture as the primary means of achieving increases in fish supply to match increases in population and demand.

Dr. P.V. Dehadrai, Fisheries Development Commissioner, Government of India, inaugurated the meeting by describing India's experience with coastal aquaculture, and underlined the need and urgency to better understand the social dimension of the task.

In his keynote speech, Dr. Ian Smith, Deputy Director General of ICLARM, addressed the task of building the fouhdation of ideas and issues on which the discussions and deliberations of the Consultation could be built. With a group of participants drawn from diverse environments and functional specialities, the address had to not only review the state of art of the subject; it had to provide the bases for discussion of the major issues relevant to assessing the social feasibility of technology for coastal aquaculture in the tropics.

Dr. Smith began by looking at the role of technology in development : for technology, and the structural change it has wrought, is the centrepiece of claims to current prosperity in the developed countries and is, therefore. espoused by planners and policymakers as the solution to underdevelopment and poverty elsewhere. He felt that at the heart of the discussion regarding development should be concern for the means of development and its purpose and impact : we cannot measure development solely in terms of increase in total output or monetary value, but need to

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- **ADB : Asian Development Ban&, Manila**
  ICLARM : International Center for Living Aquatic Resources Management, Manila
  ODA : Overseas Development Authority, UK
  SEAFDEC : South East Asian Fisheries Development Centre. Iloilo, Philippines.

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determine the fashion in which such benefits are distributed and their impact on various strata of society.

Focussing on coastal aquaculture in the tropics, he pointed out that there was a critical need to determine its social feasibility because of several factors :

- Many countries are actively promoting aquaculture by creating favourable economic conditions because they view it as a means to overcome the constraints that capture fisheries are facing;
- The expansion of export markets for the products of coastal aquaculture (especially shrimp) is further fueling this expansion;
- The fragile nature of the coastal zone, particularly mangroves, and the potential competition for its use that aquaculture development can lead to; and
- The general lack of institutional preparedness to deal with this competition in the coastal zone.

Coastal aquaculture for whom?

Dr. Smith said that at the heart of deliberations on social feasibility is the question : "Coastal aquaculture for whom?". A socially feasible aquaculture system, he added, required that coastal communities participate in decentralized planning for the adoption of aquaculture technologies and that benefits be widespread. He warned that the interests of coastal communities were being overlooked in the drive by many nations for foreign exchange earnings from such coastal cultured species as shrimp which require large-scale investments.

Learning from the "Green Revolution"

Determining social feasibility required prediction and being able to judge ***a priori*** whether or not to proceed down a particular path – a difficult proposition in the best of times. However, it was suggested that valuable lessons for aquaculture development planning and implementation could be learned from experience with the "Green Revolution" in agriculture and the 'appropriate technology' movement. He identified and examined the factors that need to be taken into account when planning socially feasible coastal aquaculture systems. These include :

1. Informal and formal institutions, especially those of a legal nature, that govern property and use-rights in the coastal zone;
2. Source and degree of concentration of wealth in the coastal community;
3. Male and female labour use patterns and availability;
4. Extent of previous community collective action and the strength of local leadership;
5. Previous experience with aquaculture or technological change in other sectors;
6. Present technical and managerial skill levels;
7. Extent of community linkages with external institutions such as those concerned with credit, extension and markets; and
8. Socio-cultural aspects of community power structures, role of local elites, and consumer preferences.

Aquaculture can benefit the poor if . . . .

Dr. Smith concluded his presentation by suggesting that coastal aquaculture systems of an extensive rather than intensive type that could be integrated with existing community activities be developed. Examples : shell fish culture, pen culture of finfish and integrated poultry-fish and pig-fish pond culture. To facilitate this, he felt the need for legislative change or enforcement to reserve parts of the coastal zone exclusively for small-scale aquaculture activities of coastal communities which might otherwise be displaced by large-scale,capital intensive, corporate managed shrimp farming; long-term support; subsidies; and, of course, decentralized and participative planning and implementation. All this will bring about the type of change which may disruptive to existing community structures, but, as Dr. Smith pointed out, this change can also be liberating for the majority of coastal residents, who presently live in conditions of poverty and oppression.

Case studies

The keynote address had raised several issues, and there was need for a debate which would firmly root these ideas and concepts in the reality of planning and implementation of coastal aquaculture

projects. The participants formed themselves into smaller groups and spent the next three days discussing four cases that had been specially researched and written for the Consultation. The cases were developed around four coastal aquaculture projects in various stages of planning, implementation and functioning, and were drawn from Bangladesh, India and Thailand. Background materials for each case were provided, and each case study session was preceded by a presentation by the authors of the particular case study. The task set for the participants was to identify the social and cultural factors that could affect the success of the project under study and to suggest a strategic plan to make the project socially feasible. The groups had the option of rejecting the project as socially infeasible.

The first case was of a planning study undertaken prior to extension of shrimp pen culture in the backwaters of Killai in Tamil Nadu, India. A technical effort undertaken by the BOBP and the Government of Tamil Nadu had indicated technical and economic viability, and the case described a social feasibility study and the subsequent planning effort.

The second case was quite different in that it was not about a project. Local farmers and entrepreneurs of Satkhira in south-western coastal Bangladesh had responded to market conditions and had upgraded the existing technology of shrimp-paddy culture, which has been practised locally for years. The technology used the special environmental conditions created by a series of protective dykes that the government had built to prevent infiltration of brackishwater into agricultural land. What had begun as a means of protection had turned out to be an ideal way of containing the brackishwaters for shrimp culture. The question in this case was to look at the impact of such development on the local economy and the poor of the region and then to recommend regulations and modifications.

The third case concerned a project in Orissa, India. The Brackishwater Fisheries Development Agency in that state had developed a technology of contained tank shrimp culture, which had been discovered quite by accident, and had begun a successful extension of the technology along the shores of the Chilka lake, India's largest brackishwater lake. The programme seemed to be technically and economically viable and was obviously being transferred to the poor of the region. Here, the participants were asked to identify potential social problems, recommend policies and programmes and to learn from the effort the methods if any that had been used to ensure successful implementation of the project.

The last case was from Phang Nga in southern Thailand, a tourist resort made famous by a James Bond film that was shot in its beautiful surroundings. The poor fishermen faced with depleted stocks were in trouble, when the Government of Thailand and the BOBP developed and introduced cage culture of finfish and various forms of shell-fish farming. The idea seems to have caught on and several communities have taken up culture. The participants discussed the case with an eye to social and economic problems that the project expansion may cause and suggested strategies to overcome the problems.

Out of the discussions, multi-disciplinary in perspective and often heated, there seemed to evolve a consensus that technically viable and economically feasible projects can, and often do, fail to meet the social equity and social development needs of the very people the projects set out to help. More importantly, the discussion threw up several ideas and strategies that could be used to create socially feasible coastal aquaculture projects.

Findings **and recommendations**

The final sessions of the Consultation required of the participants a shift in logic, as it were. They had to take their findings and recommendations from the case studies and raise them out of their particular contexts in order to evolve general guidelines and recommendations which would enable agencies to develop, plan and programme socially feasible coastal aquaculture projects.

Out of the discussions emerged ideas, issues, questions and recommendations from which agencies could choose those relevant to their circumstances. Such an open-ended process is necessary when dealing with a complex area such as social feasibility with its subjective nature, dependent as it is on the particular social milieu, the project under consideration and its characteristics, the agencies involved, policy frames and objectives.

What is social feasibility?

The case studies and their personal experiences helped the group to evolve a consensus that technically and economically viable projects. have sometimes failed to meet the social equity and development needs of the very communities that the projects set out to help. With increasing levels of awareness and with Governments and major international agencies being held accountable for their efforts, such failures of a socio-cultural and political nature are becoming serious problems, and, therefore, need to be avoided. Development is no more an act of goodwill or charity which goes unquestioned. The group agreed that it was important that agencies evolve strategies which would enable them to plan and programme projects which are 'socially feasible'.

Social feasibility, most generally stated, seems to mean that :

- benefits of a programme should reflect the felt and actual needs of the people it sets out to help;
- the benefits actually reach tne people they are meant for;
- while focussing its activity and benefits on the target population, the programme does not exclude others in the region and tries to answer their just needs, which also minimizes the social conflict that often ensues from helping some and not others:
- the distribution of benefits is equitable;

  the programme involves the people in deciding objectives and priorities, in planning and implementation;
- the effort begins where people are at but does not keep them there. The programme should consider and respect existing traditions, mores and attitudes in important areas like seasonal behaviour, leisure time use, sex-caste labour divisions, and cultural taboos while designing the effort, to ensure minimal conflict at entry;
- the development should be self-sustaining and should not develop dependencies on the agency of development.

While these might sound idealistic and even impractical, they are nonetheless important as they focus on the correct attitude that an agency should adopt. How practical these factors are, of course, varies from agency to agency and project to project.

Social feasibility is a complex idea and while most of the participants agreed to the need for social feasibility and what it generally constitutes, it is important to balance such agreement with the dissenting voices that raised some very basic questions. Fr. Thomas Kocherry, the Chairman of the National Fishermen's Forum, said that underdevelopment can only be understood in terms of the social, oolitical and economic structures in society that not only expropriate but also channel benefits to the few at the cost of the many. Any 'real' development will have to address itself to these structures and reorder them. And it is safe to assume that such reordering will be resisted and the process will generate social conflict. Would not then, Fr. Kocherrry asked, a process that set out to develop people in a 'socially feasible' manner be a contradiction in terms, for the only way it would be 'socially feasible' would be by not 'really' developing people?

Aquaculture for whom?

At the heart of deliberations on social feasibility is the question : "Coastal aquaculture for whom?" Development agencies need to have clear and well thought out policies and strategies which precisely define the target, the concept of development being adopted and the means to achieve it. The participants felt that there tended to be too much focus on projects and technologies, and insufficient concern about the overall strategies which would lead to the development of coastal communities. It was even suggested that development agencies should shift their emphasis from the development of technologies to the development of people; in this case from the development of fisheries to the development of fisher-folk.

Arne Andreasson of NSBF and Lasse Krantz. consultant to SIDA, pointed out that SIDA sees aquaculture in the context of rural development and has a clearly stated rural development strategy that defines the target as the socially and economically weaker sections of the population.

The SIDA strategy recommends that a majority of the benefits should flow to the specific target group but it does not suggest that all the others should be excluded as that would be neither socially feasible nor just. The strategy focusses on resource growth through people's participation. It works

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towards greater economic and social equality, better'access to services for all, greater influence on decision making, especially in the political arena; it promotes self-sustaining development and requires the community to get involved in the process by organizing itself and taking independent decisions.

The problem in most cases, however, is that development agencies, especially those that evolve and transfer technologies, often have no idea or knowledge of the particular communities to whom the technology will be extended to. Target communities are selected on the basis of prevailing government policies or even for the convenience (in working) of the concerned development agency and invariably after the technology is ready for extension and transfer.

In effect, solutions are often first generated, which then look for problems to solve!

Development agencies have their own objectives deriving from their particular ideologies, their understanding of underdevelopment, of national and regional needs, the physical environment and of course of the state of the art of science and technology. The needs and problems of the people they set out to help are often only understood in general and aggregate terms. More often than not the objectives of a programme are negotiated by the development agency (especially if it is an international one) and the concerned government. The target communities who have their own felt and actual needs and problems cannot really be sure that their needs will be met by the programme unless of course their own needs fit the objectives negotiated by the agencies and governments. As Figure 1 shows, the need profile of the community can be in at least four different locations in the objectives map but will be satisfied only in position 4 where it coincides with the common negotiated objectives. The group recommended that agencies should identify target communities to the extent possible before they begin evolving technologies and involve them in the process of deciding on the technologies that should be evolved.

A second problem was identified in this respect. The different government, development and funding agencies communicate freely with each other, negotiate objectives and have considerable influence on each other's decisions. The target population or, to be specific, any particular community, even if it is identified and known, rarely has the ability and the means to participate

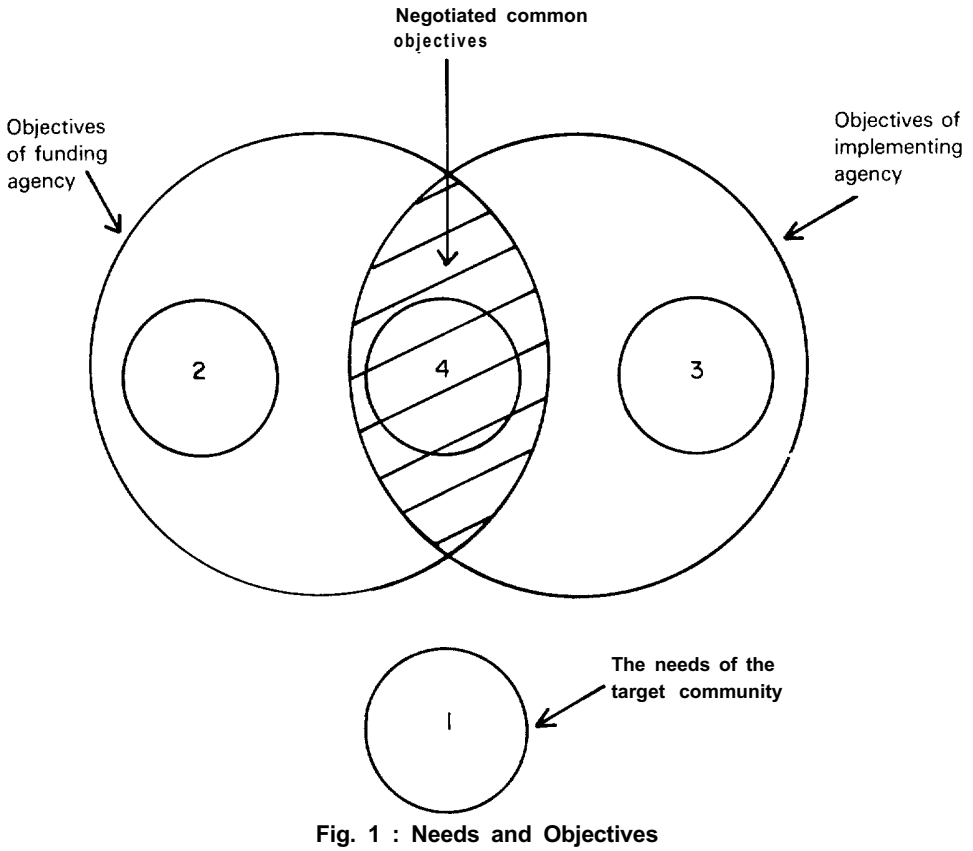

Fig. 1 : Needs and Objectives

in the negotiations and influence them. Figure 2 visualizes this problem and it can be seen that there may be a need for some form of a mediating agency if the social feasibility requirement of participation has to be taken seriously. Some participants suggested that non-governmental service organizations and people's movements could take up the mediation role. However, it was pointed out,that should they not exist, the agency may have to take the responsibility of mobilizing and organizing the community to secure its participation in the development process.

A third problem, and one that might have far reaching policy implications for development agencies was pointed out by the participants and this revolved around the question : why aquaculture?

Why Aquaculture?

At its most simple level the question "why aquaculture?" c.nmes up because the communities' needs are not matched by the agency's abilities. People live their lives, rarely separating and articulating their needs and problems into neat functional areas. They prioritize their needs and problems based on their own logic frames. For them one technology or even a group of technologies that satisfy only a sub-set of their needs and problems may not be a very attractive proposition especially if the sub-set addressed is low on their priority list.

Development agencies on the other hand are usually specialized groups working in one or at best a few functional areas, for example fishing. They do so because such specialization is not only

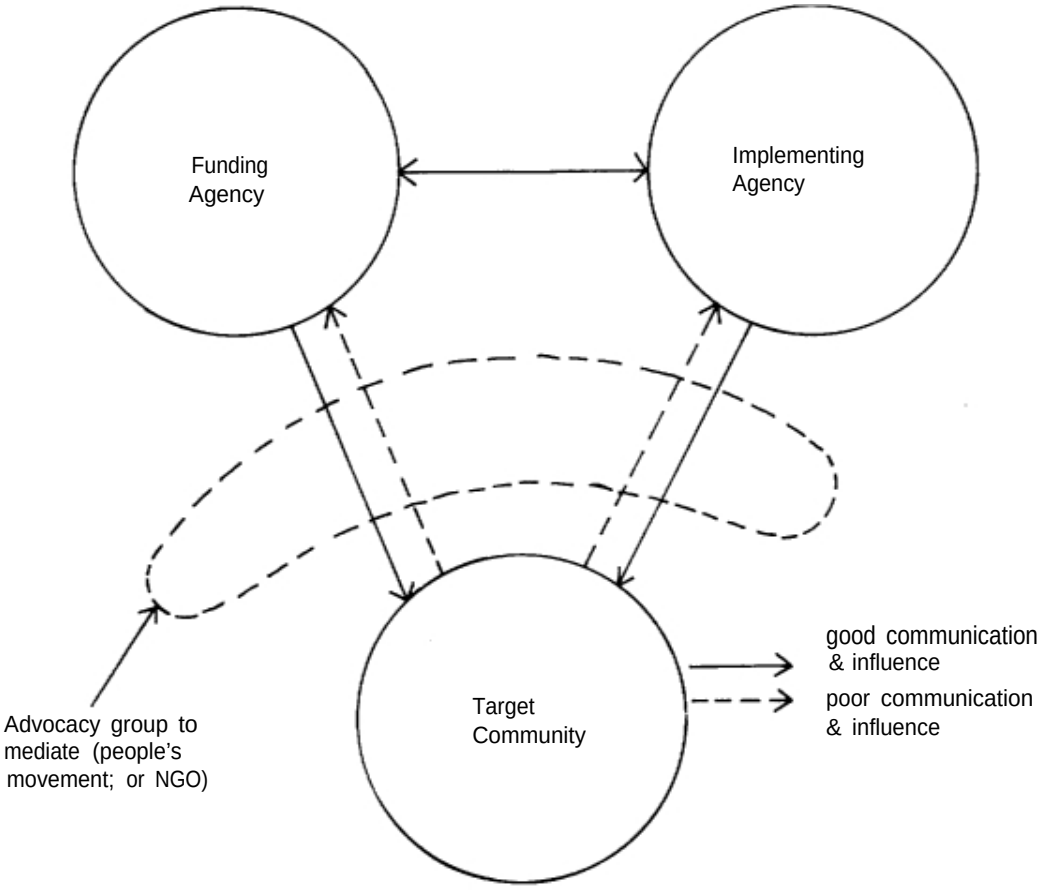

Fig. 2 : The need for a voice for the target community

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efficient and easy to manage but because it reflects the logic frame of scientificdevelopment. Thus the insufficient concern about overall strategies, a complaint that has often been levelled at specialist agencies, is an organizational problem which can only be overcome with basic policy shifts. The participants suggested that either the agency could widen its role and consider a range of technologies or it should develop collaborative superstructures with other agencies to provide the community with a range of technologies to answer their range of needs – a cafeteria approach that will give the community opportunity to choose and answer several of its problems simultaneously with the organizational ease of working with one organization.

An agency, the participants recommended, ought to ask certain questions before it decides "which technology" and the "process of extension" :

- for whom is the effort?
- do we know them and of them?
- do they know us, and understand why we are trying to assist them in their development?
- what are their stated needs and how do they prioritize their needs?
- are the causes of their problems known to them and to us?
- how is the community organized socially and commercially to carry the new technologies into the mainstream of its life?
- what are the people willing to do for and by themselves?
- do we understand the communities' concept of advantage?
- will one particular technology ensure equitable spread of benefits or would a range of technologies be required?
- what constitutes 'appropriate' technology for the community in terms of its social, cultural and political attitudes and mores?
- are we (the agency) committed to (and will the people) participate in the planning, choice and development of technologies and implementation?
- keeping in mind the existing social and power structures in the community, who will get which benefits and why?
- how, if at all, can we ensure that those who need the benefits the most get them while reducing social tension and conflict along the way?

It was suggested that in the very process of asking these (sometimes difficult) questions the planners of the agency will begin to put into practice socially feasible projects, for the questions and their answers would not only help in the selection of technologies and programmes but, more importantly, suggest means and methods of developing and transferring such technologies.

Organization for Social Feasibility

Most of the participants realized that the organizational structure of development agencies, not to mention their policies, would have to be reordered to meet the new requirements. For example, concern for socio-economic aspects of the development process usually is the responsibility of the extension department or division which more often than not comes into the picture after the scientists, technologists, economists and administrators have selected, developed, tested and have convinced themselves of the techno-economic feasibility of the technology earmarked for extension.

The new socially feasible approach would require the agency to build into its structure a group concerned with understanding and working with the community and which will have an opportunity to affect basic policy and literally write the briefs for the scientists and technologists on the kind of technology to be evolved. Such a group would also look after extension and work with the community. Ideally such a group would study social feasibility, plan for it, programme it and evaluate the social impact of programming. This is an important and difficult task which, the participants felt, would be impossible unless the organization as a whole believed in the concept and supported it. Figure 3 suggests an organizational form that incorporates such activities into an agency.

The new orientation also requires agencies, particularly those divisions and departments who have responsibility for technology development, to rethink their modus operandi. With the needs of the community deciding the selection of technologies to be developed, a very strong case may be made for not only involving the community in developing and testing the technologies but also for doing it in *situ* rather than in centralized laboratories and centres. This concept should make particular sense in aquaculture where the technologies are extremely environment-specific and

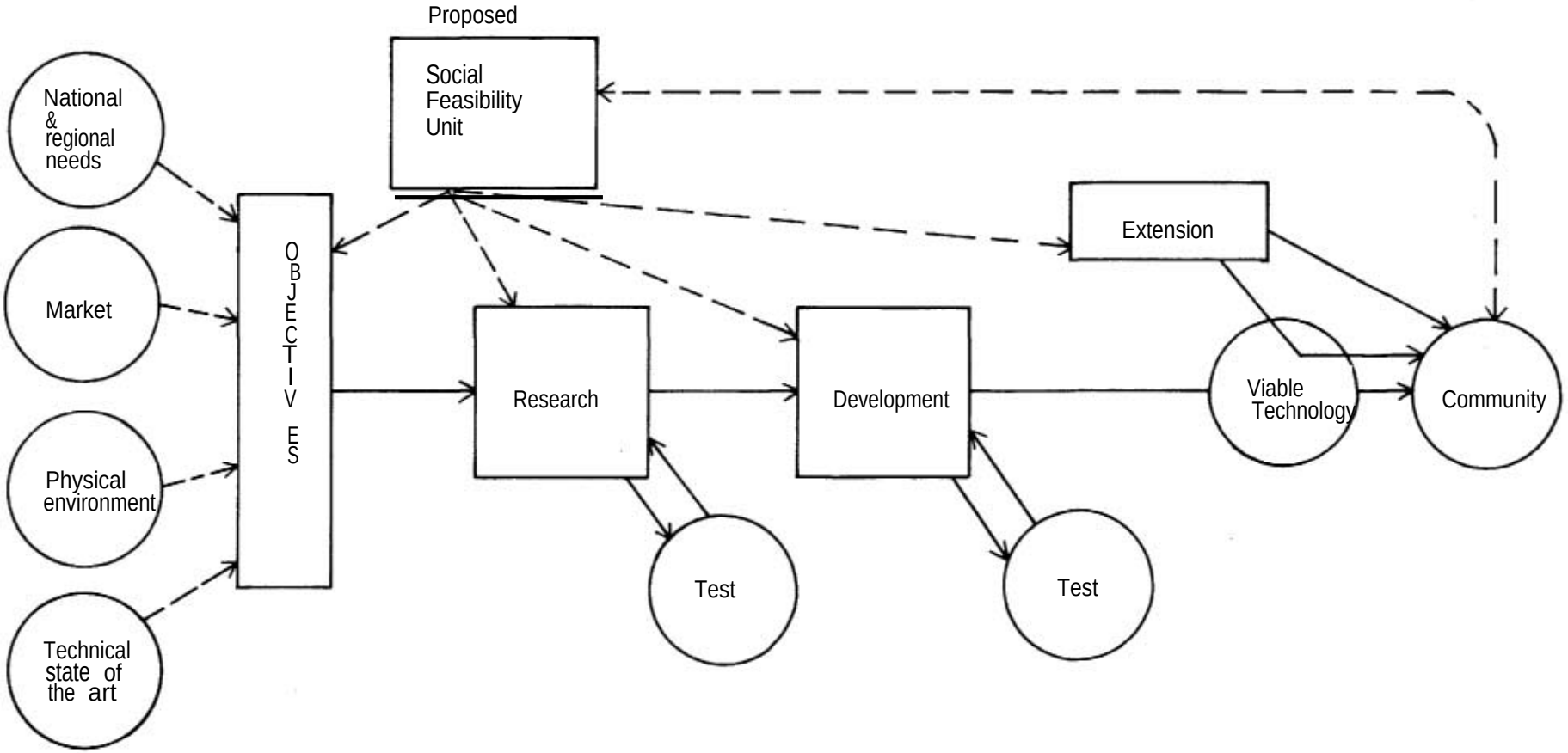

Fig. 3 Incorporating social feasibility

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their success depends to a very large extent on the ability of the community to manage them. Both these factors would get incorporated and eventually resolved in decentralized participatory research and development. Ultimately the strongest case for such an approach would be that the community would need very little convincing and would transfer the technology by word of mouth and practice faster and better than any organized extension process. Further, the self sustaining aspect of the technology would be ensured to a certain extent because of the 'transparency' of a technology locally developed with the people.

Practicability of Social Feasibility

In the final analysis an agency would incorporate social feasibility considerations into its working only if it is practical for it to do so. The participants realized this and dwelt on the topic and came up with ideas and recommendations. The success in operationalizing a concept such as social feasibility, that is in danger of becoming vague and intangible, lies in being able to observe it and to measure it. This would require the agency to have a clearly stated policy and strategy which spells out the ends and means of various developmental activities. It would also require that the agency evolve indicators to measure the achievement of social feasibility in quantitative and qualitative terms.

A few instruments should be developed to help agencies to operationalize the social feasibility approach. They could be :

1. *A community* status and needs *statement,* which could be used by the agency at the stage of negotiating the objectives and methods of the project;
2. *A socio-economic impact statement,* to help in the preliminary selection of technology and in deciding whether the scheme will be socially feasible at all;
3. *In-process social impact appraisals,* to monitor the social impact along the way and to indicate mid-course corrections; and
4. *A socio-economic audit* at the end of the project, to guide future efforts of the agency and to make the agency accountable in a sense for its efforts and impacts.

Organizations are constrained by time and funds. And no agency would accept social feasibility if it inordinately delayed its efforts and cost a lot. This, of course, requires the development of rapid, cost-effective appraisal techniques that save time and money without compromising on data, analysis quality. Finally, and perhaps most importantly, agencies would have to develop manpower in sufficient numbers to undertake these new and difficult tasks to make an impact on development. All this, the participants suggested, requires a concerted push by those who are convinced of the need for social feasibility in development programming to persuade and enable agencies to take the right steps.

Finally, the participants realized that they had raised more questions than they had answered, but this was to be expected considering the complexity and 'newness' of the subject. They felt that the Consultation had provided them with an opportunity to articulate thoughts, feelings and ideas which in the course of their work they would hesitate to, because of the sensitive nature of the subject and for the fear of political implications. In articulating the problem they felt a begining had been made. A problem had been stated and the first few tentative stepstaken in understanding it and evolving solutions.

Appendix 1

LIST OF PARTICIPANTS

1. Dr. Aftabuzzaman	Physician & Private Shrimp Farmer Satkhira, Bangladesh
2. Ms. Karuna Anbarasan	Consultant – FAO/BOBP Madras, India
3. Mr. Arne Andreasson	Head of Section, NSBF Gothenburg, Sweden
4. Mr. V.C. Bose	Team Leader – BOBP Shrimp Culture Project Killai, India
5. Dr. Sean Conlin	Social Development Adviser Overseas Development Administration London, U.K.
6. Mr. R.G. Dandekar	Dy. General Manager National Bank for Agricultural and Rural Development Bombay, India
7. Dr. P.V. Dehadrai	Fisheries Development Commissioner Govt. of India New Delhi, India
8. Mr. Hans Dorresteijn	Extension Training Officer – FAO/BOBP Madras, India
9. Ms. Edeltraud Drewes	Socio-economist – FAO/BOBP Madras, India
10. Dr. Bo Holmberg	Head of Section, NSBF Gothenburg, Sweden
11. Mr. J.A.J. Janssen	Aquaculturist – FAO/BOBP Associate Professional Officer Colombo, Sri Lanka
12. Mr. V.M.T. Joshi	General Manager (Planning) State Bank of India Madras, India
13. Mr. Kachornsak Wetchagarun	Policy and Planning Analyst Department of Fisheries Bangkok, Thailand
14. Dr. M. Karim	Aquaculturist FAO/BOBP Colombo, Sri Lanka
15. Mr. Md. Shafi Khan	Consulting engineer & private shrimp farmer Dhaka, Bangladesh
16. Mr. Sanjay Kumar Khatua	Sr. Research Associate & Coordinator DANIDA Drinking Water Project Bhubaneswar, India
17. Rev. Fr. Thomas Kocherry	Chairman National Fishermen's Forum of India Cochin, India
18. Mr. Lasse Krantz	University of Stockholm Stockholm, Sweden
19. Mr. T. Lakshmanan	Dy. Manager United India Insurance Co. Ltd. Madras, India
20. Dr. Don MacIntosh	Overseas Development Administration London, U.K.

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21. Mr. Manu Potaros	Sr. Fisheries Biologist Department of Fisheries Bangkok, Thailand
22. Dr. Robert C. May	Sr. Aquaculture Specialist Asian Development Bank Manila, Philippines
23. Mr. P. Mohapatra	Addl. Director of Fisheries Govt. Of Orissa Cuttack, India
24. Ms. Patchanee Natpracha	Sociologist – FAO/BOBP Madras, India
25. Ms. Laura E. Piriz	Aquaculturist – FAO/BOBP Gothenburg, Sweden
26. Ms. J.H. Primavera	Researcher SEAFDEC Iloilo, Philippines
27. Mr. A.D. Isaac Rajendran	Jt. Director of Fisheries Govt. of Tamil Nadu Madras,. India
28. Mr. D.S. Raju	Private Shrimp Farmer Kakinada, India
29. Mr. Siow Kuan Tow	Sr. Fisheries Officer Fisheries Department Kuala Lumpur, Malaysia
30. Dr. Ian R. Smith	Dy. Director General ICLARM Manila, Philippines
31. Ms. Diana Tempelman	Socio-Economist – FAO/BOBP Madras, India
32. Mr. K. Thayaparan	Director of Inland Fisheries Ministry of Fisheries Colombo, Sri Lanka

Appendix 2

PROGRAMME

Monday, November 26, 1984

0900	Registration of participants
0930	Inauguration Welcome : – R N Roy, Consultation Secretary – L O Engvall, Programme Director, BOBP A Andreasson, Head of Section, NSBF Inauguration by : Dr P V Dehadrai, Development Commissioner (Fisheries) Ministry of Agriculture, Govt. of India Keynote address : Dr Ian R Smith, Dy. Director General, ICLARM
1130	Briefing of participants on the case method
	Lunch
1400	Case study No. 1 “Planning for Extension of Shrimp Pen Culture in Killai, Tamil Nadu” (after briefing by case writer the participants will break into three committees to discuss the case).
1700	Session concludes.

Tuesday, November 27, 1984

0930	Case study No. 1. Discussions continue till 1300
1400	Case study No. 2 "Shrimp culture in Satkhira, Bangladesh"
1700	Session concludes

Wednesday, November 28, 1984

0930	**Case** study No. 2. Discussions continue till 1300

Thursday, November 29, 1984

0930	Case study No. 3 "Confined Tank Shrimp Culture in Chilka Lake, Orissa, India" Case study No. 4 "Extension of Cage and Shellfish Culture in Phang Nga, Thailand" (after briefing by the case writers the group will break into two groups to discuss the cases).
1400	Case study No. 3 / Case study No. 4 Discussions continue till 1700

Friday, November 30, 1984

0930	Plenary session Summing up of findings and recommendations of case study discussions followed by briefing on developing guidelines and recommendations for agencies on socially feasible coastal aquaculture – R N Roy (the group will break into committees after the briefing for discussions)
1400	Discussion continues
1600	Plenary session : Presentation of recommendations/guidelines and discussion

Saturday, December 01, 1984

0930	Plenary session Presentation of recommendations/guidelines Presentation by agency representatives of their organization's ideas/policies
1300	Consultation concludes.

Appendix 3

SOCIAL FEASIBILITY OF COASTAL AQUACULTURE : PACKAGED TECHNOLOGY FROM ABOVE OR PARTICIPATORY RURAL DEVELOPMENT?

Keynote Address by

Dr. Ian R. Smith,
Deputy Director General, ICLARM, Manila

ABSTRACT

The critical need to determine the social feasibility of coastal aquaculture in the tropics exists because of several factors : the rapid pace of technological development in coastal aquaculture systems; the expansion of potential export markets for the products of coastal aquaculture (especially shrimp) and the economic pressure for increased production; the fragile nature of the coastal zone, particularly mangroves, and the potential competition for its use that aquaculture development can bring; and the general lack of institutional preparedness to deal with this competition in the coastal zone.

A socially feasible aquaculture system requires that coastal communities participate in decentralized planning for the adoption of aquaculture technologies and that benefits be widespread. Projects justified solely on technical and financial grounds usually fail to take into account the socio-cultural and institutional setting of coastal communities, and there is the danger that the interest of these communities is being overlooked in the drive by many nations for foreign exchange earnings from such coastal cultured species as shrimp which require large-scale investments.

1. Introduction

A. *Technology and Development*

The appropriate role of technology in rural and agricultural development, indeed in economic growth and progress as a whole, has been the subject of intense debate for many years. Pitting purists against pragmatists, and involving a lot of others in between, the issue has always been contentious because technological improvement of one form or another is not only an integral part of so many approaches advocated to alleviate poverty around the world but also a challenge to the status quo. Technology, and the structural change it has wrought, is the centrepiece of claims to current prosperity in the west and is therefore espoused by Westerners as the solution to under-development and poverty elsewhere. Western approaches, though, are often criticized for their materialism and failure to appreciate socio-cultural differences elsewhere (Reddy 1976).

This criticism comes not only from individuals in societies which claim to be subjected to cultural and technological pressure from external sources but also from Westerners themselves. For example Will and Ariel Durant share this doubt about the direction that technology leads us all when they state :

> "Sometimes, we feel that the Middle Ages and Renaissance, which stressed mythology and art rather than science and power, may have been wiser than we, who repeatedly enlarge our instrumentalities without improving our purposes." (1968, p. 95).

Concern for technology and its purpose and impact should be at the heart of the discussion regarding development of any sector, be it industry, commerce, agriculture or aquaculture. Measuring development solely in terms of increases in total output or monetary value is the easy though oft-misleading measure of impact; determining the fashion in which benefits from output expansion are distributed is much more difficult. Even more problematic is trying to *anticipate* these distribution effects and therefore being able to judge a *priori* whether or not to proceed down the path indicated by technical feasibility alone or in what fashion the path should be redirected to achieve social ends. Prediction will always be difficult, but experience with agricultural development over the past two decades, especially with the impact of the high yielding crops of the Green Revolution, can at least assist planners in other sectors such as aquaculture to ask the right set of questions.

B. *Social Feasibility*

The primary purpose of this paper is to develop the major issues relevant to assessing the social feasibility of technology for coastal aquaculture in the tropics. The issue of social feasibility will begin from the point where technical and financial possibility leave off, thus assuming that both of these aspects of technology evaluation have been answered positively.

The concept of 'social feasibility' as used in this paper is thus a broad one, essentially encompassing "all aspects except those which are technical and financial." This distinction between techno-financial and other aspects is crucial because much of the current aquaculture development in the coastal zone in the tropics is undertaken by *private* entrepreneurs, motivated primarily, if not exclusively, by technical and financial considerations. It stands to reason, therefore, that issues related to social feasibility which include economic (in the social welfare sense as distinct from straight forward profitability), socio-cultural, legal, political and institutional dimensions of aquaculture development should be addressed by participants in the *public* planning process.

As the question raised by the subtitle of this paper implies (packaged technology from above or participatory rural development ?), equally important to consider as the right set of questions is the process through which answers are sought and in particular the degree to which coastal zone residents in the tropics can participate when questions of aquaculture development are addressed. For, at the heart of deliberations about social feasibility should be the question: "coastal aquaculture development for whom?"

One might well ask why at the current time questions of social feasibility of coastal aquaculture are particularly important. The critical need to address these issues arises because of the following factors :

(a) the rapid pace of technological development in coastal aquaculture systems;

(b) the expansion of potential exports markets for the products of coastal aquaculture and the economic pressure that this potential creates for increased production;

(c) the need to add to the supply of aquatic protein available domestically;

(d) the fragile nature of the coastal zone itself and the potential competition for its use and misuse that aquaculture. development can bring; and,

(e) the general lack of institutional preparedness to deal with extreme competition for use of the coastal zone.

It is the underlying theme of this paper that ways must be found to balance the technical and financial arguments in favour of rapid expansion of large-scale capital-intensive coastal aquaculture with a concern for the long-term effects that such development will have on the coastal zone in the tropics and more importantly, upon the present inhabitants there, most of whom are small-scale fishermen and gatherers with few, if any, alternative employment opportunities.

Valuable lessons for aquaculture development planning and implementation can be learned from experience with the Green Revolution in agriculture and the 'appropriate technology' movement. Factors that need to be taken into account when planning socially feasible coastal aquaculture systems include : (1) Informal and formal institutions, especially those of a legal nature, that govern property or use rights in the coastal zone; (2) sources and degree of concentration of coastal community wealth; (3) male and female labour use patterns and availability; (4) extent of previous community collective action and strength of local leadership; (5) previous experience with aquaculture or technological change in other sectors; (6) present technical and managerial skill levels; (7) extent of community linkages with external institutions such as credit, extension and markets; (8) socio-cultural aspects of community power structures, role of local elites and consumer preferences.

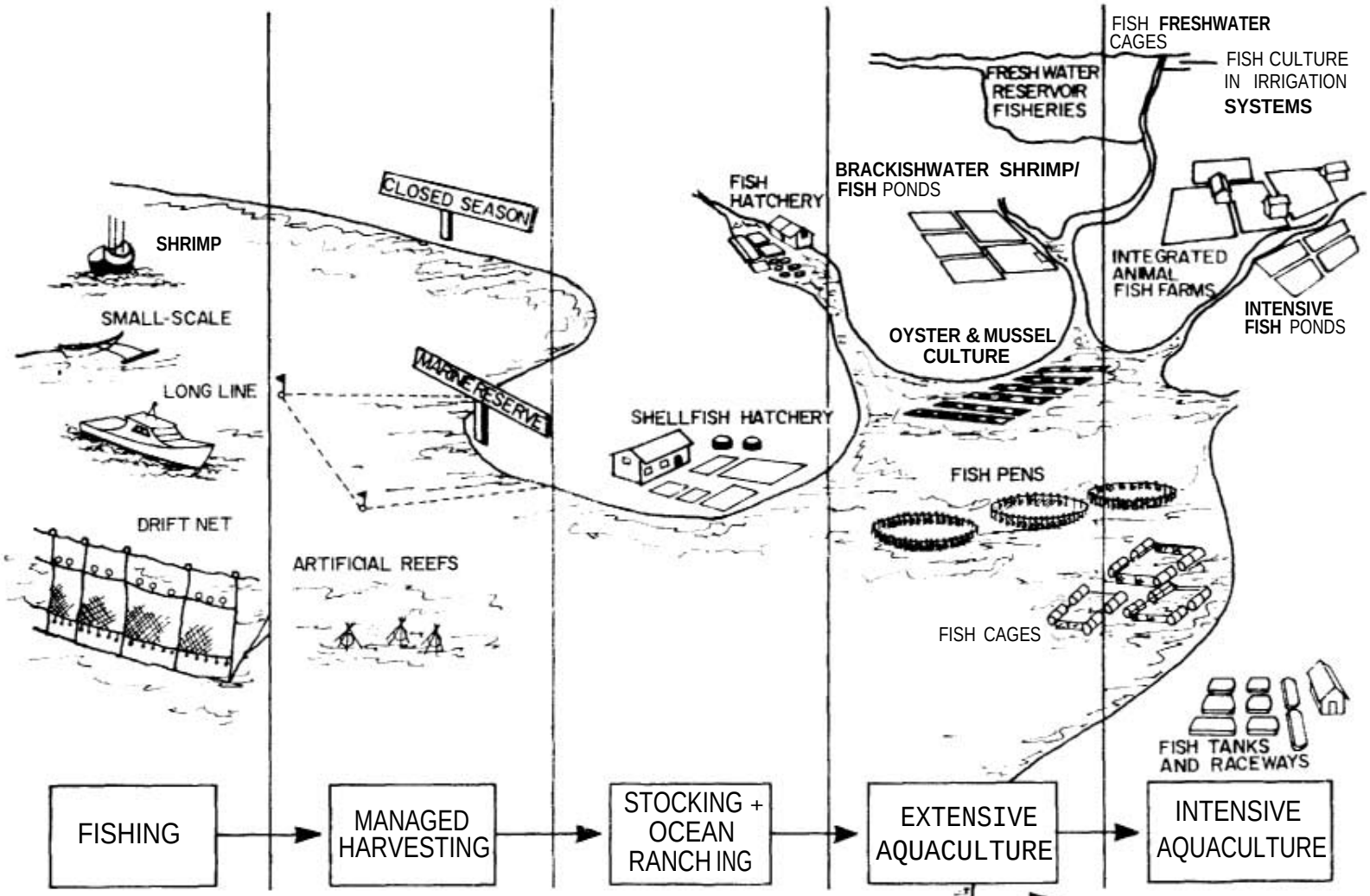
This paper examines each of the above factors and concludes that socially feasible coastal aquaculture systems, such as bivalve culture and integrated farming that can be integrated with existing community activities, can be developed. Successful implementation of such projects will require long-term support and even subsidies for coastal communities. Also required is legislative change or enforcement to reserve parts of the coastal zone specifically for small-scale aquaculture activities of coastal communities which might otherwise be displaced by large-scale capital intensive corporate-managed shrimp farming. Aquaculture technologies will bring change to coastal communities which may be disruptive to the existing community structure, but this change can also be liberating for the majority of coastal residents who presently exist in conditions of extreme poverty.

2. Coastal Aquaculture in the Tropics

A. *Production Trends and* Systems *Diversity*

With fish protein supplies levelling off in many countries as limits to capture fisheries production are reached, aquaculture is being viewed as the primary means of achieving the incremental growth in aquatic food supply necessary to keep up with continued increases in population and demand. In response to the favourable economic conditions created for aquaculture producers in many countries by these relative shifts in supply and demand, aquaculture production is already rapidly increasing. Although aquaculture currently provides only 9% of the total annual worldwide fisheries output of 75 million metric tons, production from aquaculture is growing at more than 7% annually, far outstripping the rates of increase in most other worldwide food producing sectors (FAO 1980). In some southeast Asian nations, annual rates of aquaculture production increase since 1980 approach 20%, a potentially gratifying development for consumers in these countries since up to 69% of the population's animal protein requirements are derived from fish.

While much of this increase worldwide comes from freshwater culture systems, especially those for carps and tilapia, coastal aquaculture systems are also experiencing rapid expansion and increases in production. Important species raised in brackishwater and nearshore aquaculture systems include milkfish, shrimps, mullets, various bivalves, and to a lesser extent certain marine species such as seabass and grouper. Of these, shrimps are the most important economically; indeed, it is the attractive export potential of shrimp more than any other factor which explains recent changes in coastal aquaculture production patterns.



TREND TOWARD MORE INTENSIVE UTILIZATION OF AQUATIC RESOURCES

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There are important regional distinctions in aquaculture's status around the tropics, however. Tropical Asian nations (including China) account for 65% of the world's aquaculture production; Japan, outside the tropics, produces much of the rest. Between them, Latin America and Africa accounted for less than 3% of the world's production in 1975, although of late certain countries in Latin America (e.g., Ecuador) have been attracting both private and government investment, particularly for shrimp, providing indications of potential expansion (Luna 1983). In contrast to this embryonic industry, Southeast Asian brackishwater aquaculture area, which has more than 500 years of history in Taiwan, Indonesia and the Philippines, totals more than 400,000 hectares (Smith and Chong 1984). Most of this area is used for rearing milkfish (Chanos chanos) or for polyculture of shrimps (especially *Penaeus* monodon) with milkfish.

These regional differences in terms of prior experience with aquaculture have important implications for further development of coastal aquaculture systems. In much of Southeast Asia, where long-standing traditions of culture exist, the major debate is on whether production increases can best be achieved through the opening up of new areas (i.e. mangroves and swamplands) or through intensification of production techniques on existing pond areas. Private producers are well-established in Southeast Asia and influence government policies with respect to land use, credit, research and extension services. In other parts of Asia and in Africa and Latin America, coastal aquaculture is being introduced in areas where little previous aquaculture experience exists. In these areas a different set of development issues arises with respect to consumer acceptability of the product and the need for managerial skills and supporting infrastructure to foster those entrepreneurs or communities that initiate aquaculture activities (Smith and Peterson 1982).

In addition to these species and geographic differences, coastal aquaculture systems can vary greatly in terms of the resources that they use (land, water, labour and capital inputs) and the intensity of this use (see Figure 4). In the coastal aquaculture category, one can include on the one hand, very extensive systems such as ranching and pen culture of finfish or stake and bottom culture of bivalves that use few if any supplementary inputs, and very *intensive* systems such as cage culture and supporting hatcheries for certain marine species, on the other.

Straddling these two extremes that are practised primarily in nearshore waters, is brackishwater pond culture which uses large areas of land though it does not necessarily use large amounts of labour or supplementary inputs. Most of the area currently used for brackishwater aquaculture pond production was formerly mangrove forest and swampland and the range of yields, even for single species, can be large. Milkfish yields, for example, can range from 300 kg to 3 ton/ha/yr, depending upon the intensity of the technology used.

Despite these species, regional and systemic differences, there are a number of continuums across the coastal aquaculture spectrum that are relevant to this dtscussion on social feasibility of coastal aquaculture. These include (Figure 5) :

(i) historical development and extent of previous aquaculture experience;
(ii) the technical and managerial complexity of the system;
(iii) the property rights arrangements that govern the ownership and/or use of the land and water resources required;
(iv) population density and intensity of alternative use of these land and water resources; and
(v) the degree of market orientation for the cultured product.

Each of the above continuums raises social feasibility issues that are relevant to individuals, communities, nations as a whole or all of these.

B. *Emerging Issues*

The rapid growth of aquaculture production in the tropics highlights certain emerging issues that can be broadly categorized as managerial, economic, nutritional, socio-cultural and institutional. Each has implications for this discussion on social feasibility.

1. Managerial complexity. First, aquaculture production techniques, despite a long history with certain species, are still in their infancy. The husbandry of most aquatic species is now at an elementary stage where the very basics of reproduction, nutrition and pathology are still being worked on (Pullin and Neal 1984). One would be hard pressed to claim that tropical aquaculture is currently managed on a scientific basis; most culturists, though in some cases backed by many generations of experience, still work on the basis of trial-and-error and certain 'rules of thumb'.

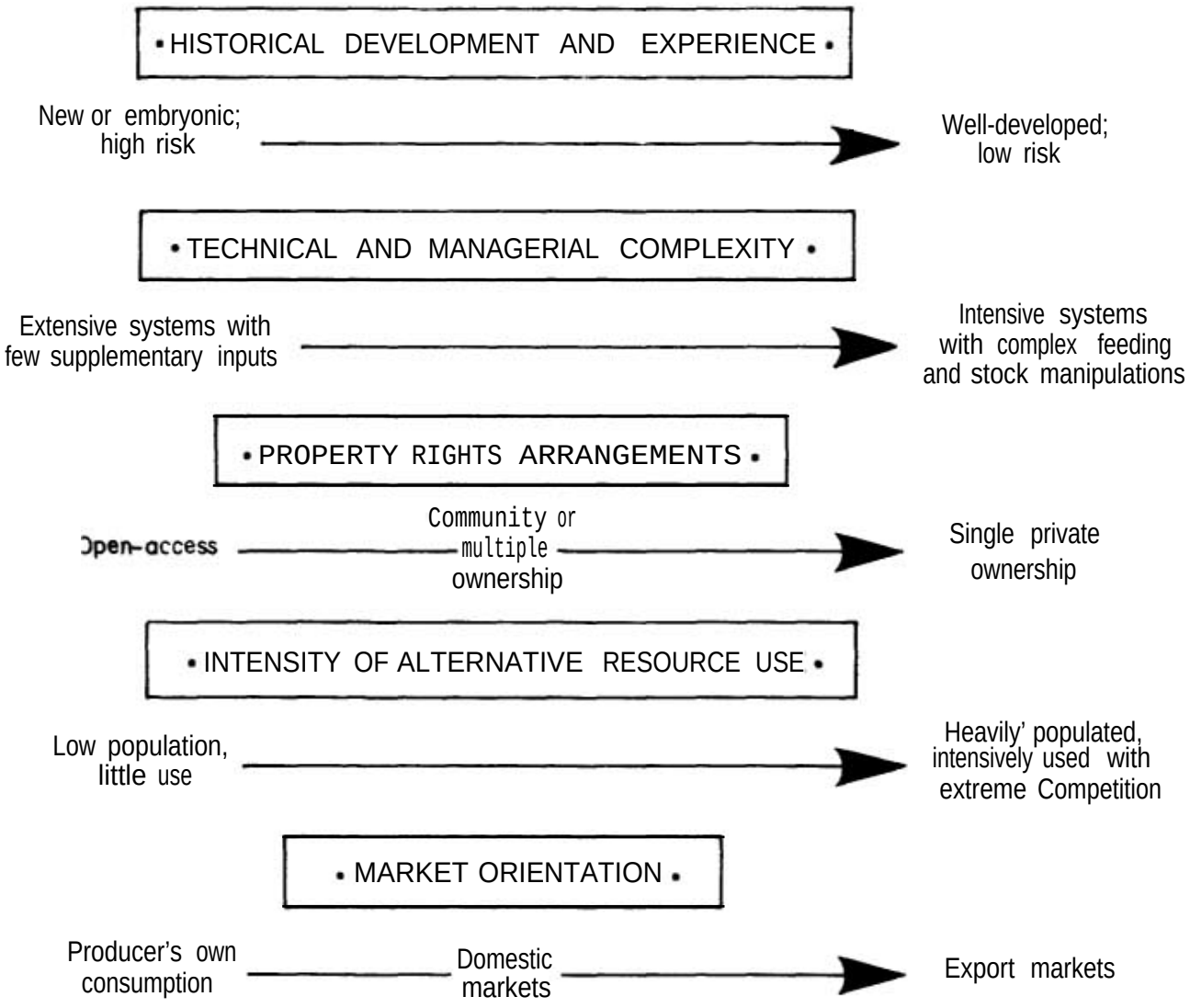

Fig. 5 Continuums across the coastal aquaculture spectrum

One could say the same of many traditional agricultural systems of course, but in the case of aquaculture the lack of a strong scientific base translates into additional unavoidable risks for producers. The more intensive the system (e.g. shrimp culture with supplementary feeding) the greater the risk and the more difficult the managerial task for the average producer. This production risk is further complicated for certain species, especially shrimp, by emerging constraints on seed (juvenile stocking materials) and feed availability and seasonal shortages. Where high risk systems are contemplated for areas with little previous aquaculture experience, the skill and managerial leap required of would-be producers from previous activities, such as small-scale fishing, can indeed be substantial. The managerial task is significantly reduced for more extensive systems Such as bivalve culture.

2. Economic incentives. Coastal aquaculture has an emerging export orientation that is guiding much of the current investment in aquaculture. Shrimp is the primary commodity of interest here. With nearshore trawling for shrimp now coming under increasing criticism because of its negative impact on small-scale non-trawl fishermen, many governments are turning to brackishwater pond culture of shrimp as a means of maintaining or even increasing the levels of foreign exchange that are earned by exporting shrimp to Japan, North America and Western Europe which depend for most of their supply upon imports. Indonesia, for example, earned USS 100-150 million annually from shrimp exports during the 1970's until trawling was banned in 1981 (Sardjono 1981); aquaculture planning in Indonesia heavily emphasizes brackishwater culture of shrimp from existing ponds and over 200 shrimp hatcheries are planned to support this effort,.

It has been estimated that world shrimp landings (mostly from tropical coastal waters and ponds) have remained steady at about 1.75 million tons live weight since 1977 (Rackowe 1983). Ninety per cent of this comes from the capture fisheries and perhaps 50% is exported. Additional imports required in Japan, North America and Europe by 1990 will be approximately 55,000 metric tons. Adjusting for local consumption and the percentage weight loss in post-harvest processing, the ***additional*** havest of shrimp required from ponds (assuming no change in catch from trawlers) will be approximately 170,000 metric tons. Experimental farms can presently produce 2-4 tons per hectare per year; on-farm yields, ***on*** an average, are generally much lower at 0.5-1 .5 tons/ha/ yr (Hamilton and Snedaker 1984). Assuming that this lower level of production is profitable (and there should be some serious doubt about long-term profitability at these lower yields except under subsidized conditions – see below), a total of 170,000 hectares of brackishwater ponds will be required.

The actual area projected for development worldwide exceeds the area that will be needed, unless one can assume that coastal trawling will be further restricted. Driven by the currently attractive export prices and the need of tropical developing countries for foreign exchange, the shrimp farming race is on in Southeast Asia, South Asia and Latin America with large development bank funded projects for conversion of existing brackishwater ponds and expansion into new areas. Malaysia, which is just one of the countries in this race, has announced its intention to develop 110,000 ha for shrimp culture (Infofish ***Marketing Digest*** 4/84 : p.6). The Philippines plan to develop 30,000 ha (IFC 1984). Indonesia's plans for 200 hatcheries imply an intention to convert large areas of its 185,000 ha of brackishwater ponds to shrimp culture. Other projects are proceeding in India, Pakistan and numerous countries in Latin America. Almost without exception, these projects are to be undertaken by large-scale private entrepreneurs or corporations. One must wonder if all this proposed shrimp production and the conversion of mangrove aress that it entails is sustainable economically, much less environmentally and socially.

3. Nutritional needs. The fact that supply of aquatic products from the capture fishery is levelling off is leading to increased concern for declining nutritional standards among those nations and communities that depend heavily on fish. Many Asian countries, for example, depend upon aquatic products for half or more of their animal protein requirements. With an increased market orientation for fisheries, incidence of protein malnutrition is high even in many coastal fishing communities. The FAO has raised concern for nutritidnal issues to the international arena (Saetersdal 1979, Carroz 1984, Reeves 1984).

While aquaculture is frequently cited as a means of contributing to the solution of this emerging nutritional problem, it is not at all clear that aquaculture products will be directed primarily towards domestic markets. In fact there is a growing tendency for aquatic products to be exported to developed nations; some would argue that this is at the expense of domestic nutrition and markets (Kent, 1983). This actually remains to be proven, but certainly the current trend is to send the

aquatic products to the areas and countries with the highest purchasing power. Are assumptions that local producers benefit from these higher prices for their products correct? The relevant point here for "socially feasible" aquaculture systems is that measurement of the nutritional impact of aquaculture projects (either directly in the form of production for household purposes or purchased with higher incomes derived from aquaculture activities) should be an important criterion to consider during planning and implementation (Kent 1984).

4. Institutional *preparedness.* Is it possible then that all the socio-economic and institutional issues of trawling (intense competition in the coastal zone, displacement of traditional users, skewed distribution of benefits, long-term environmental damage) are simply being transferred from the nearshore to the brackishwater zone through economic pressure driven by attractive export markets for aquaculture products such as shrimp? This emphasis upon brackishwater pond culture of shrimp is intentional because it is here that that greatest divergence between techno-financial and social feasibility lies.

While the same issues of competition among nearshore users exist with cage culture of marine species or stake culture of mussels, the potential for integration of these systems into existing community work patterns with community capital resources is much greater than for capital-intensive high risk shrimp farming. With these systems, the social feasibility issues can be resolved at the community level. In contrast, the conversion of often fragile coastal ecosystems into shrimp farms is not only beyond the control of coastal communities at present, but the impact on these communities (both human and aquatic) is likely to be far greater and, because of lack of institutional preparedness, far more negative.

There are both scientific and institutional weaknesses that facilitate the conversion of mangroves, in particular, to pond aquaculture under private ownership or use rights. Mangroves are believed to be important breeding and nursery grounds for many aquatic species that are later caught in the nearshore areas by capture fisheries. However, scientists have been unable to establish in definitive fashion the exact quantitative relationship between mangroves and nearshore fisheries (Hamilton and Snedaker 1984); consequently, the potential fisheries losses that may occur by clear cutting mangroves are usually understated, if stated at all, in cost/benefit studies of coastal pond aquaculture. Other traditional users of mangrove areas such as shellfish gatherers, charcoal makers and nipa palm growers are also frequently ignored in these calculations, though the value of these activities can be substantial (Velasco 1980 and Ong 1982).

This incomplete assessment of the value of current traditional use of mangrove areas has resulted in the setting of ridiculously low user fees for conversion of mangrove areas for aquacultural purposes. For example, a 25 year lease for conversion of mangroves to brackishwater fish ponds can be obtained in the Philippines for only P30 (US$1.50) per hectare per annum. Needless to say, this hardly acts as an effective barrier to entry. Transaction costs to obtain the lease may be higher, but these and loan processing fees are recoverable from any development bank loan obtained. While most mangrove area in the tropics is nominally public land, in many locations there has been institutional neglect governing its use that in effect encourages the transition of large areas from common property to private use. Large numbers of traditional users have undoubtedly been displaced in this process. Lending policies have encouraged rapid conversion through an emphasis on loans for capital and construction costs rather than for operating expenses such as supplementary inputs in existing ponds. These seeming inabilities of the scientific community and coastal zone management institutions (where they exist at all) to control the rate of mangrove conversion have led to the possibility that the incentives of private profitability will be able to proceed unencumbered by social and institutional considerations.

The above comments should not be taken (yet) as an argument against all coastal shrimp farming. It is the power and momentum of current economic arrangements and trends that link foreign markets, multinational or large local corporations, ready access to the coastal zone and large-scale development bank financing that are frightening. Again one must ask : "coastal aquaculture development for whom?" Is there not a better way to achieve close to the same levels of output or foreign exchange earnings, a way in which coastal fishing or agricultural communities can participate in this new economic activity proposed for the coastal zone, a way that assures more environmentally gentle and equitable use?

Just because aquaculture is a speciality activity dealing with aquatic rather than agricultural products, does not mean that the multi-faceted setting of rural agricultural and fishing communities in which it does and will operate can be ignored. In essence, aquaculture should be viewed as yet another rural innovation that is bound to impact on work patterns, sources of wealth, incomes, income distribution and local institutions. The task of those promoting and guiding aquaculture development is to work towards the adoption of systems that bring increased welfare to the community as a whole.

3. Lessons to be Learned from Agriculture

A. *The Green Revolution*

It was Robert Oppenheimer, describing his work on atomic weapons, who stated, "From a technical point of view, it was a sweet and lovely and beautiful job". (Dyson 1981, p. 89). A primary focus on technical aspects, a production emphasis, has also haunted agriculture's Green Revolution. Without getting into the highly debatable issue of who or which institutions should have had the foresight, initiative and courage to examine the non-technical aspects of the high-yielding varieties, suffice it to say that the early expectations of the Green Revolution have not been fully met (Hainsworth 1982). Production of grains has increased in many countries but the majority of rural producers find themselves no better off now than when they grew traditional grain varieties. In fact, in many countries producers are worse off with lower real incomes, greater indebtedness and increased dependence upon imported inputs, especially fertilizers. Wealthier landlords appear to have benefited disproportionately, while the numbers of landless labourers have grown. Structural change was brought about but not in the form anticipated and hoped for. It is debatable, of course, whether conditions are worse than they would have been without *any* development of high yielding varieties, but it can hardly be debated that 'technically sweet' alone is insufficient as a criterion for pursuit of improvement in well-being and incomes in rural areas.

More than anything else, this hindsight about the Green Revolution reflects disappointment that the full expectation of higher-yielding varieties to emancipate rural agriculturists was not achieved. Sociologists had long thought that the transformation of rural economies and traditional agriculture would be very hard to achieve (Rogers 1969). But with their emphasis upon the conservative, even irrational attitudes of peasant farmers, these sociologists were right about the rate of transformation but for the wrong reasons. There is now ample evidence of rationality among small-scale agriculturists just as there is among small-scale fishermen. Of the various socio-cultural, economic and institutional theories regarding' agricultural change and growth, it is that of institutional constraints which appears most reasonable and is best documented by empirical evidence. The gist of the argument is that informal and formal institutions adapt slowly to changing technologies and thus often stand in the way of more equitable distribution of benefits from the application of these technologies. In other words, structural changes in economic, socio-cultural, legal and political patterns do not occur overnight.

B. *Alternative Theories of Agricultural Change*

The following brief overview of alternative theories of agricultural change summarized from the Chong *et al.* (1984) study of milk fish aquaculture in the Philippines, and the Stevens (1977) study of agriculture on small farms is presented to highlight and summarize previous research which bears on similar issues in aquaculture elsewhere, such as resistance to change, technology transfer and diffusion of innovations. The-major theories of agricultural stagnation and transformation can be grouped into those that attempt to explain the farmer's behaviour through socio-cultural perspectives, those that assess their behaviour primarily in economic terms, and those that emphasize the role of formal and informal institutions.

1. Small Farmers are Poor Decisionmakers' Theory. This hypothesis assumes that more productive or profitable alternative production activities are available to traditional farmers but "they" do not make the right decisions about these new opportunities because they are poor decision-makers, irrational, ill-informed or even lazy. This hypothesis which underlies much of the rationale for community development programmes in Pakistan and India in the 1950s suggests that extension services, community development programmes and other forms of educational and management assistance have crucial roles to play to improve farmers' production decisions.

Parallel to this view of farmers' poor decision-making capabilities are explanations that focus on the "subculture of peasantry". This viewpoint suggests that traditional agriculture or other rural pursuits are essentially a cultural characterization of the way particular people live. Cultural attributes of farmers and the value system that farmers hold are cited as the major barriers to their increased productivity, adoption of innovations and transformation. For example, Lewis (1962, 1964) and Rogers (1969) cite such values as (1)strong disposition towards authoritarianism; (2) mutual distrust in interpersonal relations; (3) perceived limited good; (4) lack of innovativeness and resistance to change; (5) fatalism; (6) limited aspirations; (7) limited view of the world; (8) lack of geographic mobility, and (9) low empathy as characteristics that prevent farmers from participating in the agricultural transformation or modernization process.

Proponents of this viewpoint give primary importance to socio-cultural attributes as deterrents to the agricultural transformation process: If one accepts this socio-cultural point of view, overcoming these attitudes and constraints is primarily possible through education, training and extension programmes.

2. 'Small Farmers are *Poor but Efficient' Theory.* In contrast to the above hypothesis, a widely accepted economic viewpoint discounts socio-cultural explanations of the *constraints* to the agricultural transformation process. This viewpoint espouses the belief that agricultural transformation is held back not so much by the farmers' cultural attributes and value systems but by economic factors that make any efforts at increased agricultural productivity non-profitable. This view is strongly endorsed by Schultz (1965) who advocates the concentration on high-payoff new inputs (both materials and human capital) to improve the state of the art of production techniques of farmers. According to Schultz, unless the rate of return to investment in inputs of production is improved, there will always be little or no incentive on the part of the farmers to increase productivity, nor for them to save and invest.

Theorists of this particular school of thought state that small farmers are poor, but efficient. This implies that traditional peasant farmers are generally good decision-makers, given their knowledge and resources, but the scarcity (high price) of capital, and non-access to and unavailability of new agricultural technology have deterred their agricultural transformation. Small farmers are trapped in a technical and economic equilibrium, and any reallocation of their resources would not appreciably increase income because, given prevailing prices of inputs (land, labour, capital), farmers are already efficient in utilizing the production inputs they have at their disposal.

Empirical support for Schultz's ideas has been found among Nigerian dryland farmers (Norman 1977), small farms in Brazil (Rask 1977) and Thai livestock producers (DeBoer and Welsch 1977) to cite a few. To overcome the low level equilibrium trap, Schultz argued for the introduction of high-payoff new technologies which markedly reduce average costs per kg of production. That was the approach, in simplest form, of the Green Revolution. Similarly, such a focus on high payoff new technologies appears to be behind much of the thinking of coastal aquaculture proponents today.

Acceptance of the view that small farmers are trapped in a low level equilibrium has led some economists to argue in favour of larger-scale farms to achieve greater productivity by taking advantage of economies of scale. Empirical research, however, has indicated that while theoretically possible, there are limited economies of scale in agricultural production in developing nations and that small farms can often compete effectively with medium and large farms or state farms (Takahashi 1970). While evidence accumulates that farm enlargement is not necessarily associated with increased land productivity, others have cautioned that the shift to science-based agriculture and use of technology also poses threats to rural employment and political equilibrium (Sinaga and Collier 1975). According to this view, small farms are threatened by the introduction of new machines that may displace labour utilization in the area.

3. Induced Innovation and Rural Stagnation. Economic viewpoints generally accept that breaking out of the technical and economic equilibrium described by Schultz cannot only be achieved by means of the introduction of advanced technology, but also by induced innovation (Hayami and Ruttan 1971; Ruttan 1977). Changes in relative factor prices or output prices and the provision of institutional support such as credit, extension and information dissemination will produce *disequilibrium* to which small farmers will respond positively. According to this viewpoint, technical change and institutional development are entwined.

The view that institutions are key to the transformation process is echoed by Bromley (1979b). However, he is less optimistic about the rapidity with which institutions will respond. According to Bromley's view, while technology is engine of economic change, institutions are barriers to the growth in the agricultural sector;

> "We have seen decades of investment in new seeds, fertilizer plants, pest control, farmer training, and the like. We cannot say how great the transformation has been, because we do not have an experiment in which we can hold some other things constant. We of course know that some farmers in some countries have indeed made impressive strides in terms of increased production and increased incomes. We also know that there are still millions of subsistence farmers barely able to make a living."

The millions of subsistence farmers left behind who are barely able to make a living even after the Green Revolution give rise to a social phenomenon called "rural stagnation." Rural stagnation, according to Bromley, is caused by the inability of traditional agriculture to generate a sustainable economic surplus in the face of institutional barriers. Similar to socio-cultural explanations, this lack of sustainable surplus is attributed to a power-elite manipulating institutional arrangements in order that the economic environment of subsistence farmers be just sufficient to keep the subsistence farmers in production, yet not sufficiently propitious to encourage experimentation. Some observors claim this is one of the main reasons for the increasing numbers of landless labourers and resulting pressure on marginal lands (Lappe and Collins 1977).

These various viewpoints to explain rural agricultural stagnation and transformation have been presented above in a necessarily brief summary. However, this discussion serves to illustrate the need to examine the non-technical issues that must be dealt with in any serious examination of aquaculture development and its impact. Will the aquaculture development activity or project proposed reinforce existing socio-cultural and institutional power structures that keep the majority in poverty, or will it provide opportunities for a wider spread of benefits?

C. *Relevance to Coastal Aquaculture*

The above perspective on agricultural transformation and growth also has much relevance to the coastal communities in the vicinity of previous and proposed aquaculture development activities but with a different institutional twist. Rare indeed is the location in which there is ongoing activity which will not be affected by a new or expanded aquaculture endeavour. Coastal communities face an added dimension when use of coastal resources for aquaculture purposes is considered; even though the coastal communities themselves may view the nearshore waters, connecting waterways, mangroves and swamplands as "their" resource by virtue of traditional use rights, much of these areas are in fact viewed as public property by fisheries and aquaculture authorities at state and national levels. Planning for aquaculture development at these central levels thus not in-frequently occurs without any consultation whatsoever with the current users of the resource. While within the coastal communities one will find many of the same inequities and institutional rigidities characteristic of agricultural communities (i.e., local power elites, patron-client ties, indebtedness to moneylenders), the interest of the whole community might be bypassed or over-run by new aquaculture developments that do not respect traditional use rights.

Large-scale aquaculture enterprises frequently displace small-scale fishermen and aquaculturists. This has already occurred in several locations, the most notable being the expropriation of over 30,000 ha of the 90,000 ha public waters of freshwater Laguna de Bay in the Philippines by large-scale milk fish pen operators. The largest of these private business operations exceed 5,000 ha and contain individual fish pens more than 400 ha in size. The 9,000-10,000 fishermen using the lake have seen their fishing area reduced by one-third; some but not all those displaced, have been hired as labourers by fish pen operators. Lack of management mechanisms to control use of the lake is the major shortcoming that has led to this undesirable situation (Smith 1983).

This bypassing of coastal communities is frequently true also of large-scale shrimp farms which are often corporate run. In other cases, true to the agricultural model, the elite group within the

community participates in the new development to the exclusion of most of the other community members, thus reinforcing local power structures. Labour requirements for pond aquaculture is not great. Some individuals may be hired as casual or part-time labourers but participation in mangement and profits is rare. The institutional twist in the case of coastal communities with respect to their traditional resources which are suitable for aquaculture is that most frequently no institution exists to protect the community's interests in the face of the 'technically sweet' and financially profitable project which may be, and usually is, proposed from outside the community rather than from within.

Although there are exceptions to this pattern, some of which will be presented as case studies at this workshop, the general rule for aquaculture development appears to be that of packaged technology imposed from above or by outsiders rather than through participatory rural development by coastal communities themselves. The residents of most coastal communities frequently have few alternative income generating possibilities; they may even be former landless labourers who are fishing or gathering in coastal waters as the "employer of last resort". It is therefore imperative that some compromise be found between national objectives of increased aquaculture production and foreign exchange, on the one hand, and coastal community requirements for increased employment and income, on the other hand. I would argue that the solution can best be found through (1) innovative forms of socially feasible aquaculture projects and management that permit community participation and (2) a willingness to adjust the pace of development to assure coastal community readiness to assume a full management function with respect to these aquaculture activities.

It is always easier (and less costly to most nations initially) to develop aquaculture through large-scale, corporate undertakings financed by development banks, probably at subsidized or below-market interest rates. Initial economies of scale in production, marketing and information (not to mention loan supervision) are often used as justification for approaches that exclude substantial development support for coastal communities and their small-scale endealours. But can developing countries in the tropics afford the social and human cost that often accompanies this approach to aquaculture, just as they earlier experienced in agriculture and coastal fisheries? Violence between coastal small-scale fishermen and trawler operators has been widely reported; perhaps less widely known are similar cases in the Philippines and Thailand where aquaculturists use force to maintain their recently acquired 'use rights' from coastal and inland fishermen. Aquaculture need not become an elitist craft or one defended by rifles, but to avoid this, more than laissez-faire approaches and support for large-scale activities are needed. Direct intervention and inwalvement by governmental and non-governmental organizations in community based aquaculture is apparently required to achieve greater "social feasibility" in the sector.

What factors and community or individual attributes should such organizations be aware of to fulfill this goal of 'social feasibility'?

4. Major Factors Influencing Social Feasibility

Much of the recent worldwide enthusiasm for 'appropriate technology' has come about through a desire to develop productive activities and techniques which fit local resources and environments and thus benefit the majority of local residents. 'Appropriate technology' is thought to bring change with widespread benefits because it can remain within the control of the community that adopts it. Any change that reduces the tyranny and inequities of so many rural villages should be desirable, but to succeed will require courage by those who would try to get out from under the yokes of indebtedness and poverty, as well as long-teim commitment and support from the individuals and organizations that wish to contribute to rural development through the use of 'appropriate technology'. Recent experience has shown that generally it is still groups outside the community that define what is and is not 'appropriate' ; and it is now widely agreed that community participation in development of appropriate technology is essential (Roy 1982, Crombrugghe 1984, Miles 1984).

It is almost a platitude to say that the social structure, economic needs and cultural wishes of a coastal community must be understood before those who desire to work with such communities can contribute constructively to change and the community's possible adoption of aquaculture technology. A coastal community, be it a fishing or an agricultural community is not a single entity within which each individual and family has universally shared roles, concerns and ambitions. Most common among such communities are local power structures that allow individuals or groups

to concentrate control of the community's sources of wealth. In fishing communities, it may be the boat and gear owners or, more likely, the moneylender, fuel supplier or fish processor. Sometimes these three functions are consolidated in one and the same individual; perhaps, as occurs in the Philippines, this individual will be the wife of a village councilman. Such local power structures require that for assessment of the 'social feasibility' of aquaculture, distinctions be made among individual, family group and community perspectives and interests. In addition, the possible influence of others physically outside the community, an absentee landlord for example, should be determined.

A. Socio-Cultural Issues

There are important socio-cultural differences among and within tropical countries around the world. There are also differences between fishing and agricultural communities in the coastal zone. The more obvious differences relate to religious and cultural practices that reserve or prohibit certain activities for particular groups. For fishing communities in the Bay of Bengal region, these aspects have been discussed at length at previous workshops and in various publications (e.g., Fernando et al., 1980) which are available for this consultation. Comprehensive reviews have also been conducted for other parts of the world (see various papers in Smith and Peterson (eds.) 1982). The more obvious socio-cultural concerns of individuals, communities and nations that are important to appreciate when coastal aquaculture projects are being considered include attributes of both producers and consumers. For example :

1. Producers :
   - religious prohibitions against killing of animals, including fish;
   - cultural values regarding the appropriate role of the individual and family in a group setting (e.g., leadership and individual initiative, peer relationsips, sharing systems, dependency on others, pursuit of education and new skills, importance of economic incentives relative to other social objectives, attitudes to change);
   - cultural values of the community and nation (e.g., social stratification) which influence working relationships and tasks, access to sources of community wealth, roles of men/women and various age groups, and processes through which leaders evolve and are maintained.
2. Consumers :
   - religious prohibitions against consumption of certain species of or even all fish;
   - religious practices that create seasonal or weekly demand fluctuations;
   - consumer preferences or prejudices with respect to fisheries products (e.g., species, size, colour, taste, texture, freshness and number of bones).

Sociologists would draw up a much larger checklist (see Pollnac 1982; Pollnac ***et al.*** 1982); perhaps this consultation will also do so. These lists are indeed useful and help avoid some of the gross mistakes that have been made with some aquaculture projects. Grivetti (1982) reports two such projects that could certainly have benefitted from such a checklist :

(1) A project developed by foreign consultants for the Qatarra region of Egypt which proposed making local residents into fish farmers to produce fish for their own consumption. The local 'residents', it turned out, were nomadic and rejected fish as human food.

(2) A project for fish ponds in Botswana to produce fish to supplement diets of Kalahari tribes-people, who it transpired had dietary taboos against fish.

Extreme examples perhaps, but certainly there have been others where planning and implementation have gone wrong solely because of socio-cultural reasons.

B. *Coastal Community Structure and Institutions*

The broad definition of 'social feasibility' proposed at the beginning of this paper included not only socio-cultural aspects but also legal, political and institutional aspects. For aquaculture development, these factors are equally if not more important than the socio-cultural factors outlined briefly above. This is so because of the demonstrated technical feasibility and financial profitability of many aquaculture systems. For purposes of this discussion, these legal, political and institutional factors can be broadly classified as related to coastal community structure and institutions. To the extent that the characteristicsof structure and institutions are shared by numerous communities they contribute to the structural and institutional setting for the coastal zone or nation as a whole.

Some will argue that a focus on strucutre and institutions is a retreat into economics rather than further elucidation of social feasibility, but this is not the case. Economics as generally practised with respect to aquaculture feasibility is little more than financial analysis, that is, the determination of private profitability. It may (but usually does not) take into account in a subjective way certain aspects of impact of the proposed projects on income distribution and other intangible costs and benefits (Gittinger 1972). The limitations of cost-benefit analysis have long been recognised (UNIDO 1972); conflicts of interest based upon the distribution of economic, social and political power are almost inevitable and cannot be dealt with through a narrow analytical technique that depends upon quantifying all variables.

In many cases, economists ignore or presume away many issues related to alternative property rights and use arrangements (Bromley 1979 a and b argues against ignoring them). Other economists, the sensible ones other social scientists would say, treat the legal, political and institutional factors as keys to determining project feasibility and to influencing the direction and pace of aquaculture development (Johnston 1977). Certainly, they are key considerations if the participation of coastal communities in aquaculture is to be encouraged.

In this context of working with coastal communities to develop appropriate aquaculture systems, the following aspects of community structure and institutions appear to be the most important :

- informal and formal institutions, especially those of a legal nature that govern property or use rights;
- sources of wealth (productive assets) and degree of concentration of ownership;
- male and female labour use patterns and availability;
- extent of collective action and strong leadership;
- previous experience with and reactions to technological change in aquaculture or other community activities;
- present skill levels, both technical and managerial; and,
- extent of linkages with external institutions, including credit, extension and markets.

Each of these is discussed briefly below.

1. Informal *and formal* institutions : Most coastal communities until recently had systems of traditional use rights that determined what type of activities could be undertaken in nearby land and nearshore territories, when and by whom. Such traditional systems still exist in certain parts of the Pacific Islands. In other areas of Asia they appear to have succumbed to technological advance (more mobile fishing vessels, for example) and to a lesser extent to population pressure. In Japan and Korea they have been resurrected in the form of community cooperatives that manage coastal fishery resources out to 40 km from the shore.

Coastal communities clearly need to retain or acquire use rights to the nearby coastal environment if external investors who may wish to use these areas for private aquaculture are to be excluded or to be charged reasonable user fees. Otherwise, disputes over rights to use the coastal zone for aquaculture will continue to be a problem as they are currently in Irian Jaya (Anonymous 19841 and will stifle its development just as they can do for agriculture (Vylder 1982; Khan 1980). Espinoza (1982) reports that disputes are highly likely in Latin America also, where fisheries laws are generally so "antiquated that they do not even mention aquaculture." There are too few instances of successful community managed aquaculture ventures to date; reservation of much of the coastal zone for community activities should be initiated immediately if it is to be available in the long-term for the purposes. The present highly centralized processes for allocation of use rights in the coastal zone need to be decentralized and institutions for management decisions created and strengthened at the local level. This is equally true for coastal fisheries as it is for aquaculture; lack of decentralization can be equated directly with lack of effective control over use and with environmental deterioration.

Not only do the institutions that deal with access and use rights have to be made locally relevant, but user groups need to actively participate; a decentralized structure which is still controlled by individuals fromoutside the community, such as a government official, will not suffice. These decentralized and more participatory systems also need to become strong enough to resolve resource use competition at the local level and to preclude takeover by elite self-interested individuals and groups from within the community. This type of challenge to existing power structures can perhaps best be accomplished through competition alongside the existing power structures rather than

immediate challenge to take them over. A cockle farming project in Kuala Juru, Malaysia, has successfully followed this approach by establishing a community cooperative alongside local traders and eventually displacing them.

2. Sources of community wealth : The more equitably distributed productive assets are in the community in the first place, the more likely is the whole community to unite around a common objective. For this reason, communities of small-scale fishermen make good potential aquaculturists. Often, the vast majority of families in these communities face common threats or constraints from outside sources such as landlords and moneylenders. There may be problems of transferability of skills between fishing and culture, but the fact remains that the vast majority of coastal aquaculturists have formerly depended primarily upon fishing. Referred to here are the vast numbers of households involved in cultivation of bivalves (cockles, mussels and oysters) in Southeast Asia, and not the much more limited number of shrimp farmers most of whom were previously or still are wealthy agriculturists or businessmen.

A high degree of concentration of wealth in a community, though warranting the more equitable distribution that small-scale aquaculture could bring about, may require more perseverence by the community and its supporters to introduce and maintain such technologies.

3. *Labour use patrerns and availability* : The existing patterns of labour utilization of both men and women must be assessed before a new activity such as aquaculture is initiated (Banta and Jayasuriya 1984). Peak labour demand for agricultural activities such as transplanting and harvesting may coincide with the needs of aquacultural activity. However, in many coastal communities such as in Thailand, this does not appear to have been a major problem; while husbands have continued to fish, wives and other family members have undertaken bivalve culture and small-scale processing. This diversification is a useful strategy for most households during the early testing period for the new technology and may be reduced somewhat if the aquaculture venture is successful and can fully sustain the household. Still, labour availability must be carefully assessed, not simply assumed. Many African aquaculture projects have failed because existing labour use patterns and leisure requirements were overlooked (Grover et al. *1980).*

4. Collective action and *leadership* : A coastal community without strong leadership or the **potential** for it, is going to be slow in adopting any aquaculture system that will be to the general benefit of the community as a whole. In most communities that now successfully engage in reasonably equitable systems of aquaculture, a key element all along has been the strength, patience and selflessness of an individual whom the rest of the community respects. Japanese systems are renowned for this, where the entire coastal rights system has evolved from the long-term efforts of a single individual (Hamlish 1980). The same is true in the sustained activities underway in Kuala Juru's cockle farming and in the tilapia hatchery systems of Bay Laguna in the Philippines (Gaite et al. *1983).* The identification, even creation, of leadership qualities such as those found in Pak Salleh in Kuala Juru and Mang Pascual in Bay is a necessary condition for success in broad-based community aquaculture projects. Without such leadership, efforts to help any community to help itself will probably be in vain.

5. *Previous experience with technological change* : Communities with structures and institutions already undergoing modification due to technological change emanating from other sectors are also likely to be more willing to undertake new aquaculture endeavours if such previous experience has been beneficial for the majority. Communities more frozen in time or with negative experience are less likely to be receptive.

6. *Technical and managerial skill* levels : Any new aquaculture activity demands a new set of technical skills, and if the community is fishing rather than agriculture-dependent, then probably new managerial skills also. The jump from daily incomes and vessel management to deferred incomes and culture management can be extemely large. The more capital intensive the system and the more supplementary inputs required, the more difficult this transition will prove to be. Special technical and managerial training will be required in almost all cases.

7. *External linkages* : Institutional support, especially for credit, extension and markets will be necessary if the aquaculture activity is to be sustainable. While the community's preference may be to rely as little as possible on formal credit schemes, the lack of sound technical advice on production and inadequate market potential will surely result in much waste of community resources. Boom and bust cycles are not unknown in coastal aquaculture (see Smith and Pestano-Smith 1980, for a Philippine seaweed example). These are frequently caused by initial overestimation of

market potentials or sustainable prices and resulting overproduction relative to the markets that have been identified. Actually, this problem can affect not only individual communities. If all the shrimp farming projects that are currently proposed are successfully completed and meet their production targets, Japanese, European and American markets are likely to be awash with shrimps selling at prices below production costs of several countries. The higher the value of the species produced, the more likely is the market to be limited and easily saturated; only dramatic reductions in production costs will permit huge quantities of such products as shrimps and seabass to be marketed.

External linkages with credit and extension institutions will be especially important for community-based aquaculture projects. Credit at less than the moneylenders' rate, but retaining some of the same elements of flexibility in timing of repayment will be necessary. Supervision of large numbers of small loans will be required; a subsidy in other words, but why not? Credit subsidies have been made available to large-scale fishing and aquaculture endeavours; why not to small-scale activities that generate increased incomes and protein for local markets? The argument that development banks cannot bear the cost of added supervision for small loans is spurious; this added cost could easily be recovered by setting the interest rate at a level somewhat above those made available to the large-scale sector. Even at this higher rate, the interest rate would still be far below the rates charged by local moneylenders.

Extension services for aquaculture pose a very special problem in most tropical countries (FAO 1980, 1984). If the best approach to successful aquaculture development in coastal communities is essentially one of adopting a rural development and community organizing approach, most fisheries and aquaculture extension services are ill-equipped to do so. In fact, even technical qualifications in many services are low. Special training to upgrade technical qualifications is needed in most cases and partnerships with rural or community development organizations must be formed.

It is apparent that one cannot draw a line to clearly separate those communities that will successfully embark upon coastal aquaculture from those that will not. Nevertheless, inclusion of the above structural and institutional dimensions of coastal communities and their assessment into the aquaculture planning process will certainly increase the probabilities of success.

5. Appropriate Community-based Aquaculture Systems

Three major questions remain to be addressed. First, can appropriate community-based aquaculture systems be developed within the contexts of the socio-cultural and community structure dimensions discussed in the previous section, and, if so, what types of systems would the; likely be? Second, can a balanced approach be found that permits community participation in planning and management of their aquaculture systems while at the same time leaving the community receptive to adaptation of aquaculture technology that may have been developed externally at research experiment stations for example? Third, can community-based systems coexist with the capital-intensive often corporate-run systems that are currently invading the coastal zone?

A. Community systems

Most coastal communities in the tropics and the majority of residents in those communities are poor. The common characteristics of limited resources for investment for new activities and the jump in technical and managerial skill that would be required of the new aquaculturists, suggest that capital-intensive systems such as brackishwater pond culture of shrimp and shrimp hatcheries will not be appropriate. More appropriate will be small-scala activities such as :

- stake or raft culture of molluscs;
- bottom culture of oysters or cockles;
- culture of seaweeds;
- cage culture of marine species;
- integrated systems such as animal-fish culture in backyard ponds; and,
- managed ranching systems such as artificial reefs, pens or other enclosures.

All of these have the advantages of being amenable to small-scale part-time operation. They can begin at such a level that the other primary occupation of the individual or family, such as fishing, can continue to provide steady cash flow to the household while the cultured harvest is awaited. Labour requirements for all are within the likely levels available to households without need of hired labour; indeed they likely add to the productivity of household labour (Schmidt 1980). The level of

other inputs required from outside coastal communities is low. All can be operated by atomistic groups (individuals or families) or communally and can be expanded as managerial skills and markets (including household and community consumption) permits.

Both land-based and water-based integrated systems can be considered. On land, backyard ponds using waste from domestic animals or organic fertilizer need not be large; in the Philippines, ponds of 100-200 m^2 are successfully operated primarily for household fish (tilapia) consumption (Fermin 1983). Larger pond systems do not seem too feasible as access to land is difficult for many coastal communities and the development cost is extremely high. Several fish pond estates that anticipated groups of 30 small farms cooperatively organized with managerial support have been proposed for the Philippines but were not initiated because of the high investment cost per beneficiary. In coastal waters, integrated systems that grow bivalves as feed ingredients for higher value species could be considered in areas where no human market exists for the bivalves. Artificial reefs not only make coastal waters inaccessible to trawlers, they also enhance local resource productivity to the benefit of small-scale fishing. Bamboo and old tires can be used so the structures need not be extremely expensive.

Small-scale aquaculture systems are already being used in many communities in the tropics and some of these systems provide useful models for other communities to follow when local environmental conditions permit. In cases where social impact has been monitored, the effect on income distribution and employment has been quite dramatic and widespread within individual communities (e.g., Smith and Pestano-Smith 1980).

B. *Community Participation and Technology Adaptation*

Current systems of research and technology development for aquaculture are most often widely separated from coastal communities. This gap must be closed if culture systems appropriate to coastal communities are to be developed and if communities are to be receptive to rather than resistant to the technologies developed externally by the scientists. Certain basic research need not be linked directly with coastal communities, but there is no reason why technology development and modification cannot be conducted with the active participation of coastal residents.

An ongoing project of the University of the Philippines Marine Sciences Centre (UPMSC) and the International Centre for Living Aquatic Resources Management (ICLARM) provides an example of how this participatory research can be undertaken.' UPMSC and ICLARM are conducting research on the genetics and economics of various tilapia strains available in the Philippines. The growth trials are conducted by a small-scale fish farmer in six cages in Laguna de Bay. The cages and all labour were provided by the farmer; UPMSC and ICLARM provide the tilapia fingerlings and the feeds. Records are kept by the farmer of length and weight of the fish and costs/amounts of all inputs, including his own and family labour. Research assistants visit the project site regularly and results of the electrophoretic analysis that is conducted in the UPMSC laboratory to determine genetic purity or contamination are reported to the fish farmer.

A second phase of the project will expand the number of farm cooperators to six and will involve a non-governmental organization experienced in community rural development and organizing so as to spread the impact of the project beyond the fish farm cooperators. Finally, an audio-visual will be prepared about the on-form experiments and extension work of non-governmental organizations.

This unique project thus has :

- a multidisciplinary research component;
- a partnership between the small-scale aquaculturist and the researchers with both evaluating the technical changes;
- involvement of a rural development NGO; and,
- multiplier effects through easy visibility of the project to other nearby farmers and further afield through the audiovisual component.

Partnerships between individual fish farmers or communities, researchers and non-governmental rural development organizations will be necessary to assure that technology developed by researchers will be appropriate for community adoption and modification. The role of rural development NGOs is particularly important because they are likely to have the expertise in judging 'social

[1] Partially funded by a grant from IDRC, Canada.

feasibility' that technicians in research organizations and government extension services lack. Such groups can also assist in training researchers and extension officers to build up the number of professional rural developers who also have an understanding of the technical, financial and managerial aspects of aquaculture. McGoodwin (1982) strongly advocates this approach to increase the number of rural developers who are willing to spend the time necessary (years, not months or weeks) patiently working with coastal communities to make their projects a success, technically, financially and socially.

Thomson (1979) cites an integrated approach of FAO that supports community-based centres for integrated development and demonstration of fishing technology which would appear to be suitable for model community approaches to aquaculture and thus worthy of further investigation.

C. Co-existence with Large-scale Systems :

Given the multiple use to which coastal zone resources could be put, to what extent can the full range of coastal aquaculture systems as shown in Figure 1 (page 5) co-exist? The lessons of the Green Revolution in agriculture seem to imply that there will be differential adoption rates with any new technology, that at least initially the rich will get richer, and that despite attempts to redistribute productive assets, these holdings may become more concentrated. The same process need not occur with aquaculture, however, as successful co-existence of large-scale and small-scale community activities is possible with careful planning.

To begin with, there are many more species and systems choices in aquaculture than for rice farming. This implies more specialization possibilities with wealthier farmers concentrating upon higher value (and higher risk) systems, such as shrimp, while other less-well-off producers concentrate initially upon less complex systems, such as bivalve culture for domestic markets. Market competition between systems is thus somewhat reduced.

Competition for space within the mangrove and backwater areas is much more difficult to resolve but it can be done. In most countries, neither enabling legislation nor management infrastructure to address resource allocation and use questions exist. *Ad hoc* decisions or lack of enforcement of mangrove 'moratoriums' is common and in most countries conversion of mangroves to shrimp pond culture is proceeding without too much consideration of existing or alternative use of the coastal areas. In addition to problems associated with shrimp farming, there are also questions to be addressed regarding competition between coastal mariculture such as mussel stake culture and the traditional small-scale fishing activities that this aquaculture displaces. This competition for space in the coastal zone thus has a wide national dimension (because it involves foreign exchange generation) and a more localized dimension that may extend no further than a single community. Resolution of both requires a means of taking into account the alternative uses of the coastal resource and a decision-making process that appreciates more than simply technical or financial facets.

If users of renewable resources such as fisheries, forests and coastal zone mangroves and wetlands are excluded from decision-making regarding use of these resources, one can be fairly certain that centralized attempts at the national level to regulate rates of use and types of users will be ineffective. Missing from most coastal zones in the tropics is the element of local control over use. National interests that award trawl licenses, logging concessions or shrimp farm permits at fees far below the true value in use of these resources are merely encouraging their over-exploitation and depletion. Resources such as mangrove or backwaters suitable for coastal aquaculture can be valuable sources of revenue in the form of rental fees which can be used to invest in other income generating activities in coastal communities. The key question is which entity national, regional or state, or local community should have the right to license users and hence earn the income from these user fees?

Since national systems of regulation have generally failed to meet basic conservation guidelines and avoid over-exploitation, a decentralized approach to coastal zone management is clearly called for. Decentralized management decision-making and infrastructure operating within certain scientifically prescribed limits has many advantages. Not only will such an approach be essential to resolving issues of competition at the local level, it will potentially generate income for coastal communities which are among the rural communities most in need of such income. For example, the case of extremely low annual leases ($1.50/h/yr) was cited for the Philippines. The value in use of the mangrove areas is clearly more than this. Why could not a system of ownership over

these resources be established for the local municipality, with the municipality entitled to charge higher lease fees? Well-defined limits would need to be established for the amount of area out of the total available area that could be leased out in each locality, but such a system would certainly be preferable to the present approach which enables local or multi-national corporations to gain access to these areas by paying nominal rents. Even if decentralized approaches are not possible, at the very least, the fees payable by fish or shrimp pond culturists to gain access to coastal wetlands should be significantly increased.

Most of the aquaculture systems that appear to be appropriate for coastal communities are not land-using because unlike pond culture, they can be undertaken in coastal and backwaters. The primary concern of producers in these bivalve, pen and cage culture systems is that they be able to recover the products of their labour. Poaching and even sabotage by competing fishermen is a problem with almost all of these systems and local granting and enforcement of use rights is really the only way in which this problem can be kept within reasonable limits.

Thus, both for large-scale capital-intensive culture systems and for the more extensive community-based systems, some element of legislative intervention and delegation of management authority is necessary if both systems are to co-exist, even in a dualistic fashion. There must also be a willingness to sacrifice short-term foreign exchange goals for longer-term social feasibility and income distribution goals. Finally, redirection of some of the current research effort and credit facilities away from capital-intensive systems towards support of community systems will be needed.

6 Conclusion

As Goulet (1977) has quite rightly pointed out, in most instances, technology is a two-edged sword. While it can potentially liberate and add to general community welfare, it frequently does so at the cost of established socio-cultural values, community structures and institutions. In the case of coastal aquaculture, however, two major factors must be kept in mind with respect to this issue :

(1) The vast majority of residents in coastal communities are desperately poor. They are poor because of their lack of access to alternative employment opportunities and because existing community and national structures and institutions most often allow local elites to capture the bulk of any benefits that come from more productive technologies introduced to or adopted by such communities.

(2) The common-property nature of the coastal zone's resources, especially mangrove areas, is being rapidly eroded by the conversion of much of these areas to private fishpond use. This use and misuse of the coastal zone is made possible through subsidized financing and institutional arrangements that favour the large-scale private or corporate investor over the small-scale, perhaps, communal, investor.

The above two factors imply that for the majority of residents in the coastal zone there is nothing particularly beneficial in existing community power structures and institutional arrangements. It is naive or worse, therefore, to speak of trying to maintain these structures and. institutions intact for the sake of some socio-cultural ideal. Rural communities are only idyllic to the casual or misguided observer; they are hardly so to the majority of residents who directly experience the poverty there. Besides, the economic pressures to use the coastal zone for the benefit of society as a whole make it virtually impossible for coastal communities to remain untouched by technological advances. Most often, those communities have experienced only the negative aspects of this technology; for example, in the form of large-scale trawlers that have led to the over-exploitation of many coastal fishing grounds. What has been missing in much of their experience to date with technological advance is an element of community control over its development and use.

Aquaculture, because it can be small-scale and because it has such widespread potential to add to locally available protein supplies and income can be a most attractive technology from the community viewpoint if it is guided by 'social feasibility'. It need not be developed externally from the coastal community and then imposed upon it; experience has shown that participatory development is possible. It has the potential to add to community income and nutrition and to do so in a more equitable fashion than many other alternative activities that may require access to large areas of land. Precisely because it offers the potential for involvement of large numbers of rural residents, it also offers the potential for modifying community structures and institutions in ways that will benefit the majority. To the extent that aquaculture can help circumvent or overcome oppressive rural power structures while maintaining or even adding to the number of rural-based

employment opportunities, it should be encouraged. In this context, Hayashi (1984) stresses that the "task of government is to liberate technology from its classed class structure and make it accessible to society at large."

Participatory development on the part of coastal communities will require conscious efforts to involve them in the process of aquaculture development; it certainly will not come about without efforts to decentralize control and decision-making over the coastal zone itself and the technologies that are appropriate there. Nor will participatory development come about without efforts of interested researchers, extension workers, rural bankers and non-governmental community developers to make certain that communities are directly involved and supported over the long-term. Involvement of these cooperative and supportive groups is also necess ary to help individuals and families adjust to the changes and new roles that aquaculture activities bring.

If current trends of aquaculture development in the coastal zone that favour large-scale corporate endeavours are not modified in some way, not only will the likely environment damage be great but 'social feasibility' in terms of more equitable growth, better local nutrition and increased employment opportunities will not be achieved. Deliberate interventions and innovative approaches to facilitate community involvement in coastal aquaculture will be required to increase the 'social feasibility' of many of these 'technically sweet' activities.

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Appendix 4

This Appendix reproduces a note circulated to workshop participants

A NOTE ON THE CASE METHOD

1. What is the case method?

The definition of the case method starts with the definition of a case. A case is a short description, in words and numbers, of an actual situation in our case the planning and implementation of coastal aquaculture projects. Most cases stop short of presenting all the actions and decisions taken by the decision-makers in the real world situation. Thus the case leaves open to the partici pant the selection of options and decisions which could and should be taken. It is expected that participants will study the cases, come to their own conclusions about what is and what should be done, then discuss the case in a committee describing and defending their suggested courses of action. The case method puts the participant, or almost puts him or her, into the position of the real world decision maker · in our case YOU, the aquaculturist, or project manager, or fisheries depattment official, or government administrator, or banker or development and funding agency representative, who has to make the decisions and prepare plans of action and then implement thern.

2. The Consultation has been planned around four cases based on actual instances of coastal aquaculture in three countries in the Bay of Bengal region. The cases describe projects at various stages of development; one at a stage when feasibility is being discussed, prior to the decision to extend the technology; one other which was planned and has been implemented; a third which

was not really planned, but which 'happened' as a result of various economic and environmental conditions that existed in the area, and so on.

3. In each of these cases the participant, in individual study and through committee discussion, is expected to:

(a) decide on what the objective of the project in the case is (or should be) and why, in terms of who the beneficiaries of the project are (or should be) and what constitutes 'benefit' and 'project success';

(b) identify and understand those social, cultural and political factors which may affect the success of the project or effort; and

(c) evolve a strategic plan (if it is felt that it is feasible to do so) to work towards a socially feasible project under the specified circumstances.

4. A further expectation of the Consultation is that it should draw out and clarify the general concepts involved in this cluster of cases in order to suggest guidelines to implementing and funding agencies on the types of organizational, planning and implementation strategies they could use to work towards socially feasible coastal aquaculture projects.

5. How to study a case

It should go without saying that the case method requires participants to do most of their studying before the committee session, as contrasted with attending the lecture-presentation-based meeting, in which most of the effort and learning occurs in the question period and later while reviewing and reflecting on the lecture and notes. If you are going to understand and appreciate fully the arguments and presentations of your colleagues in the committee, not to mention giving a good presentation of your own, you must be prepared before hand. In effect, you must place yourself in the role of the responsible decision-maker in the case situation, and make the decisions and plan the action called for by the facts as you interpret them.

6. Steps in case study

Read the case through once, very quickly. The purpose of this reading is to make you familiar with the local environment, the people, the technology and the agencies of development, the cast of characters, the decision-makers whose role you will play as you analyse the case, the general nature and quality of the evidence with which you must work, and some idea of the problem that must be solved.

7. Read the case thoroughly a second time. Take note of important facts in the written passages, and study each quantitative exhibit to decide what important fact or facts can be identified there. By the end of your second reading, you should abstract from the case a statement of the problems involved, the nature of the decisions facing the decision-makers, and most of the major elements (constraints, opportunities and resources) which influence the decisions and plans.

8. It is at this point that you will prepare your analysis and recommendations, using your understanding and particular experience. You will also prepare to defend in the committee your recommendations and views, as you would in the real world of decision-making, The committees have been carefully formed to include as many types of backgrounds and functions as one should expect to encounter in the planning and implementation of developmental fisheries projects. At the end of each case, on the yellow sheets, the case writers have suggested some propositions and questions to help and guide you in the direction of the objectives that the Consultation sets out to achieve. See Paragraph 3.

9. Case discussion

We have allotted one morning and one evening session of the Consultation to each case study. The case study will begin with a briefing, in plenary session, where participants will have an opportunity to clarify their doubts and seek further information. The briefing will be done by the case writer(s) and participants familiar with the region and the project. They will also be requested to act as resource persons. After the briefing, the participants will divide themselves into three smaller committees and discuss the case in depth. Each committee will have a moderator and a rapporteur to enable the deliberations to proceed smoothly.

10. Case output

Each committee should submit to the Secretariat a summary statement, not more than 3-4 typed pages in length, that clearly states what the group sees are the factors that affect the success of the project under discussion, what strategies they recommend to achieve social feasibility, and why. These summary statements will be typed, duplicated and distributed to all the participants at the end of each case study and will be used in the plenary discussions at the end of the Consultation when an attempt will be made to draw out and clarify the general concepts involved and to suggest guidelines to agencies to work toward social feasibility

Appendix 5

PLANNING FOR EXTENSION OF SHRIMP PEN CULTURE IN KILLAI

A Case Study

by

Rathindra Nath Roy
Consultant, BOBP

I The Process

During the Fourth Advisory Committee Meeting of the BOBP (27 30 November 1979, in Thailand), India, along with the other participating countries, expressed interest in the BOBP's technical cooperation for aquaculture development in her coastal waters.

Following the Advisory Committee Meeting, the state of Tamil Nadu made a specific request to the BOBP in 1980 for technical cooperation in aquaculture development in the state's coastal waters The increased demand for fish both for local consumption and export, escalating fuel costs which constrained any substantial expansion of fuel-dependent capture fisheries, the socio economic need for improving the lot of small fisherfolk by increasing and expanding their earning options and the availability of large stretches of coastal fallows and shallow backwaters had no doubt caused the government to actively consider the development possibility of brackishwater aquaculture along the coast of Tamil Nadu

Pursuant to the request of the Tamil Nadu Government, the BOBP made a preliminary review of the state's aquaculture status. This was followed by a 15-day long reconnaissance study by a consultant who along with the BOBP staff, visited 11 potential sites distributed in seven coastal districts Further studies were made by a two-member Thai TCDC aquaculture mission organized and sponsored by the BOBP. The Mission visited the state for four weeks in September October 1981 and submitted its findings and recommendations.

The Mission, *inter alia,* recommended pen culture in the backwaters as the most promising technology for developing coastal aquaculture in the state. Low tidal amplitudes and the generally sandy nature of the soil in Tamil Nadu tends to limit the possibilities of pond culture, and the abundance of shallow and protected backwaters make pen culture and floating cage culture viable and preferred options. Further, the low capital costs of such systems when compared to pond culture makes the proposition even more attractive. In particular, the Mission identified the sandy mud flats near Pulicat Lake and the Killai backwaters as areas where pen culture of shrimp could be profitably developed.

Out of these recommendations emerged a 21 -month project to test the technical feasibility of shrimp pen culture in the Killai backwaters, to evolve and test culturing practices and to assist the Government of Tamil Nadu to formulate its aquaculture development strategy. The project, a collaborative effort of the Department of Fisheries, the Government of Tamil Nadu and the BOBP, went on line in May 1982.

A year and a quarter and three harvests later, with a preliminary indication of technical feasibility in hand, the BOBP and the Tamil Nadu Government began considering the problems of economic and social feasibility which in turn would dictate the directions of state policy in extending the technology to its fisherfolk.

The Tamil Nadu Government, which ultimately would be the agency of development, has clear and well-stated guidelines which help it to determine beneficiaries for its development and technology transfer programme. Development programmes are expected to preferentially benefit the weaker sections of society, defined by their membership of scheduled castes, scheduled tribes and backward classes. The Government, in principle, prefers collectives to individual enterprise to receive the technology and undertake development programmes. The Government protects the interests of those who have historically been in a trade or practice by giving lower preferences to those seeking to migrate from one occupation to another; for example, when transferring fisheries technologies, fishermen (by caste) are preferred to others in spite of their practice of fishing.

In the case of shrimp pen culture, the Government of Tamil Nadu wants to transfer the technology to the economically and socially weaker segments of fishing communities of the Killai region.

BOBP undertook a social feasibility analysis in order to help give direction to the Government of Tamil Nadu's policy of extending shrimp pen culture to the fisher-folk of the Killai backwater region. This case study is derived from the techno-economic and social analysis that formed the social feasibility study. On the basis of the study, the BOBP and the Government of Tamil Nadu are planning an extension programme which is expected to go on-line sometime in 1985.

The case first looks at the technology in all its aspects and then looks at the target communities in terms of their living conditions, their attitudes and their needs.

II The Technology : Working towards feasibility

Shrimp pen culture – the technology in brief.

There are two basic means of aquaculture, aquaculture in ponds constructed on coastal low lands or in backwaters enclosed in pens and cages. The Tamil Nadu coast is predominantly characterised by sandy soil and the tidal amplitude is very narrow, usually in the range of 150 – 300 mm. These two conditions make pond construction, maintenance and water management difficult and expensive. Erosion of pond dykes, water and nutrient loss through seepage and a constant dependence on fuel-operated pumps are some of the problems which limit pond culture potential.

On the other hand, the state has vast areas of backwaters offering opportunities for pen culture which do not depend on fuel-dependent pumps as they are naturally serviced by tidal rises and falls. Pen construction requires low capital investment, is easy, and requires very little by way of skills or manpower, and is ready for full-scale production as soon as it is installed, made pest-free and stocked with seed. For these reasons pen culture is likely to prove an appropriate and financially accessible technology for fisherfolk of limited means.

Pen culture involves segregating an area of water with nylon netting held in place by casuarina poles and ropes. ***Once*** the water body is penned in, predators and other undesirable organisms are removed by using various fishing gear and by hand picking. The pen is then stocked with juveniles of the preferred species and given supplementary feed until harvest. In the case of shrimp, ***Penaeus monodon*** and ***P. indicus,*** the feed consists of squid offal, trash fish, clams and mussel meat, cooked and supplemented with rice bran and groundnut cake and bound with tapioca.

The juveniles caught in their natural habitats using push nets are first stocked in nursery ponds and transferred to grow-out pens when they reach a particular size, usually in about a month's time. Once in the grow-out pen, the farmer has to concern himself with several problems that may arise and affect the growth of the shrimp and occasionally even jeopardize their life. Among these are:

(a) Damage to nets by crabs and other pests, their subsequent entry into the pen and the consequences – competition for feed with the culture stock and, in the case of predators, consumption of culture stock. This problem has to be overcome by systematic and regular inspection and repair of nets and removal of pests at regular intervals.

(b) Salinity changes in the water due to environmental and climatic influences. Nothing can be done about these, except that when the crop is threatened it can be harvested and sold for what it is worth.

(c) Large temperature changes which can jeopardize the crop. The response to this is similar to that in the case of salinity changes.

(d) Diseases and ailments of the culture stock which have to be checked by regular sample harvests and dealt with as above.

Except for damage to nets, the other problems do not occur too often, but constant monitoring is required to save the crop.

Technological feasibility

The technology of shrimp pen culture was tested and optimised and its feasibility calculated over a 21-month technical trial at the BOBP shrimp farm in the Killai backwaters. Table 1111 gives the production data and details of the three trials that convinced BOBP and the Fisheries Department of the Government of Tamil Nadu that while there were technical questions yet to be answered, there was enough data to suggest technical and (to a certain extent) economic feasibility.

The average weighted and extrapolated production of P. *monodon* and *P. indicus* over three trials was 460.33 kg/ha /cycle while the production of fin fish, crabs and auto-stocked shrimp was 330.33 kg/ha/cycle. Using the average procurement prices received of *Rs.* 31.04/kg for *P. monodon* + *P. indicus* and Rs. 2.15/kg for the rest, the per hectare earnings amount to Rs. 14,998/cycle or about Rs. 44,996/year.

The Killai-based shrimp culture project has had three trials since its inception. Unfortunately, their results are not comparable because of differences in season, water area, stocking rates and the growth period. However, with weighted averages and extrapolated trends, one can get a reasonable idea of production characteristics.

It is risky to extrapolate production trends from smaller pen sizes and aquaculturists prefer a minimum size of half an hectare. In trial 3 there were 2 half ha pens and the overall extrapolated figures came close to figures extrapolated from the half ha pen's productions.

The Fisheries Department undertook three studies of area, seed and feed availability to ensure that shrimp pen culture would be technically viable in the Killai region. They first ensured that there would be suitable water areas that would fit the environmental and management requirements.

Table II/1 : Production Data from BOBP Shrimp Culture Project

Trial 1 80 days (10 July 28 September 1982)
2 ponds of 1500 m² each and 2 ponds of 625 m² each
Average stocking rate : 37870/ha; Recovery Percentage : 73.97
Final Average Weight in *g : P. monodon* 19.42
P. indicus 11.75
Production of *Pm* + *Pi* was 186.1 kg and was sold for Rs. 5794 50 or at an average rate of Rs. 31.136/kg
Production of other species was 57.4 kg and was sold for Rs. 175.75 or at an average rate of Rs. 3.06/kg
Production/ha (weighted average, extrapolated)
Pm + Pi 437 kg
Others 135 kg
Earnings per ha Rs. 14117.42/cycle.

Trial 2 117 days (15 October – 10 February 1983)
2 ponds of 1250 m² each and 2 ponds of 625 m² each
Average stocking rate : 44000/ha; Recovery Percentage : 68.80
Final Average Weight in *g : P. monodon 26.00*
P. indicus 16.00
Production of *Pm* + *Pi* was 214.6 kg and was sold for Rs. 9334.00 or at an average rate of Rs. 43.49/kg
Production of others was 218.8 kg and was sold for Rs. 210.00 or at an average rate of Rs. 0.959/kg
Production/ha (weighted average; extrapolated)
Pm + Pi 572 kg
Others *583* kg
Earnings/ha : Rs. 25669.89/cycle

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Trial 3 94 – 127 days

2 ponds of 1250 m^2 each; 2 ponds of 625 m^2 each; and 2 ponds of 1500 m^2 each

Average stocking rate : 56600/ha; Recovery Percentage : 53.50

Final average Weight in g : P. monodon NA
P. indicus 10.7

Production of Pm + Pi was 511.4 kg and was sold for Rs. 9347.00 or at an average rate of Rs. 18.27/kg

Production of others was 375.5 kg and was sold for Rs. 925.00 or at an average rate of 2.46/kg.

Production/ha (weighted average; extrapolated)
Pm + Pi 372 kg
Others 273 kg

Earnings per ha : Rs. 7468.00/cycle

Average for 3 Trials

Production/ha (weighted average; extrapolated)
Pm + Pi 460.33 kg/cycle
Others 330.33 kg/cycle

Average price received for Pm + Pi Rs. 31.04/kg
Average price received for others Rs. 2.15/kg

Earning per ha : Rs. 14998.85/cycle
Rs. 44996.55/year

The backwater system at Killai extends to about 1300 ha as estimated from topographical maps of the Survey of India. The water body is intercepted by irregular land masses, and thick bushy mangroves are the characteristic vegetation. The backwater is connected to the Bay of Bengal by two perenially open bar mouths. Two other bar mouths which existed in the past are now closed due to silting/erosion. The tidal amplitude is low, ranging between 100 and 300 mm, the maximum being 400 mm during the highest high tide.

The criteria used for selecting suitable areas were

a. a minimum depth of 300 mm keeping in mind the minimum ecological habitat depth requirements of shrimp
b. a maximum depth of 800 mm keeping in view the construction costs of pens and vulnerability to maintenance and management
c. shorelining the areas to enable shore-based management
d. that the areas selected be neither ferry landing sites nor on the regular waterways used by fishermen.

By detailed depth sounding of the whale area over a two-month period and by making appropriate seasonal corrections, 15 potential water sites satisfying these criteria were identified. The areas ranged from 1.3 ha to 13.3 ha in size and the total area available was estimated to be approximately 85 ha in size.

The second study looked at the availability of seed in the Killai backwater eco-system. The entire Killai backwaters were covered on foot and boat and 30 probable sites were identified as nursery grounds, and sample collections were made of 25 minutes each using four types of gear. Physico-chemical parameters like dissolved oxygen, salinity, water and atmospheric temperature and pH with reference to time and lunar phase were recorded simultaneously. The nature of the bottom was also studied. The study was undertaken during the months of June and July 1983. Naturally such a small and seasonally restrictive sample cannot be expected to give a realistic picture of the seed resources. The sample therefore was augmented with the records of the BOBP shrimp project which has been functioning since May 1982 in the region. In the opinion of the technical staff of the Department of Fisheries, Government of Tamil Nadu, and of the BOBP, the seed resources are sufficient to meet the requirements of 85 ha of pen culture in the region.

Availability of seed is critical to the success of the technology and to assure oneself of the validity of the results of the study a simple back-of-the-envelope type of exercise was performed. From the socio-economic data collected the approximate amount of shrimp now being captured in the Killai backwaters was estimated at 107.47 tonnes/year. Such a catch would bring in about 50%

juveniles and if one assumes a weight of 0.1 g/juvenile, then the number of juveniles caught each year is about 537.5 million. It is fair to estimate that a fishery that can sustain capture of 537.5 million juveniles can support a demand of 17.85 million live juveniles needed to stock the 85 ha of proposed pen culture even if one's numbers are off by one order of magnitude. Thus the seed resources survey, in spite of its small sample, indicates that the Killai backwaters can supply sufficient seed for the 85 ha available area suitable for shrimp pen culture.

While one **can** be reasonably sure that the Killai backwaters have enough seed supply capability, it is important to ascertain the seasonal availability of seed (in order to successfully stock the farm, year around) and to determine the actual effort (in terms of manpower and cost) that would be necessary to capture the seed.

The-study estimated that a man using a push net and working 4 to 5 hours a day should be able to collect 3500 seeds, Assuming that each cycle of production will have to be preceded by about a month of seed collection, and a seed demand per year of 17.85 million seeds (85 ha x 3 production cycles x 70,000 seeds/ha/cycle), a total of 5100 man days of effort will be needed to collect seeds. This would require 57 men working for 90 days in a year, a labour demand which is within the region's capacity, especially considering the Veddar folk, who are particularly skilled in similar **activity** and are in need of regular employment. Each hectare of pen culture would require 60 man days of effort to stock it with seed during the year.

A further aspect that needs to be studied, but has not been, is the ecological impact of seed collection and seed collection activity on the capure fisheries in the backwaters and on in-shore marine shrimp fisheries which use the backwaters as nurseries.

The third study estimated the availability of feed. Table II/2 proposes a feeding protocol that, in the opinion of the BOBP and Fisheries Department staff, should have been followed. It has not followed in practice due to factors that were beyond the control of the staff. For example, the feed composition depended on the availability of the various components, and in their absence these were substituted by others. The contractors who provided the feed insisted on a uniform supply amount irrespective of the growth stage and it made practical sense to feed what was on hand. The table also proposes a feed mix based on practical factors like cost and availability rather than on optimal growth and cost effectiveness.

The feed survey looked at the availability of squid offal, prawn heads, trash fish, squilla and crabs, clam, oysters and mussels in and around the Killai area during June and July 1982. Non-meat sources like rice bran, ground nut cake and tapioca were also studied. In terms of quantity, the study indicated that there is sufficient feed in the region to supply the requirements of 85 ha of pen culture. In fact, clams and squid offal and trash fish are two sources that the study suggested can independently meet a very high proportion of the feed demand of the proposed pen culture fishery.

However, availability of feed either in terms of natural stock assessment or in terms of estimates of present landing cannot be considered real availability without looking into factors such as the effort needed to collect or capture the feed, the alternate demands for such products and the economics of pen culture which will determine what can be paid for the feed while making a profit. Thus, while there is an indication that sufficient feed resources exist, further studies are indicated to identify and measure the catch effort, alternate demand for the products and the prices that the culture practice will be able to afford for feed.

In considering catch effort, the study found that one man could collect enough clams in a day to provide for about 7.5 kg of clam meat. To supply 76% of the feed demand of 85 ha would thus require 51,900 man days of effort, or 228 men working just on feed collection. It is debatable whether the region would be able to generate such a vast manpower source just for feed collection. Also clams are now being exported and clam pickers will have a more lucrative alternate market to feed. Thus what seemed at first sight a possible source, may not, on closer examination, turn out to be so.

Squid offal and trash fish, however, seem a fairly reliable source as they are already being landed and more often than not being thrown away as no alternate demand exists. In the BOBP experiments, squid offal and trash fish at 60% of the diet with the rest being made up of non-meat proteins, provided an excellent feed substitute for high conversion feeds like clams and mussels.

As in the case of seed availability, what remains to be ascertained is the detailed seasonwise availability of feed types, the effort that goes into their capture/collection, the alternate demands for

these products and whether the economics of the culture practice can afford to pay for the feed in the desired combinations and quantities.

The very size of the pen culture fishery may well be constrained and decided by factors such as labour availability for seed collection, catch/collection effort, alternate demand for feed, and the costs affordable by the culture practice economics.

The three cycles of culture experiments and the survey of area, seed and feed indicated that shrimp pen culture had a better than even chance of being technically viable in the Killai region. They also raised several questions that needed to be answered before full-scale extension could be undertaken.

Economic feasibility

The analysis of economic feasibility is based on private costs and returns. Social cost-benefit analysis (sometimes called economic analysis by banks) would also take into consideration the true social costs and benefits of the operation, particularly as they affect employment. The data available at this stage of operation makes it difficult to go very much beyond financial analysis; however, it is recommended that thorough economic analysis including social cost benefit analysis should be undertaken before full-scale extension. However, such an analysis will require hard operations data in commercial working conditions which would need some form of real scale operations.

All the calculations are for a 1 ha shrimp pen farm consisting of 2 half hectare pens in the Killai region. The data was derived from the estimates made by BOBP staff and on the basis of long and detailed discussions with the field staff who were able to provide their expert guesstimates. This had to be done because the pen size/farm size for which calculations were being done did not exist; hence the data had to be evolved out of the existing data base and expert opinion.

Table II/3 shows the investment costs and annual depreciation of a 1 ha shrimp farm.

Table II/4 estimates the labour demand for pen erection and for culture activities. It also differentiates between hired labour demand and the demand for essentially unpaid family labour contribution.

Table II/2 estimates feed demand considering the proposed protocol, the recommended feed mix and 1983 prices.

The market determines the revenue and as such is perhaps the single most important variable controlling profits; and to get an understanding of the market mechanisms that the Killai fishermen encounter, the socio-economic study obtained price and organizational data all the way up the market chain beginning with shore sales and ending in export procurements. The numbers begin to make sense when visually simplified as in Table II/5. In addition to the obvious fact that prices seem to increase upstream, one has to notice that unlike the situation in Killai, Chidambaram and in the BOBP project, *P. indicus* fetches a better price than either *P. monodon* or pink shrimp *(Pp).* This obviously benefits the middlemen as *P. monodon* and pink shrimp are relatively scarce species and with their seemingly logical higher price keep the price of the more abundant *P. indicus* depressed, in spite of the fact that it is preferred and fetches a better price in the export markets.

One would also expect that transportation costs would cause a sharp increase in prices as the shrimp covered the long distance to Madras. This does not really happen as Table II/6 clarifies. Longer and larger hauls turn out to be ridiculously cheap. For example, shipping shrimp in bulk by refrigerated truck from Killai to Madras would cost a 1 ha farm about Rs. 103/year – a per kg cost increase of about Rs. 0.10. This is quite different from the local picture in Killai where the transportation to Chidambaram adds substantially to the price. This is the irony of scale.

The price data was collected over a 2-month period which is a small sample for the widely fluctuating shrimp trade. However, relative positions along the market chain seemed to remain stable and thus the figures are indicative. The gap between export-supported procurement prices and local consumption prices is so vast that even with violent fluctuations the production would be drawn towards export.

Table II/7 sums up the annual costs and returns and estimates the returns expected, assuming rates received at Cuddalore or Madras. The residual returns are also estimated. A sensitivity analysis was done to identify those factors which particularly affect the profit (or loss) by their changes; and the two most critical factors were found to be the cost of feed and the rate received for the shrimp.

(Tables II/2 **to** *II/7 on pages 42-46;* **rext** *continues on page 47)*

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Table II/2

Feed demand for 1 ha shrimp pen/stocking : 50000/ha

Time in days	Wt./ piece (g)	Total biomass (kg)	Feed as % of biomass	Feed/day (kg)	Cumulative feed (kg)
0	2	100	10	10	–
15	6	300	9	27	150
30	9	450	8	36	405
45	11	550	7	38.5	540
60	13	650	6	39	577.5
75	15	750	5	37.5	585
90	16	–	–	–	562.5
Total for 90-day growing period					2820
Feed for nursery pen at 10% of above					282
Total *feed demand/cycle*					3102 *kg*

Recommended feed mix

Feed component	% in mix	Cost/kg	Cost contributed to 1 kg of composite
Clams/mussels	60	2.50	1.50
or Squid offal & trash fish	60	1.25	0.75
Rice bran	20	1.00	0.20
Groundnut cake	15	2.50	0.375
Tapioca	5	2.00	0.1
Total	100		1.425

Say approximately Rs. 1.60/kg

Per cycle cost of feed/ha = 3102 x 1.6 = Rs. 4963.20

Per year cost of feed/ha = 3102 x 7.6 x 3 = Rs. 14890

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Table II/3

Investment costs and annual depreciation for a 1 ha shrimp pen

Items	*1983* costs (Rs.)	Estimate of useful life (years)	Annual depreciation (Rs.)
1. ***Pen construction materials :***			
Nylon webbing/IO mm mesh	10780	3	**3593.33**
Nylon webbing/6 mm mesh	2480	3	826.66
HDPE rope/5 mm	570	3	190.00
Nylon twine	70	3	23.33
Casuarina posts	1200	3	400.00
Casuarina crossbars	400	3	133.33
Coir rope	100	3	33.33
Cost of nursery pen at 10% of growing out pen	1560	3	519.99
Sub-total for pen materials	17160		***5719.97***
2. Equipment :			
Bottom furrower	**50**	10	5.00
Buckets, tubs	200	1	200.00
Knives, choppers	50	5	10.00
Meat grinders	350	5	70.00
Table for grinder	300	5	60.00
Weighing balance	loo	5	20.0
Torch/hurricane lamp	60	2	30.00
Seed collection gear	200	3	66.66
Castnets (2)	800	2	400.00
Feeding trays	100	1	100.00
Crab traps	**100**	1	100.00
Sub-total for equipment	2310		1061.66
3. Guard shed :	500	3	166.66
Sub-total for shed	500		166.66
4. Labour for pen construction 30 m-d @ Rs. 12/m-d	360		
Sub-total for labour	360		
5. Contingency:	**940**		
Sub-total for contingency	**940**		
Total Investment costs	Rs. 21270		Rs. 6848.29

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Table II/4

Labour demand for a one ha shrimp pen

Activity	Sk/NSk	Int.	Ex.	m-ds	Rate/ m-d in Rs.	Year's total cost in Rs.
1. Pen construction	NSk		X	30	12	360
2. Initial harvesting to remove pests : 30 m-d cast nets/20 m-d drag nets/10 m-d hand picking; 33% on subsequent efforts	Sk		X	100	12	1200
3. Seed collection : (3500 seeds/m-d for 70000/ha/ cycle)	Sk		X	60	12	720
4. Pen maintenance	NSk	X		60	12	720
5. Feed preparation	NSk	X		60	12	720
6. Intermitent pest removal	Sk	X		60	12	720
7. Harvesting as in Activity 2	Sk		X	180	12	2160
Total				550		6600

Classification of labour

1. Labour in investment	30 m-d	@ Rs. 12/m-d	Rs. 360
2. Hired labour	340 m-d	@ Rs. 12/m-d	Rs. 4080
3. Internal labour (family contribution)	180 m-d	@ Rs. 12/m-d	Rs. 2160

• Sk : Skilled; NSk : Non-skilled; Int. : Internal; Ex. : External; m-d : man-day.

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Table II/5 Summary of shrimp procurement prices at various locations.

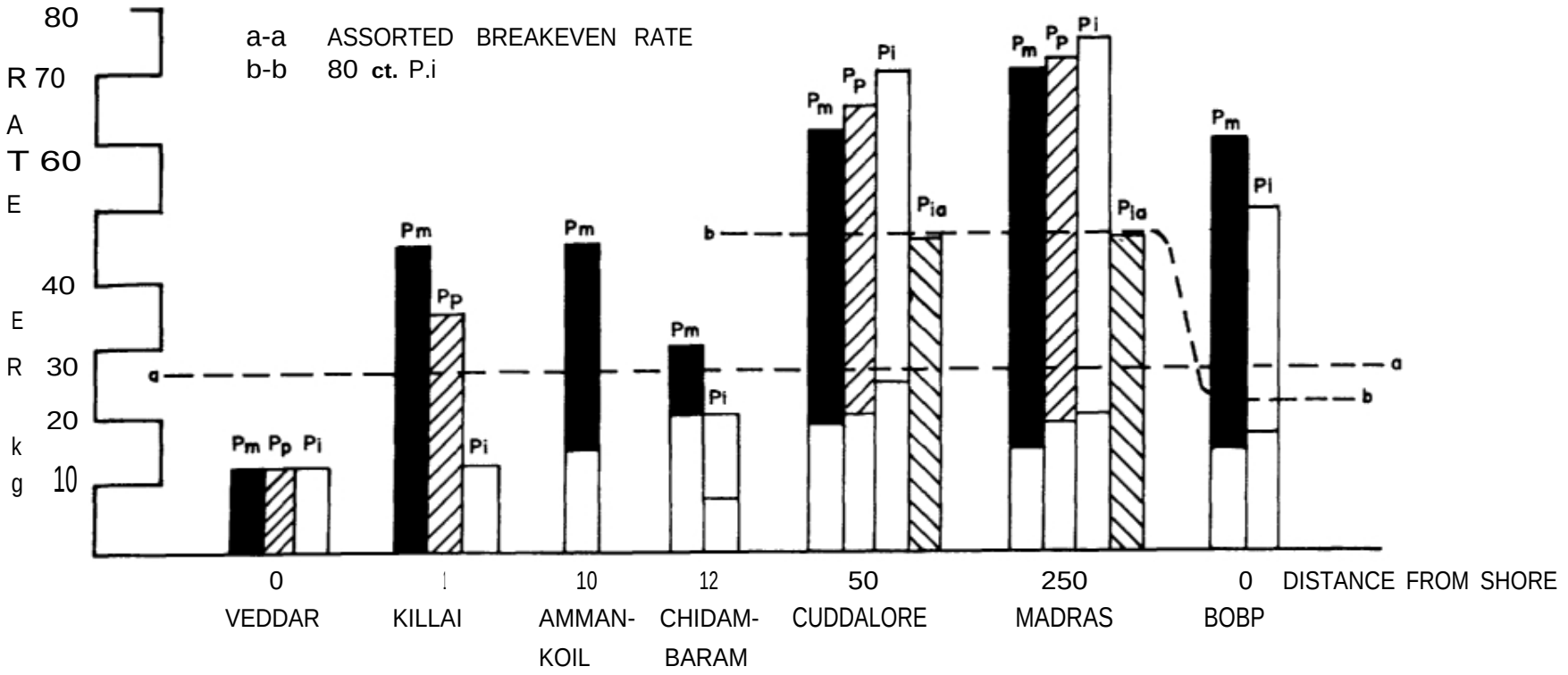

Table II/6

Transportation costs by refrigerated trucks

Garage-to-garage rentals for 72 hour periods of 6 tonne refrigerated trucks from Marine Products Export Development Authority, Madras.

Cost per tonne - km = Rs. 0.28.

Cost of transportation from Killai to Madras (250 kmi of 1.5 tonnes (1 ha's production per year).

= 1.5 x 250 x 2 x 0.28

= Rs. 210.00

Cost added per kg due to transportation = Rs. 0.14

Note : To optimally utilize the haulage capacity of the 6 tonne truck, the harvest will have to be scheduled in 12 to 15 hectare lots.

Table II/7

Annual costs and returns for a 1 ha shrimp farm

1. *Capital investment :* For pen construction materials, equipment, a guard/tool/storage hut and labour for pen construction (See Table II/3)			*Rs 21270.00*
2. *Variable costs :*			
1. Seed	Rs. 720.00	(60 m-d @ Rs. 12/m-d)	
2. Feed	Rs. 14889.00	(9305 kg @ Rs. 1.60/kg)	
3. Firewood	Rs. *600.00*		
4. Kerosene	*Rs. 300.00*		
5. Torch cells	Rs. *150.00*		
6. Boat rental	Rs. *600.00*		
7. Hired labour	Rs. 4080.00	(340 m-d @ Rs. 12/m-d)	
	Rs. 21339.00		Rs. 21339.00
3. *Fixed costs :*			
1. Depreciation	Rs. 6948.00		
2. Interest	Rs. 3284.00	(Rs. 21270 @ 12.5% + Rs. 5000 @ 12.5%)	
	Rs. 10232.00		Rs. 10232.00
4. *Returns :* P. monodon + P. indicus 460 kg x 3 cycles x Rs. 45/kg average price = 62100.00 Fin fish + crabs + auto stock shrimp 330 kg x 3 cycles x Rs. 3/kg average price = 2970.00			
	Rs. 65070.00		Rs. 65070.00
5. *Total costs (2 + 3)*			Rs. 31571 .00
6. *Residual returns : (4 – (2 + 3)*			Rs. 33499.00

To cover own labour
- unpaid family labour
- opportunity cost of investment
- inputs of management/technical knowhow

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Cash flow analysis indicated that with a loan to cover capital expenses and an overdraft facility of Rs. 5,000 both at a non-subsidised 12.5% interest, the farmer should have no cash flow problems and actually generate sufficient surplus to provide for a reasonable profit and enough to provide for working capital for the second year.

While the availability of data at this stage of operations makes it difficult to go beyond financial analysis, it is worthwhile to do what might be described as a paper exercise to get a feel for the way the technology would affect employment in the Killai region.

A detailed month-by-month labour demand was worked out for a 1 ha pen and extrapolated for the 85 ha scheme; and equivalent labour demand assuming full-time employment for at least a month at a time was derived and this demand was allocated on the basis of a policy assumption : that the Veddars who have the lowest socio-economic status would get first preference in employment, followed by Killai fishermen who own only nets, and finally by boat owners and others.

The present earnings of the Veddars and net owners (who would be employed by the project) were estimated from the socio-economic data.The project earnings from the expansion scheme were estimated using a per day labour rate of Rs. 12. Two options were then considered : (i) the substitution option wherein those not employed by the project would continue to earn at present levels while those employed would earn only from the project; (ii) the complementary option where labour would work in the project and continue their present occupation, thus earning from both sources.

While the present earnings of 276 Veddars and net owners who are not dependent on the backwaters is Rs. 1,097,628 per year, in the substitution option it is Rs. 1,217,189 and in the complementary option Rs. 1,450,788 – an increase of 10.8% and 32.17%, respectively.

The increases in earnings due to the project do not seem very high, especially in the substitution option. So while the pen culture scheme is extremely paying for the entrepreneur who owns the farm, it is not as attractive to the labourer who works the farm. For a 30% increase in labour earnings he or she would have to continue in his or her present occupation and also do the work of the farms.

One important aspect is that in computing present earnings, gross returns are being considered. If the opportunity cost of labour be deducted, the residual returns turn out to be far less and would make the increases in earning due to the project far more attractive. However, one must be warned that people generally do not set a cost to their own labour and as such the logic of deducting opportunity costs may not be a real exercise.

III. The People

Socio-economic data on Killai backwater communities ;

The community and sample design :

The Killai community is scattered in 10 hamlets and takes its name from the main village, Killai. While the entire population in these 10 hamlets consider itself as 'belonging' to Killai, on closer examination they fall into distinct groups : those who have permanently moved away and practise marine fishing, return to Killai only for religious and social occasions; those who shuttle between Killai and one of the hamlets and spend at least one season in Killai, fishing the backwaters; those who live in Killai and do not participate in the fishing activity directly. Since the focus of the study was to examine the feasibility of extending a new technology to the present users of the backwater the study ignored the first category and considered the last category in lesser detail. The community was enumerated by physically checking a recently put-together voters' list and stratifying the families on the basis of ownership of fishing assets. The family was considered as the unit of study because the family is the existing commercial and social unit of organization.

All the fishermen – in fact the entire Killai community – belong to one caste of Hindus : Parathevars, a scheduled and hence backward caste. The other community in the backwater area who live off the backwaters are a tribal, semi-nomadic group who are referred to as the Veddars, but who in all probability are an off-shoot of the wandering Irula tribes of south India. This community moved into the region a decade ago, with the hope that the Government would allot them homesteads. Their hope has remained unfulfilled but they have remained, eking out a livelihood by working the local fields, working in construction and fishing the backwaters with their bare hands and basket nets.

Community size of Killai fishermen	
Families owning boats (and nets)	**102 (32.07%)**
Families owning only nets	**9 7 (30.50%)**
Families with no fishing assets	**119 (37.42%)**
Total families	**318 (100.00%)**
Veddars	
Total families	**61 (100.00%)**
Samples drawn	
Families owning boats	**25/102 (24.50%)**
Families owning nets	**26/97 (26.80%)**
Families with no fishing assets	**11/119 (9.24%)**
Total families	**62/318 (19.49%)**
Veddars	**24/61 (39.34%**

The number of families in the backwater area who depend on the backwaters for a major part of their livelihood is 219, or 57.51%.

Population characteristics, literacy and occupation

Characteristic	B	N	NA	v
Female/male ratio	00.67	01.09	01.78	01 .00
Family size	05.68	04.19	03.54	03.41
Literate females %	14.03	15.78	28.00	04.76
Literate males %	54.11	61.53	57.14	09.52
Literate population %	38.02	37.61	38.46	07.31
Females in fishing %	42.10	28.07	16.00	76.19
Males in fishing %	56.47	48.07	07.00	40.47
Population in fishing %	50.07	37.61	12.82	59.75
Economically dependent %	48.59	58.71	71.79	40.24

Note : the following abbreviations will be used to denote the various groups in this datapac : (B) for families owning boats; (N) for families owning nets only; (NA) for families with no fishing assets; and (V) for Veddars.

Keeping in mind communication and its importance in technology transfer and in evoking participation from the community, the exposure to influence of various media was ranked by importance.

Exposure to influence by order of importance

B	N	NA	V
Radio	**Community**	**Community**	**Community**
Community	**Radio**	**Visits**	**Radio**
Print media	**Visits**	**Radio**	**Print media**
Visits	**School Teacher**	**Print media**	**Visits**
School teacher, Coop. official, Political cadres	**Political cadres**	**Political cadres**	**Political cadres**

Seasonal routines of Killai fisherfolk are summarized in Table III/1.

Table III/1 : **Seasonal routines in marine and backwater fishing and agriculture, and festival days**

Months	Backwater fishing	Marine fishing	Agriculture	Festivals
Chitrai	f P	f	r	
Apr.15-May 15	f p	f		
Vaikasi	f P	f		
May 15-Jun.15	f p	f		
Aani	f P	f		
Jun.15-Jul.15	f P	f		
Aadi	f	f		2 days
Jul.15-Aug.15	f	f		
Aavani	f P	f		5 days
Aug.15-Sep.15	f P			5 days
Puratasi	f P		r	
Sep.15-Oct.15	f P	Off	r	
Ipasi	f P	Season	r	1 day
Oct.15-Nov.15	f P		r	
Kartikai	f	f	r g	
Nov.15-Dec.15	f	f	r g	
Marghazhi	f	f	r g	
Dec.15-Jan.15	f	f	r g	
Thai	f P	f	g	4 days
Jan.15-Feb.15	f P	f	r g	
Masi	f P	f	r g	
Feb.15-Mar.15	f P	f	r	
Panguni	f P	f	r	
Mar.15-Apr.15	f P	f	r	

f = fishing activity
r = rice
p = peak season
g = groundnut

Daily routines of Killai fisherfolk are summarized in Table III/2.

Estimate of fishing days

The average number of fishing days was estimated by reducing the seasonal working days by the **days lost to festivals,** illness and bad weather.

Marine boat owners	218 days/ year
Backwater boat owners	*307* **days/ year**
Net-owners	*307* **days/** year
Veddars	*316* **days/ year**

Asset *holding* of Killai fisherfolk is summarized in Table III/3.

Present indebtedness, sources of credit *and* interest rates are summarized in Table III/4.

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Table III/2

Dally routine **of various** categories of **people**

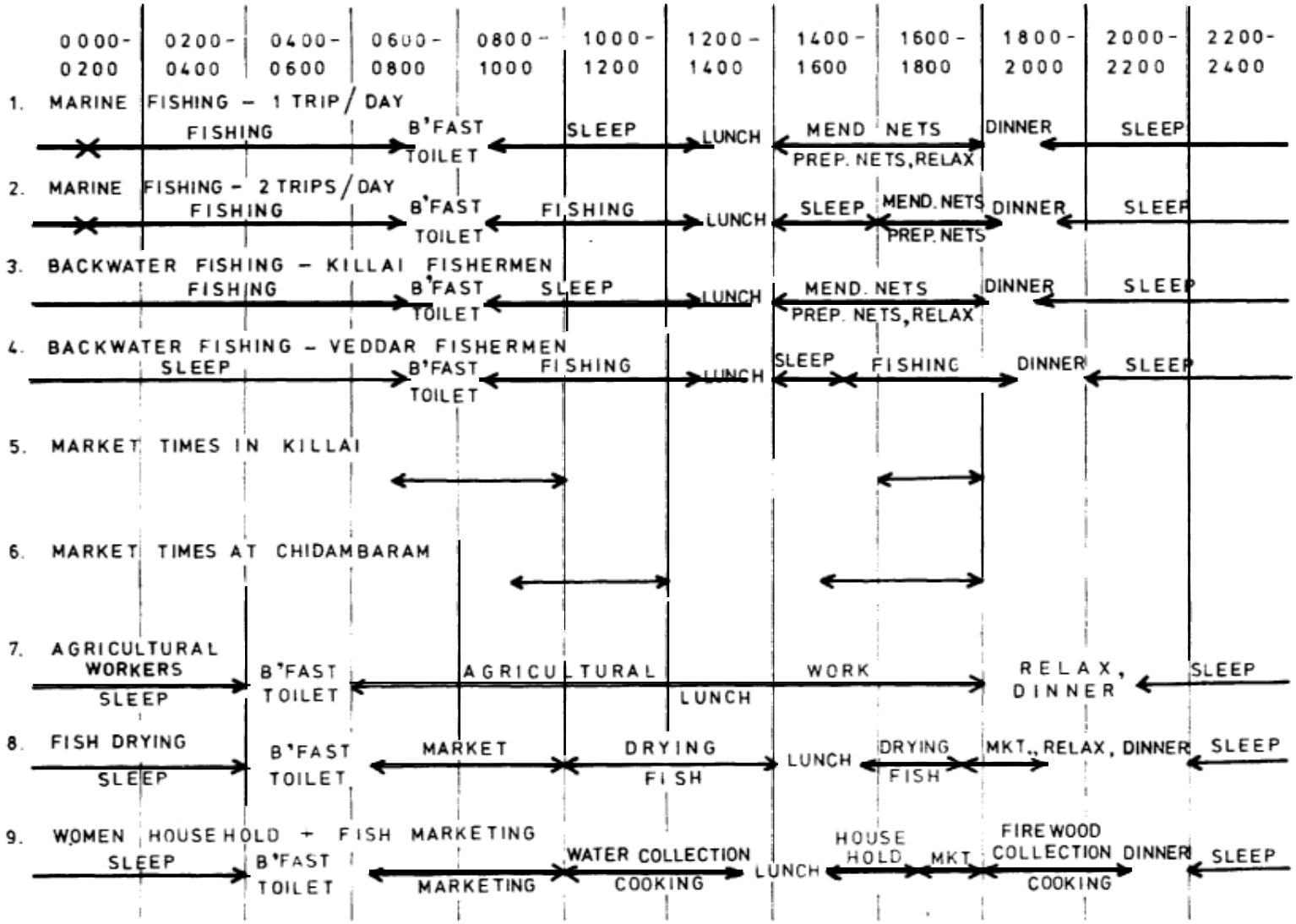

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Table III/3

Asset holdings by strata

	B	N	NA	V
House				
Per cent owning houses	100	96	91	100
Per cent living in rented houses	0	4	9	0
Land				
Per cent owning land (wet)	56 (43)	19.23 (15.15)	19 (16)	4 16 (100)
(dry)	(57)	(84.55)	(84)	(0)
Average family holding	1.21a	1.15a	1.31a	05 a
Per cent working themselves	14	40	0	100
Per cent hiring cultivators	86	60	100	0
Cattle				
Per cent owning livestock	36	19.23	9	16.66
Boats				
Per cent owning boats	100			
Boats per family	1			
Per cent buying boats on cash purchase	72			
Per cent buying boats on credit-cum-cash purchase	20			
Per cent buying boats on credit purchase	8			
Nets				
Per cent owning nets	100	100		
Net/family	4.92	2.19		
Per cent making nets themselves	96	96		
Per cent purchasing nets	4	4		
Per cent buying through credit purchase	8	8		
Per cent making net in instalments	92	96.92		

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Table 111/4

Present Indebtedness. Sources of Credit & Interest Rates

		% of thosein debt.	Sources of loans (%)							Total in debt. (%)	Amount loaned per capita	Interest rates
			Relative	Bank	Money lender	Thread shop	Co-op. Society	land owner	Fish dealer			
Boat owners	C	0										
	S	46.66	100							60	3514.28	120% 48% 36% 0%
	W	53.33	37.5	50	12.5						3093.75	200% 120% 36% 13% 12/5% 2%
Net owners	C	7.6	100								600	36%
	S	30.76	50	25	25					50	2125	25% 36% 13%
	W	61.53	12.5	25	12.5	12.5	12.5				712.50	25% 15% 13% 0%
No fishing assets	C	42.85	66.66		33.33						833.33	15% 13%
	S	14.28		100						63.63	2000	12/5%
	W	42.85		66.66	33.33						1020	30% 15% 18%
Veddars	C	83.33						80	20		410	0 Bonded labour 0 Exclusive buying rights
	S	8.33							100	50	800	0 Exclusive buying rights
	W	8.33			100						300	50% of harvest

Note: C = Consumption loans S = Special loans for festivals & fahiily rituals = Work-related loans

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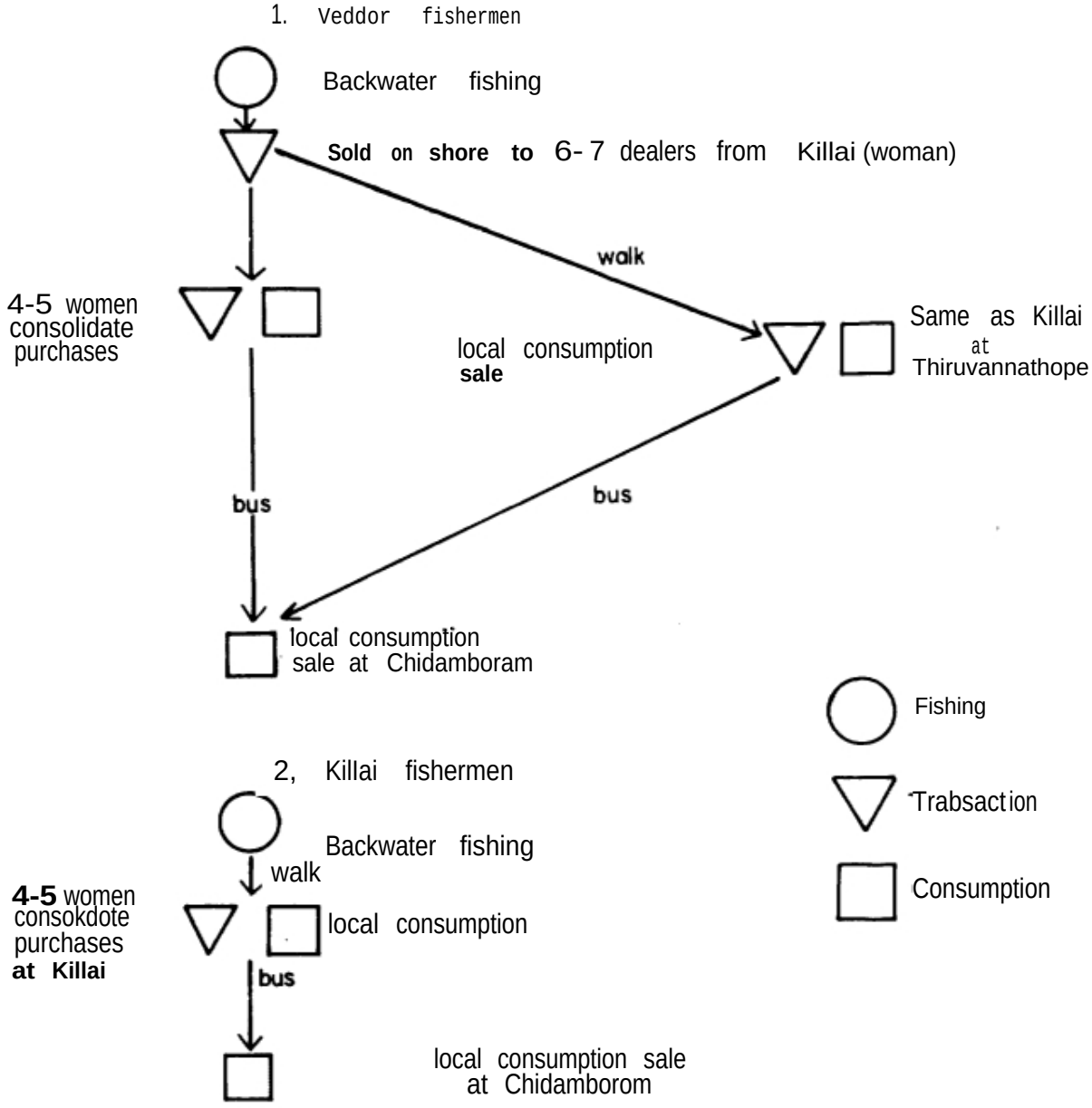
Marketing of backwater fresh finfish



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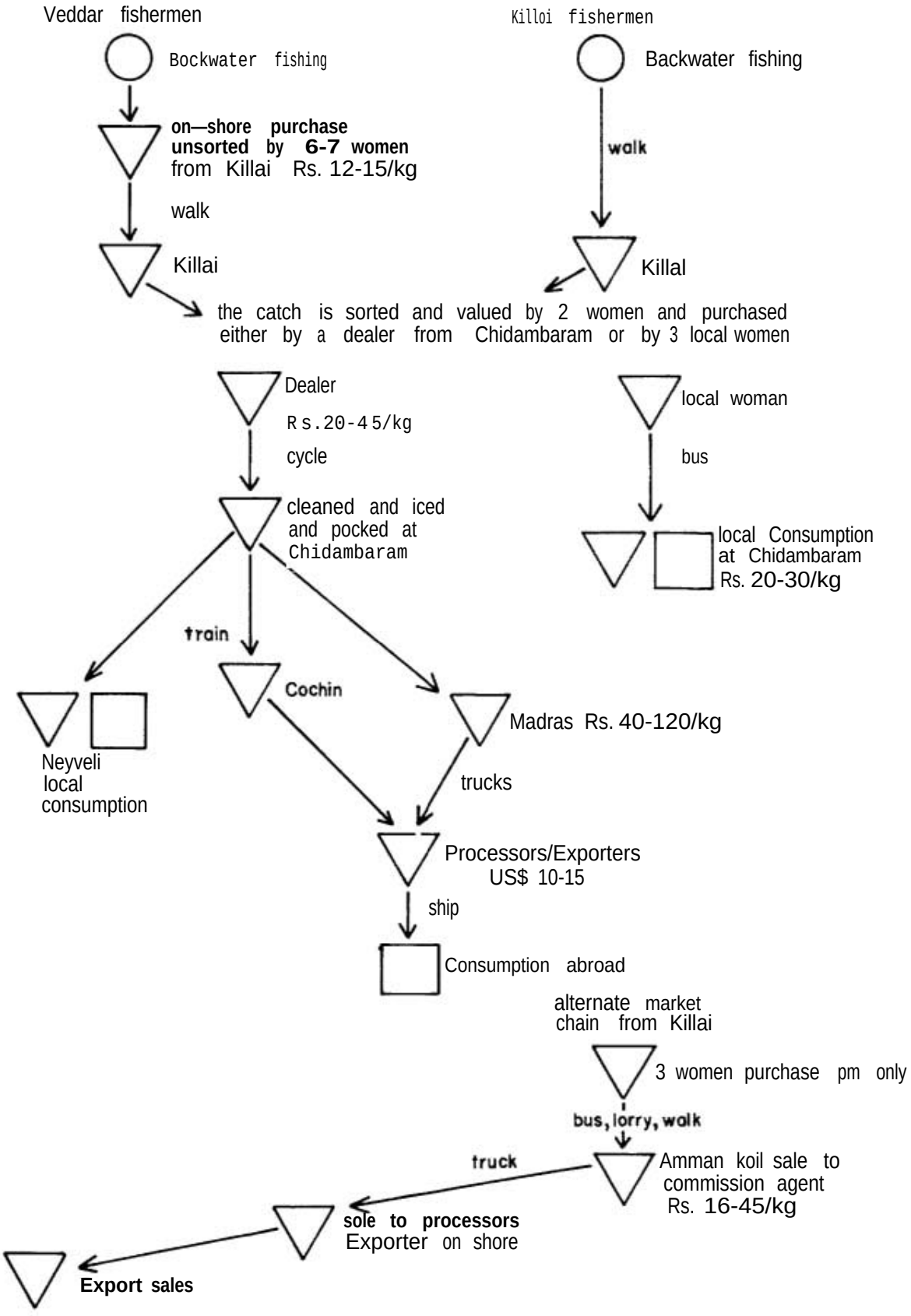
Marketing schematics of backwater shrimp



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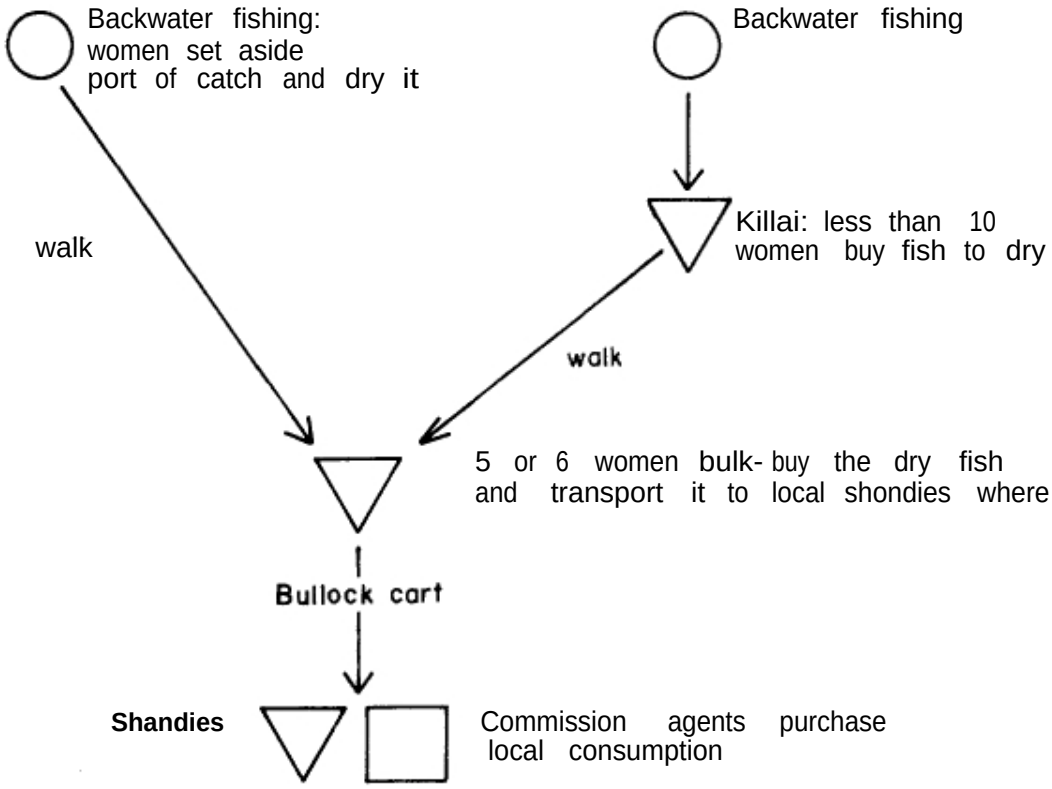
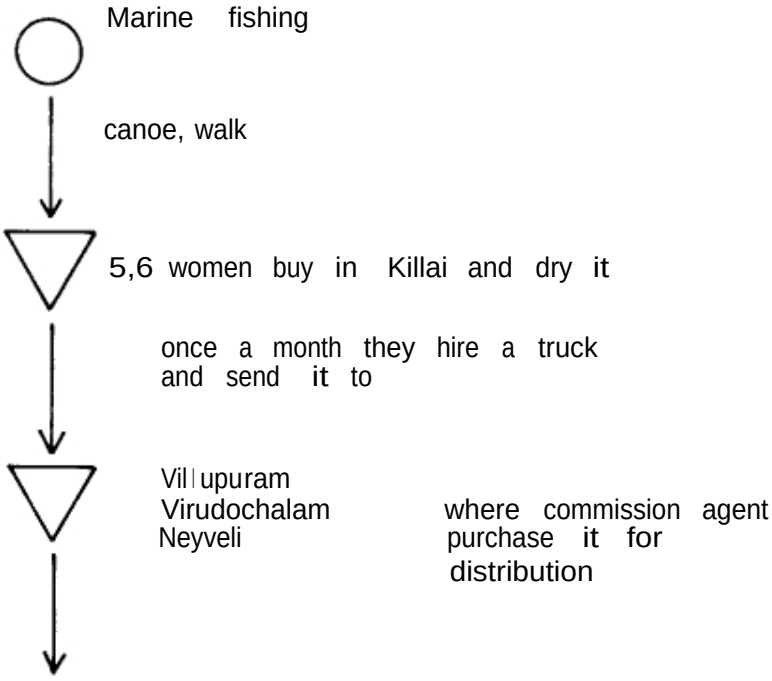
Marketing schematics of dry fish from the backwaters *





* **The dry** fish business is extremely profitable. The market is controlled by less than 10 women all of whom ore major money lenders.

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Catch information

	B	N	v
Value of catch per day per family (in Rs.)	131.84"	29.25	11.83
Weight of catch per day per family (in kgs.)	20.640	5.980	2.325
Value of catch per net per day (in Rs.)	50.00	13.11	

* This includes both marine and backwater boat owners; when separated the marine boat owners have value of catch/family/day of Rs. 223.70 and backwater boat owners have value of catch/family/day of Rs. 55.29

The catch information was arrived at in several ways. The fishermen were interviewed and asked to specify from memory their catch details over the previous week, and of averages during season and during off-season. This information was augmented by random sampling of catches as they came ashore and as they were brought into the different market points. Fish and shrimp are rarely sold by weight and the investigators had to estimate weights. All these factors affect the accuracy of the data but they are definitely indicative of the state of affairs. Several aspects of the data were cross-checked in the discussions and interviews and found to be consistant. The only information that is statistically questionable due to extremely small sample size is the marine boat owners' catch data. However, the investigators are of the opinion that the numbers, even in their case, are definitely indicative.

Estimates of income

	B(M)	B(B)	N	V
Average fishing days per year (in days)	218	307	307	316
Average catch value per family per day (in Rs.)	223.70	55.29	29.24	11.83
Average family income per year (in Rs.)	48,766.99	16,974.54	8,978.52	3,738.91
Average family size	5.68	5.68	4.19	3.41
Average per capita income per year (in Rs.)	8.585.66	2988.44	2,142.84	1,094.52

Note : This income does not include incomes from secondary occupations like agriculture, fish marketing, money lending. While it was not possible to estimate such incomes, the opinion of the respondents was that in multi-occupation families the income from activities other than fishing accounted for anywhere from 25% to 150% of the fishing income.

B. *Socio-economic aspects*

The backwaters are central to the livelihood of the people of Killai, with about 58% of them depending on it for a major portion of their earnings. Other than fishing and activities related to fishing such as marketing of fish and making of nets, there is not much else by way of economic activity in the area. There is some agriculture and tree-farming, and several fishermen own small bits of land which they lease out or get cultivators to work under their supervision. There are a few shops, a couple of schools, and some service institutions like post offices, banks and government bodies.

With fishing as the primary activity, the field is dominated by those who have fishing assets. But there is more to it than just asset ownership. Caste and class play a role. The Killai fishermen consider themselves higher in social status than the Veddars, and for various reasons see the backwater commons as their. own'. The Veddars are constantly harassed and prevented from plying their craft. And every now and then their catches are confiscated to reinforce the class stratification. The smaller, poorer and less organized Veddars are at the mercy of the Killai fishermen.

Literacy levels as defined by the ability to read and write are reasonably high, but few have any formal education and the general opinion of the community is that education does not really help, except, perhaps in getting a government job, and what is more, it alienates the educated and makes them indifferent to and useless within the community. The communities feel the need for an education that would give them inputs to enable them to do their work better, such as management and accounting.

While the income levels seems very high, especially for the asset owners, the numbers need to be viewed in the proper perspective. Little information exists about their investments and expenses. So, high incomas can be deceptive if expenses and investments are high. An indication that there may be an economic problem, is the high level of indebtedness in the communities. As would be expected, those with assets take credit for work-related loans and those without assets take loans predominantly for consumption. The sources of credit are still the money lenders, relatives and shopkeepers, in a village that boasts a rural branch of a nationalized bank. The inaccessibility of the bank, and rumours of bureaucratic and corrupt practices, keep away those who most need low-interest loans and guide them toward more informal and expensive sources.

Most of the moneylenders are women, and mos? of them make their money because of the almost exclusive control they have on the fish marketing system. Except for the Veddar women who work alongside their men in fishing, the Killai women are content with their role as marketers of fish and housewives. Their involvement in fishing activities is marginal and done more out of necessity than out of interest or expertise.

A look at the market schematics and the procurement prices at different locations would identify procurement price as the central problem of the fishery. The people who benefit the most are the middlemen, often aided and abetted by their local agents. There are several reasons for this and they are known to the community. Inadequacies in supply of ice, in facilities for storage and transportation, and lack of cohesiveness and cooperation within the community to take their catch past the middlemen and into more lucrative markets, are the primary reasons, The middlemen are the financiers too, so eliminating them without radical changes in credit availability and procedures would affect the fishery adversely.

Every technology finally succeeds because society is able to evolve social and commercial organizations to carry and nurture the technology. The existing technology has at its base the family. Extra-family organization while prevalent is loose and unstable. For example, fishing teams have very high turnover rates. Almost no enterprise exists which requires cooperation and mutual trust in any serious form. In fact, even in marketing, no cooperative behaviour is visible. The existing cooperative society is a classic example of non-cooperation. The concept has been exploited by the community to get scarce credit and to provide for upward political mobility to some of its more ambitious leaders. The society has not been able to help in technology transfer or marketing or in resolving the basic problems faced by the fisheries.

The Killai region has essentially two communities with very different problems. The Killai fishermen are reasonably well off and developed while caught up in the systemic problems that small enterprises face in our socio-economic system. With proper inputs and infrastructural support, they can step up their economic status. With additional social organization they can really move up. On the other hand the Veddars are still in the process of assuring themselves of survival and the basic needs of life. They need employment as the first step towards self-reliant enterprise.

C. Attitudes and Opinions

THE USE OF BACKWATERS

There seems to be no questioning the fact that the government owns and has the right of use of the backwaters. However, opinions differ when access and present day utilization are discussed. Most feel that the right of use should lie with those who depend on it for a livelihood now. A lesser group feels that lease holders* have the right. A significant minority, namely the Veddars, feels that the ownership, in practice, lies with the upper castes.

The communities do not share the use of the backwaters temporally or areawise amongst themselves, nor are they interested in doing so with other communities. The Killai fishermen feel it is their natural right to use the waters exclusively as they are the original residents. Except for the Veddars, who have no objection to sharing the waters with others, the Killai fishermen to the last, heavily object to sharing access.

The question of the government allocating parts of the backwaters for exclusive use was received even more negatively. A few went so far as to threaten violence, while most felt that they would

' The community through the cooperative society pays a nominal lease for the right to fish the backwaters to the Revenue Dept However. fishing IS not restricted to lease holders, nor is the control exercised by the government

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take up the matter with the panchayat. They did agree to the fact that the government had the right to allocate rights, but they insisted that they would fight such allocation either through the courts or preferentially through the political system.

The vast majority felt that should the government insist on allocating rights the only equitable and just procedure would be to ensure that everyone benefited or none at all. Any form of allocation which talked of benefitting less than all was suspect in terms of the criteria for selection of the lucky few.

Most fishermen felt that the catch in the backwaters was diminishing; they justified this opinion by the fact that they are putting in much more effort now to catch essentially the same or less than what they were used to in the past. The most important reason they felt for the state of affairs was the closure of the two bar-mouths and not increasing fishing activity. The closed bar mouths, they felt, were affecting nutrient supply and the salinity adversely. They also talked of fish and shrimp dying prematurely in large numbers. The only saving grace seems to be the fact that prices have gone up compensating for the lower catches.

ENTREPRENEURSHIP :

Most fishermen are fishermen because they are born into fishing families! They never had to affirmatively make a choice. A lack of skills, further aggravated by the inability of learning to acquire skills, and a lack of credit ensures low innovation and diversification. And the fishermen felt that this was their predicament. When questioned as to what would motivate them to take up some new enterprise they listed in order of priority dramatic increases in earning power, improvement of quality of life-style and being able to give their children a better deal in life. The Veddars are open to any work because they need work to survive; for them there was no choice or debate into the whats and whys.

All enterprise is a risk. What would help them to justify taking risks? A clear demonstration of technical and economic viability. Availability of credit and infrastructural support. And, once again, an improvement in earnings by an amount big enough to justify the risk and the change from the status quo.

None of the respondents could name an innovation that had been introduced in the recent past into their profession. One vaguely recalled that he had heard somewhere that using a light at night on the boat tends to attract fish. Had he tried it out? No.

The communities were then asked about the activity being undertaken by the Fisheries Department and **the** BOBP at their very doorsteps. They all knew about it, but very little of what was really going on. They blamed the Fisheries Department for keeping them in the dark and for having moved into their fishing grounds without even an explanation. Feelings towards the Fisheries Department were quite hostile and a part of this hostility could perhaps be explained by the fact that police had been brought in following the community's attempts to discourage the Department's activity by tearing the pen netting.

The Killai community felt that the project would not be a success and they had several reasons as to why not: they felt that water temperatures in shallow waters would rise and the shrimp would have no cool spots to go to because of the pen, resulting in mortality; they felt that it would be very difficult to acquire feed for the programme; they felt that the programme had already failed as private groups who had attempted it in the region had suffered losses and given up the idea; they felt that officers of the Fisheries Department were corrupt and would distribute jobs and allocations of rights in an unequitable manner and that too only after receiving bribes; they justified this attitude by relating rumours, which they could not substantiate, that they knew of fellow fishermen who were being allowed to secretly remove shrimp from the pens for private sale upon payment of appropriate amounts of commission. The complaint that the programme had already failed gives some credence to the implication that the Fisheries Department had not communicated with the fisherfolk; the programmes that had failed were pond culture experiments and had nothing to do with the present exercise. Such confusions are difficult to explain without involving a communication gap.

The Veddars, on the other hand, felt that some good would come of the exercise, and hoped that they would benefit in some manner from the findings of the study. The general opinion expressed

about the Fisheries Department was that the Department would not do any good for the people unless pressure was brought to bear upon it from political sources.

Lifestyles and cooperation :

In discussing the possible changes in lifestyle that new ways of earning a livelihood may bring about the fishermen felt that not getting paid on a daily basis would take some getting used to. The problem they felt would be their lack of planning and discipline in money matters. However, they felt they could learn and get used to the new mode.

Killai fishermen hesitate to work in partnerships because they feel there will be personality conflicts and trouble when it comes to sharing profit. They seem to prefer employer-employee relationships to partnerships and other forms of cooperation. As one person rather clearly pointed out, they have no objection to working with others provided they are the dominant group.

Women in Killai work at marketing the fish and feel that they do so because they are good at it. In other areas of fishing they feel their involvement is more due to economic necessity than to skill or interest. In fact, they felt that given the option and the affluence they would rather be housewives and even give up marketing.

The Veddar women on the other hand work alongside their men and see nothing unusual in it. They want to work and feel that they can do most things that their menfolk do.

Finally, when asked what the fishermen of Killai 'really' wanted, the following lists of demands were received almost from every single respondent :

The demands of the fishermen of Killai were :

1. The two bar mouths be opened, deepened and maintained.
2. Some (preferably subsidized) form of transportation be created to move fish to the various market centres thus getting a better deal for them and avoiding some of the intermediate market links.
3. An ice factory be established in the region.
4. Infrastructure to clean, pack and ice fish and shrimps be established.
5. The Cooperative Society be reorganized, or, better still, a new organization be developed that would provide stable jobs, invest in their activity and provide for inputs and services to improve the returns from fishing.

The demands of the Veddars were :

1. That they be given homestead rights to the land on which they have built up their huts;
2. That credit be made available to them for fishing assets with simpler procedures and less corruption:
3. That they be given official access to the use of the backwaters, and protection from harassment from upper caste fishermen.

Appendix 5

CASE STUDY ON SHRIMP PEN CULTURE EXTENSION IN KILLAI, TAMIL NADU, INDIA

Case Discussion Guide

The participants are requested to address themselves to :

i) identifying and understanding the social, cultural, political and techno-economic factors that may affect the success of an effort to extend shrimp pen culture to the communities in the Killai region, and

ii) to evolving strategies that would enable the transfer of the technology to the weaker sections of the Killai community in a socially feasible manner.

I. *The Process*

1 The Government of Tamil Nadu had clear and well stated guidelines which determine beneficiaries for its development and technology transfer programmes. Similarly, the BOBP also has its stated objectives to improve the conditions of small-scale fisher-folk and increase the supply of fish from the small scale sector. Could you reflect on what the rationale for wanting to develop coastal aquaculture could have been for the Tamil Nadu Government and for BOBP, which resulted in their.undertaking the effort at Killai?

2 The rationale in each case would suggest what each agency would construe as 'success'. Could we list some of the factors that the agencies may have considered as constituting success?

3 The choice of the particular technology (in this case, shrimp pen culture) could have been done on the basis of resource availability, environmental conditions, the state of the art in fisheries science, markets for the products, income generating ability of the technology and such factors, or it could have been done on the basis of the real and felt needs of the community that it is meant to benefit, keeping in mind their local resources, skills and abilities. What do yo think happened in the Killai case?

4. Could you reflect on whether the existence of, or the ability of an agency to develop, a technology should determine the target community that gets helped and how, or whether the needs of a particular target community should move the agency to seek or evolve particular technologies to solve that group's problems. Or, to put it differently, should solutions determine which problems receive attention or should problems lead to the development of solutions?

II. *The Technology*

1. In studying the technology and the efforts and methods to determine its technological feasibility, are you satisfied that this technology is 'ready' for transfer? State your reasons. Could you suggest some criteria by which an agency could go about determining the readiness of an aquaculture technology for transfer to the community?

2. Ideally we should satisfy ourselves with aspects such as the impact of the technology on the environment (and on other users of the same environment) and the long term viability of the technology. But such investigations take time and money. And can delay the benefits that may reach the people. How should an agency approach this problem and where does it draw the line between concern and indifference?

3. The economic feasibility analysis looks promising, at least from the entrepreneur shrimp farmer's point of view. Keeping in mind the target group the agencies have in mind, do you feel that the technology is appropriate? Do you feel that the communities have or can acquire the technical, managerial and entrepreneurial skills that may be required to make a success of this technology?

4. The economic analysis suggests that the worker (as different from the owner who may also work) may only make 30 per cent more than he does now by working on the farm in addition to doing what he is doing now. Do you feel the increase in earnings would motivate the person to additionally work in the farm? What incentives would have to be developed to attract people to work in the shrimp pens and to improve their conditions?

5. Put yourself in the position of a fisherman-entrepreneur. Given the data base and given the methods that have been used to establish economic viability would you be willing to invest? Is there any other way to go about testing for economic viability that will not only give us the answers needed but also make the advantages quantitatively visible even to casual observation,

and thus increase the credibility of the technology. Further, could we think of'ways by which the experience of working the technology could be made more accessible to the target community during its testing?

6. **Is** the technology compatible in terms of daily, seasonal and leisure routines of the community? Does it require labour with caste, sex balances different from exisiting social mores? How serious are these problems in terms of affecting the success of the programme?

III. ***The People***

1. Killai fishermen practise capture fisheries, and the Veddars are not really fishermen, for they fish to survive. The transfer of aquaculture technology has been more successful when the receiving groups have had a tradition of aquaculture practice. This suggests that perhaps the psychological, social and historical characteristics of a community may make the transfer of a particular technology more or less difficult. Do you feel this aspect may prove to be a problem in Killai? What, if anything, can be done about it?

2. Could you try to put yourself in the place of the Killai fisherfolk and Veddar communities and try to see what advantages could come your way by accepting shrimp pen culture, and what disadvantages? Would you consider the advantages financially and in terms of the economic and social restructuring of the community sufficient to make you accept the technology?

3. The communities in Killai are socially and commercially organized around the family. Do you feel this type of organization is suitable to carry the technology of shrimp pen culture? While the actual culture can be family-run, the infrastructure required to efficiently and economically acquire the inputs and to market the output would require collective action. Do you think that the community can organize itself to such collective action? How could you promote it?

4. How do you feel the shift from daily incomes and gear management to deferred incomes and culture management would affect the lives of the people of Killai? Would this aspect affect the strategic design of the project?

5. The area available for shrimp pen culture will make it possible only to help a fraction of the community directly. Considering the views and attitudes expressed how do you suggest the project be designed to overcome the problems of competition between capture and culture in the commons, of equity and of selecting 'beneficiaries'?

6. Who should undertake the task of making the people of Killai aware of the technology and what it can do for them, of motivating them and enabling them to accept the technology and how – especially considering their views and attitudes towards the government and towards the technology as they see it being developed in Killai?

Finally, some general thoughts and questions :

1. Shrimp pen culture can generate incomes and surpluses. In an undiversified economy like Killai which has no ability to absorb investment and generate wealth such generation of surpluses and incomes would only increase the flow of goods from, and the flow of money to, urban areas. Would you consider this real development?

2. The success of the entire concept is based on the existence of export and urban markets that need shrimp and can absorb the high prices. The community's development would be totally locked into the behaviour of the international shrimp market. Is this real development?

3. The coastal regions of India (the inshore regions to be specific) are being overfished, leading to ecological crises and often to social and economic conflicts (consider the Kerala case) One of the reasons for the worsening of this situation was the effort to 'develop' marine fishing (both industrial and artisanal) with an eye to the export market. In moving into the coastal backwaters (an as yet underexploited region) are we not just moving the problem from the in shore to the backwaters? What can we learn from the inshore crises to evolve a framework and legislation that will help to convivially support and protect the region and its people?

4. What a development agency does and how it does it could be seen as a manifestation of its perception and appraisal of underdevelopment, its understanding of the 'causes' of underdevelopment and therefore of the 'cures' of underdevelopment. Please reflect on this factor, for the culture of the agency is just as crucial to technology transfer as the culture of the receiving community and of the technology being transferred.

Case Study on Shrimp Pen Culture Extension in Killai, Tamil Nadu, India

CASE DISCUSSION SUMMARY : GROUP I

1. Objectives

The Fisheries Department of the Tamil Nadu Government wants to help and aid the fishing communities. The Veddars, a nomadic tribal community, are not classified by the government as a fishing caste group and therefore fall outside the purview of the government's objectives.

The Bay of Bengal Programme has an overall objective to improve the living conditions of small-scale fisherfolk, whom they define as people who make their living through artisanal fisheries. In the short term, the BOBP's objective for the Killai project is to test the technical feasibility of shrimp pen culture technology.

2. Target beneficiaries

The Killai fisherfolk are expected to be the primary beneficiaries who will benefit from the extension of the shrimp pen culture technology.

The Veddar community were not included in the target beneficiary group but it is expected that some secondary benefits will flow to them.

3. Benefits to the community

3.1 Direct benefits

- employment generation
- income generation
- development of entrepreneural skills

3.2 Ancillary benefits

The project hopefully will benefit the Killai community in the following ways :

- establishment of an ice-making plant : since ice procurement is difficult in Killai it was suggested that a small and economically feasible ice plant could be considered as part of the project. This would not only help freeze the shrimp to ensure quality and a good price but also cater to the needs of the other fishermen who now have to travel quite a distance to procure ice.
- local feed procurement and processing : feed for the shrimps is at present got from Porto Novo and Cuddalore. If feed gathering and processing can be done as a local enterprise, it would provide employment opportunities to persons within the village.

4. Project feasibility

Neither technical feasibility nor economic viability was thought to have been adequately demonstrated in the project to date.

A. *Technical aspects*

Extreme production (yield/ha) variation was noted among the production trials, because stocking ratios *(P. monodon vs P. indicus),* stocking densities, feeding materials and pen sizes varied in each trial and between 'replicates'. There appeared to be no scientific basis to the recommendation that 0.5 ha to 1.0 ha pen sizes were the best size pens for family operation. The extrapolations of yields to 1 ha pen sizes were also questioned since experimental pens were much smaller in size and also benefited from sound technical management by the Fisheries Department field team; per hectare yields from pens operated by new pen operators would be likely to exhibit even greater variation.

B. *Economic aspects*

The uncertainty due to yield variation was compounded by great variation in prices received for the shrimp. The annual costs and returns were apparently based on Madras prices on the assumption that pen shrimp would be sold directly to this urban market. However a recalculation of the cost and returns using prices actually received during the trials, showed losses of Rs. 9100 during trial 3 and positive returns of Rs. 10,600 for trial 1. Trial 2 was the most profitable; revised annual residual return per ha was Rs. 13,200. This variation in profitability, due to price fluctuations over which the producer has no control, is yet another risk for the producer.

C. Socio-cultural aspects

The Killai communities' (fishermen and Veddars) wishes regarding possible participation in the project are not yet clear, since to date only a few individuals have been involved peripherally in the

project. Participation by all on an equal basis, while theoretically desirable, will not be practical due to resource restrictions. According to the government order, Veddars cannot participate as pen lessees or operators. Veddars can however provide labour (seed gathering, pen maintenance). Whether they would provide full-time hired labour is not yet known. Since the project income from pen operation is likely to be insufficient to attract boat owners, primary participants are most likely to be non-asset owners. The fishing community's idea that either "all residents or none" should participate may thus change, based on the revised economic projection.

D. *Polirical/Institutional aspects*

Lease rights appear to pose no problem as the fisheries department can lease to the community cooperative; however, no lease period is specified in the government order, thus adding another element of uncertainty for potential producers. Also, bankers will need to be assured that leasehold rights can be reassigned for a fairly long period to the bank as collateral.

5. Strategy

Possibilities of activities for the Killai communities other than pen culture were not discussed as the group felt it had inadequate information to evaluate other options. It was concluded that the pen culture project was not yet ready for commercialization and warranted an additional testing period but with the involvement of Killai people. The following framework is recommended :

A. *Testing period :*

Should include 1 year (3 production cycles) plus time for pen construction and training of family operators.

B. Size *of area*

Total of 4 ha, divided as follows
4 pens of 0.5 ha = 2 ha
4 pens of 0.25 ha = 1 ha
8 pens of 0.125 ha = 1 ha

C. Input.5

Standard stocking densities/ ha and feeding rates 'ha should be used on all the above pens, so as to test for the effect of pen size on yield/ha. From these results and economic data on inputs cost and products sold, the optimum pen size could be determined.

D. *Managemenr*

4 families (probably fishermen without any assets), each operating 4 pens totalling 1 ha for a minimum of 1 year. Each family would operate one 0.5 ha pen, one 0.25 ha pen and two 0.125 ha pens.

E. *Technical Advice*

Existing management set-up (Fisheries Department and BOBP) plus advice of an extensionist for selection of the four families and further advice and training in extension methodologies (by BOBP).

F. *Supplementary studies*

This further testing period should resolve questions of technical and economic viability and clarify potential for Killai fishermen to manage pens. Additional issues that still need clarification before proceeding to commercial scale extension with additional families, are as follows :

- reliability of feed supply and effect that shrimp pen demand for trash fish and shrimp offal will have upon the current consumers of these products;
  potential impact of clam exports on availability of clam for shrimp feed;
- potential for improved polyethylene net supplies within India;
- community nutrition standards in Killai; need (if any) to improve fish protein intake and potential for the project to meet their need; also the potential for the project to provide income to women;
- evaluation of marketing and distribution options (given projected shrimp pen harvesting quantities and schedules) including local ice requirements and potential for local ice making; local sales of shrimp from pens vs. other more distant (urban) outlets and transportation costs to reach the latter; and
- assessment of community interest and extension requirements for possible subsequent commercial operation.

The funding source for this additional necessary testing period needs to be identified.

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Case Study of Shrimp Pen Culture Extension in Killai, Tamil Nadu, India

CASE DISCUSSION SUMMARY : GROUP II

1. Project Objective

The objective of this project is essentially social in its orientation, i.e., improvement of living conditions among the economically weaker segments of small-scale fisherfolk in the area, broadly defined to include both certain segments of the Killai fish&folk as well as the entire Veddar population. This could be translated into the more specific objective of increasing the income level of these target groups.

The means to attain the goal would be a shrimp pen culture project on a family-unit production level and the required support activities such as seed and feed collection and preparation. Nevertheless, there are major reservations as to the technical viability of the project given various factors listed in the next section.

2. Factors Affecting Success

Although it was pointed out in the discussion that increased monetary income does not in itself necessarily lead to an improvement in living conditions, the group came to the conclusion that a demonstrated increase in income among the target group would certainly constitute one indicator of success. On the other hand, there are a number of factors that are crucial towards attaining this end. The group listed the'following four types :

Social *factors* : the social structure in the area with its associated aspects of inequalities in control over, and access to, water resources and power in general.

Economic factors : shrimp production is highly vulnerable to fluctuations in world market prices.

Technical factors : shrimp pen culture may be constrained by the number of production cycles, seed and feed supply, post-harvest handling (levels required for export market) and environmental consideration.

Management factors : flexibility in approach so as to permit maximum local participation; proper marketing strategy; the need for close supervision.

3. Strategy for Social Feasibility

Assuming that shrimp is the only commodity in pen culture with a reasonable chance of being economically viable, the group proposed the following strategy for the project to become socially feasible :

a. In order to stimulate the active involvement of local people as well as to ensure that the design is made in accordance with the capabilities and particular experiences of the producers themselves, a pilot project involving a limited number of families should be the first step. These families should be selected from among the Killai group according to certain criteria set up to ensure that they are representatives of the economically weaker segments of this population.

b. In order not to expose the participants to the risks that are unavoidable at this stage of the project, the farmers participating, in addition to the capital inputs needed, should also be given financial support for operational costs as well as living allowances calculated on the basis of full-time employment. The farmer should also have the exclusive right to the future harvest although at this stage he may not be the owner of his culture pen.

c. One way to make the Veddar group benefit from the project without disturbing the existing social structure would be to help them establish themselves in supplementary economic a,c-tivities. The group, in this context, suggested the collection and selling of seeds and feed to the Killai shrimp farmers as one way in which the Veddars could be involved. It was recommended that parallel with the pilot project among the Killai fisherfolk, efforts should be made by the project to gather information for this type of involvement on the part of the Veddars and the kind of support they would need.

d. Since one of the objectives of the pilot project is to foster direct participation by the farmers themselves in experimentation, planning and implementation, it is essential that training and supervision be organized accordingly. The group came to the conclusion that this should preferably come directly from the BOBP in collaboration with the Ministry of Fisheries, rather than through the existing cooperative. The project could also be instrumental in assisting the farmers organize their own "committee" in an independent manner.

Case Study on Shrimp Pen Culture Extension in Killai, Tamil Nadu, India

CASE DISCUSSION SUMMARY : GROUP III

The objectives of the case discussion were :

1. to identify and understand factors that may affect the success of an extension of shrimp pen culture in Killai
2. to evolve strategies to work towards a socially feasible extension, and
3. to learn from the case, rise above it and evolve guidelines to help agencies involved in development and funding development

1. Some thoughts on project objectives :
   - the technology development exercise at Killai evolved out of the agencies'understanding
     - of the needs of the state (at that level of aggregation)
     - of the resources, particularly environmental configurations, available for exploitation
   - this translated into the need to exploit (as yet under-utilized) coastal waters, with their specific environmental attributes to increase fish production, to generate earnings and to do it in a profitable manner.
   - the particular environmental factors and not the needs of a particular community determined the choice of the technology.
   - specific communities are rarely contemplated at the technology development/planning for development stage.

2. Some thoughts on the 'why' of shrimp pen culture;
   - the technology was designed for the environmental configuration
   - it was a 'fine-tuned' technology
   - no other options and alternatives were considered to use the same resource/environmental configurations
   - questions like 'for whom is it?' 'of what specific benefit to them?' and 'how would they absorb it?' did not arise until after the technology was developed.

3. The Group decoded that agencies ought to ask themselves certain questions *before* they decided 'which technology' and the 'process of extension'
   - for whom is it, specifically?
   - do we know these people?
   - do they know us?
   - what are their needs as expressed and prioritized by them?

     do we and they understand the causes of their problems?
   - how is the community organized socially and commercially to 'carry' the technology?
   - what are the people willing to do for themselves and by themselves?
   - do we understand their concept of advantage?
   - will a single technology ensure equitable spread of benefits or will it require a range of technologies?
   - what constitutes an appropriate technology for these people at this point of time and at this stage of development?
   - are we committed to and will the people participate in the planning, choice of technologies and implementation?
   - keeping in mind the existing social and power structure in and around the community, do we know who will get what and why?
   - who else involved in the process would benefit and how?

4. The group decided that an agency ought to answer the above questions by building in a 'socio-economic and developmental' function into their structure which has its inputs at the policy and R 8 D planning levels (and not at extension levels where they are usually found, *after* the fact of technology development).

5. The Group decided that in evolving strategies for social feasibility we must consider the option *of saying no* (1) to particular technology(ies) for particular people(s) at a particular time, and suggesting alternatives such as
   - changes in the basic objectives of the effort
   - many technologies instead of one to help more people and to better utilize the resources
   - more holistic programmes to answer a range of needs instead of a solution-in-search-of-a-problem

Moving on to shrimp pen culture and the people of Killai . . . .

6. The Group identified the following 'social' factors that may affect the 'success' of technology based development programmes
   1. Confusion as to who the target groups are – should they be as determined by existing policy or should they be the (functional) fishermen who depend on the backwaters with preference to the *presenr* and those *who* are *there now.*
   2. The tension between the Killai fisherfolk and Veddars may affect programmes that require them to cooperate and which may reorganize the existing social power structure.
   3. The concept of advantage (from a technology or a programme) of the Killai fisherfolk/Veddar folk.
   4. Social/commercial organizations to carry the technology
      - the government prefers cooperatives,
      - the Killai fisher-folk deal in families and have had bad experiences with cooperatives, and
      - the Veddars are inherently cooperative.

      If one does not begin with the 'givens' there may be problems.
   5. Problems associated with shifting from fishing gear management and daily earnings to culture management and deferred earnings.
   6. Limited resources in the region (for the one particular technology) and the community's insistence that all should benefit (not necessarily from the same technology) or none.
   7. – The questions of who will work with the people; enable them to critically understand their environment, identify their needs, decide on choices and alternatives available to them; enable their development; enable sharing of technology(ies).
      - and how all this will be done by agencies with whom the Killai/Veddar folk do not seem to relate to or cooperate with well.

7. The Group decided that it was too early to evolve specific strategies for the extension of shrimp pen culture to Killai because the technology in their opinion was technically and economically not ready for sharing.

   The factors that motivated this decision were :
   1. possible environmental impact of the technology,
   2. 'sophistication' of feeding; availability of feed,
   3. uncertainties in pen design/construction/performance,
   4. the dependence on 'juveniles'; seed availability,
   5. salinity risks to culture
   6. socio-economics of the high labour demand of the technology,
   7. the 'optimal' size vs. the smallest economical size of pen culture,
   8. complexity of technology/management,
   9. non-consideration of any alternative means of exploiting the same eco-configuration.

   The following general strategy was recommended :
   1. Shift programme objectives of the agencies from development of fisheries to development of fisher-folk.
   2. Decide on a region and people specifically;
   3. Work with the people and motivate and enable them to critically understand their environment and to identify their real and felt needs ;
   4. Help the people in their process of selecting from range of technologies and methods that may address their identified needs;
   5. Evolve participatory development of technologies ;
   6. Enable sharing of the technologies keeping in mind the types of issues and questions raised elsewhere in the discussion.

Appendix 6

Case Study on Shrimp Culture in Satkhira, Bangladesh

Case Material – I

IT WILL BE SHRIMP OR NOTHING!
NOTES OF TRAVELS IN SATKHIRA

by

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I The case for shrimp culture

1. In trying to learn about the evolution of shrimp culture in Satkhira, I first met SK, a large shrimp farmer from Satkhira. SK explained to me that back in 1965 the then Government of East Pakistan, through its Water and Power Development Authority (WPDA), had begun to construct embankments in the coastal districts, essentially to protect the agricultural land from inundation. But what was started as a way to augment paddy growth, in reality turned against it. Due to silting at the draining channel mouths, the paddy lands inside the embankments could not be properly drained and this resulted in lowered yields of paddy. The yields had reduced to such an extent that by 1980 paddy could not be economically grown!

2. The Satkhira region has practised shrimp-cum-paddy culture for a very long time. Embankments were built up around paddy fields with channel access to the river systems. During high tides the channels were opened allowing water flow into the paddy enclosures, along with shrimp juveniles and other finfish fry. The channels were closed off after a sufficient quantity of water/shrimp fish was estimated to have entered and the pond essentially left alone till it was time to harvest using nets and traps. This kind of aquaculture yielded and still yields, about 120kg/ha of shrimp (high quality like P. monodon), other shrimp and finfish. And several farmers report much higher yields.

3. With the completion of the WPDA embankments, shrimp culture suffered as it was illegal to cut channels and gates into the embankments and the officials seemed quite serious about enforcing the rule. In 1977 some gates in the embankment of Polder No. 1 were damaged and with the resultant flooding, paddy growing would have been impossible. The local WPDA chief agreed to the requests of the affected farmers that they be at least allowed to use the opportunity to grow shrimp in their fields. What began as an accident became a practice.

4. With shrimp playing a big role in Bangladesh exports and world market prices skyrocketing in the 1970s a broken gate in the channel began a deluge that is still inundating Satkhira. The rapid growth period of shrimp culture and the commercialization and industrialization of shrimp farming had begun.

5. I was curious about where the technology had come from, for obviously with the expansion SK mentioned, new techniques had been introduced – like ploughing and adding lime before flooding, adding raw cowdung, screening the channels to selectively allow preferred species like P. monodon, and in some cases supplementary feeding. SK identified two sources of technology. Small and large cultivators with access to information and travel, read about shrimp culture and often ventured out of the country to study how shrimp was grown elsewhere – but the real technology transfer took place informally through over-the-border movement of working people from Satkhira to 24 Parganas in West Bengal, India. Techniques travelled with people and by word of mouth.

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6. SK feels that there is an urgent need for research and development like what is being done by the BOBP in Satkhira but he wants more of it and also that it be application oriented. He would like to know more about predator control, feeding protcols (especially whether feeding really helps), stocking procedures, and the type of water management for different hydrological (tidal amplitude) and salinity conditions. He felt he had benefited from the BOBP effort because he knew what he wanted, knew how to ask the right questions and was aggressive enough to corner the BOBP visiting consultants and get what he wanted. Otherwise, he felt the BOBP experiments had yet to have impact on the technology.

7. SK had some interesting suggestions on how extension could be enhanced from R & D projects. He felt that R & D projects should cooperate with local farmers and use the farmers' ponds for experiments thereby including them in appropriate research and learning exercises. In this way, farmers would actually understand the whys and hows of culture, and should the experiment be a success, the extension effort would be dramatically aided by the 'demonstration' and information moving along informal farmers' networks. The very methods that had triggered the shrimp revolution of Satkhira.

8. There was no doubt that it made financial sense to get into shrimp farming provided you could afford it. The way it was described by SK, it was not for the weak of heart and the poor of purse. SK strongly feels that on considering the investment and the scale of operations, you had to think of farms over 100 bighas, and preferably farms up to 1500 bighas, in size if you counted on your investment to yield reasonable returns. He did not clarify what 'reasonable' was.

9. As we talked, I raised the question of conflicts. Had anyone perhaps not benefited from shrimp culture or even suffered from it? He agreed that the very technology of (illegally ?) cutting WPDA embankments to flood the land for shrimp farming made it difficult for an individual to practise anything other than shrimp farming if his neighbours decided to do so. Dissent could be literally flooded out. So, if a few big farmers decided to join together to convert their land to shrimp farming, the other smaller farmers had to follow suit and not as partners but more often as leasers. The smaller leaser had difficulty in extracting his lease from his bigger partner who preferred to pay him in instalments or not at all. Receiving payment in instalments made it difficult for the small farmer to purchase essentials like rice at the best rates during seasonal fluctuations.

10. What had happened to people who cultivated rice and laboured in the fields? SK agreed that labour had been displaced because of the lowered demand for labour in a shrimp farm. But surely since it is shrimp-cum-paddy culture, isn't agricultural labour still around? And this was another surprise, for SK said that shrimp-cum-paddy culture was a dream. It was either shrimp or paddy. More of the former and less of the latter, because while shrimp was paying, paddy production had dropped from 'bad to worse' rather than good to bad'. SK felt that Satkhira had never been a big paddy growing area.

il. SK agreed that economic stratification had occurred but insisted that in absolute terms the poor had benefited. I asked him how he knew of this and he gave me a surrogate index to prove his hypothesis – he said that minor robberies and thefts had decreased in Satkhira since the advent of shrimp in a big way! Of course larger scale dacoities had increased, but that was because hijacking shipments and forced harvests of shrimp farms at harvest time were lucrative enough to encourage such behaviour!

12. He pointed out some other problems. Grazing grounds were fewer than before, and he felt that the livestock situation would deteriorate. Also, there was a very real threat that the quality of ground water which people drink could be affected in the long run.

13. On the whole SK supported shrimp culture and wanted it to become more extensive and intensive and felt that when all was said and done it would help the region more than any other alternative. In fact he felt the market forces would substantiate his claims – a bigha of land for shrimp culture was available for a lease of Taka 300 five years ago; today it would fetch anything from Taka 1800 to Taka 3000 and it is going up, not down. In fact, he felt that a lot of the complaints about the impact of shrimp culture was motivated by share

croppers, who found that absentee landlords had returned to culture their lands and had thus eliminated the 'illegal earnings' of the share croppers. SK felt that actions like making available infrastructure like ice plants, processing plants, better transportation and technical knowhow, ought to be taken to enable shrimp culture.

II. And the case against it

1. At Satkhira I met a local leader, AA, a politician and an ex-MP who was vehemently against the indiscriminate expansion of shrimp culture which he felt had had very harsh effects on the lives of the poor. First he did a simple calculation to show me the impact on labour demand :
   - one acre of T- aman paddy requires 50 man-days for one crop;
   - a 100 acre fish farm requires 10 men working for 90 days, i.e., 900 man-days;
   - the same size of land under paddy would generate 5000 man-days of labour;
   - and, the labour generated in paddy would be widely distributed while labour in shrimp is concentrated;
   - so, while shrimp labour paid more, the few who get it benefit, the others do not get anything.

   He went on to describe a local spot where the day-labour gathered to get contracts of work. It used to be that in the worst of times, in the month of Posh, you could not even find destitutes there because they would be out in the fields collecting the fallen grain from harvests. Now the place is full of idlers who have no work.

2. AA pointed out some other interesting labour impacts. The removal of shrimp heads is an important processing activity and most of this is done by women. In a conservative Islamic community, he felt, large groups of women working out of doors and often late into the night, would create social tensions and conflicts. To make matters worse, he said that social outcastes and people of bad character were being singled out to be hired as guards for the shrimp farms and the combination of money, alcohol and women was creating cultural shifts in the social system more rapidly than the community could cope with. He cited an increase in crimes against women in the region and a few cases of beatings and even a few murders (which he felt had resulted from the women-working-at-deheading situation) to justify his concerns.

3. Moving on to the less dramatic but equally important area of farm waste availability he mentioned that with the decline of paddy in the region the availability of fuel, thatching material and feed for livestock had been hit. In particular, this affects the poor who now have to purchase what they used to grow or gather. He cited the fact that many families had educated their children, met religious/festival expenses and even married off their daughters with the earnings from a few head of cattle and poultry. In fact this was the poor man's saving system. With the shrinking of agricultural and grazing lands, this option is finished. AA said that a careful analysis would show that in several poor families a child's education had been stopped about the same time that shrimp culture really expanded.

4. He then went on to talk about environmental impacts. He felt that the soil was getting saline in the region and this in the long run would also make shrimp culture difficult by adversely altering the soil ecology! Soon after the WPDA embankments had been built in the 60s, local people had brought in several species of plants and trees that could tolerate only non-saline and low-saline soils. He said that several of these plants and trees were stunted and dying, indicating an increase in soil salinity. AA also talked about the drinking water supply being affected. In many ways, he felt, this issue was perhaps the most serious because in the long run, it would affect the region's very carrying capacity for human habitation.

5. Satkhira in the past was a rice-surplus region, except in the worst months when, in spite of local availability, cheap rice was brought into the region to cater to the poor. Now there is an inflow of rice at all times except during the harvest. AA sees this as another indication of paddy being displaced by shrimp and even more seriously of paddy being affected by soil salinity. He quoted Kibria's study to justify his arithmetic. He suggested that the shortfall of rice was about 100,000 tons, which was being brought in at the cost of Taka 130 crores – because of instances like Polder 6-8 where 3000 acres of shrimp had affected upto 62,000 acres of rice!

6. AA and others who feel strongly about the indiscriminate growth of shrimp culture, have formed a quasi-political group called the Shrimp Culture Resistance Committee. They have the support of the people. They are going to give the system time till December to do something about their demands and recommendations after which they have threatened to take the law into their hands and stop shrimp by 'other means'. The Committee had presented many demands to the District Commissioner :

- no pond culture within 1/2 mile of any drainage sluice;
- where fish/shrimp is cultured it should be done downstream of paddy;
- drainage channels should not be allowed to be leased out:
- shrimp should be allowed to be grown only where rice growing is difficult;
- shrimp culture should be intensified so that more could be grown in less area.

Until such time as we know more about the impact of shrimp culture it should be stopped completely! The District Commissioner has agreed to the demands in principle and had even issued a memorandum to that effect, but nothing was being implemented. AA felt that the local government officials and even the law and order people were in collusion with the big shrimp farmers who were taking their earnings out of Satkhira and not investing it into the local economy.

7. AA concluded by bringing up two other points that the entire exercise was dependent on export markets and on the availability of natural shrimp juveniles. He wondered what kind of vulnerability this built into the system.

8. In a strange way I realized that AA was not an opponent of shrimp; in fact, he could be a strong supporter of it. His objection was to indiscriminate shrimp culture for the benefit of the few at the cost of many, especially the poor. He seemed to have no opposition to shrimp culture where rice grew poorly, provided it was done in an organizational mode that used the labour of the local poor people, ensured more local value adding and was owned by local collectives like limited companies of poor shareholders.

III. The Middlemen of Satkhira : Naturally for Shrimp Culture

1. Shrimp farmers make money. And big shrimp farmers make big money and there are several who count their shrimp farm size in hundreds and sometimes thousands of bighas. But who really makes the money? I met a leading shrimp dealer in Satkhira, who also is a big shrimp farmer who had adopted BOBP technology and does selective stocking, conditioning the soil, fertilization and supplementary feeding. And then he buys and sells shrimp. The market schematic for shrimp according to him looks something like this :

The farmer at the farm gets	for	The transporter-deheader gets	The dealer sells at
Taka 190/sr	30 ct/sr	Taka 5/kg approx.	Taka 282/kg
Taka 175/sr	40 ct/sr	making about	Taka 258 kg
Taka 135/sr	60 ct/sr	Taka 100/day	Taka 216/kg
Taka 105/sr	100 ct/sr	The deheading women	Taka 128/kg
Taka 44-50/sr	140 ct/sr	get Taka 10-12/day	Taka 66/kg

and the dealer transports it to Chittagong where the processor/exporter gets about US $13-15 or Taka 325-375 per kg for 60 ct and larger which gives one an idea as to who gets what and where and suggests why.

2. Of course, the shrimp dealer was happy with the growth of shrimp culture. He felt that government could do more to help out but did nct. There was not enough ice-making going on in the region and he said he was being exploited by the ice-makers. The roads were so bad that breakdowns were frequent and the resultant losses due to poor transportation were crippling. He also talked about himself as a shrimp farmer. He was quite worried. He felt that a lot more research was needed because they have been noticing dramatic differences in growth rates and yields with no apparent differences in pond quality and other culture protocols which the scientists have not been able to explain. He felt that what was needed was a local fish expert, like the local vet, to give day-to-day advice and help in trouble shooting. All this was critical, he said,because the investment had reached such levels that even the biggest shrimp farmers could not take two consecutive failures and the small farmers would be wiped out by *one!*

IV. Improvers of Technology – the BOBP

1. Right in Satkhira, the BOBP and the Fisheries and Livestock Division of the Ministry of Agriculture have an experimental fish farm where various combinations of paddy and shrimp and various shrimp trials with different input configurations are being tried. The staff feel that while due to fund allocation and staff constraints they have not really undertaken serious extension work, about 10% of the local farmers are beginning to pick up ideas and methods out of contacts and visits. The staff said that the educated, larger farmer was definitely more interested and often took the initiative to get ideas from them.

2. Some of the ideas and methods that have been picked up are selective stocking, predator control by screening the water inflow ponds and nursery rearing of juveniles collected. Ideas like feeding, soil treatment and fertilization while appreciated as important are less frequently adapted. Perhaps there is some justification for this selective uptake of technology because in its own experiments, the BOBP has had yields of 120 kg/ha (70-20 ct/kg sizes) with no culture techniques except screening inflow points for predator control and selective stocking.

3. In the experiments that are being undertaken, the BOBP staff had found that it was possible to grow paddy and shrimp, both sequentially and together, without the feared die-out of paddy. Recently, the BOBP retained a group in Dhaka to study the socio-economic impact of its programming in the area near the farm and the results are awaited. The staff, however, did feel that indiscriminate increase of shrimp farming, especially the extensive instead of the intensive type, had caused social and economic problems and conflicts. They clearly differentiated between the extensive and the intensive – as the latter actually uses more labour than even paddy which would overcome one of the main objections of labour displacement.

V. And finally, the Government

1. Shrimp culture in Satkhira depends on the Government promoting it by creating favourable conditions or by default by looking the other way. A lot of shrimp culture is done on government land and flooded through channel and gates illegally cut through government embankments. It was important to ascertain what those in authority felt about Satkhira and its shrimp industry. So I met the Secretary-in-charge of the Fisheries and Livestock Division of the Ministry of Agriculture.

2. He supported shrimp culture and set aside the arguments of labour displacement and loss of food production (rice) by stating that one, intensive culture would use more labour than rice and at higher wages, and two, that it was necessary to look at things in terms of their international prices – because he would rather prefer that all land in Satkhira be converted into shrimp culture and the high price of shrimp be used to buy (low-cost) rice to feed the people! Having set the policy tone he explained the new and recent decisions the Government had taken to promote and regulate shrimp culture in Satkhira and other coastal regions :

   - Long-term leases would be offered instead of the inhibiting one year lease at present ;
   - for farms of 20 acres and below the lease value would be Taka 1000/acre ;
   - for farms of 20-50 acres Taka 1500 for every acre above 20 acres ;
   - for farms above 50 acres Taka 2000 for every acre above 50 ;
   - the lease for the first year would be subsidized by 50% ;
   - the rent would be reviewed and revised every three years ;
   - industries and private owners will not be allowed to possess or lease farms above 100 acres in size. These will only be allowed as cooperatives ;
   - the FLD intends to promote 10,500 ha of farms in the next 10 years ;
   - saline water intrusion will be allowed by WPDA (WBD) in selected areas dependent on 'suitability' of land for shrimp culture (as different from unsuitability of land for rice culture) ;
   - long-term lease of embankment size lands will be allowed.

3. The Secretary went on to say that Bangladesh hoped to earn Taka 180 crores from fish exports and that brackishwater products would form a major component of this, and he felt the target would not only be reached but exceeded, thanks to places like Satkhira.

Case Study on Shrimp Culture in Satkhira, Bangladesh

Case Material II

EVOLUTION OF SHRIMP CULTURE IN SATKHIRA, AND ITS IMPACT ON LANDLESS, SMALL AND MARGINAL FARMERS/FISHERMEN

A rapid appraisal by

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Objectives

1. **The rapid appraisal set out to :**
   - **a. trace the evolution of shrimp culture in the Satkhira region**
   - **b. to assess the impact of increasing shrimp culture on the lives of the landless, small and marginal farmers and fishermen, with particular emphasis on its impact on women.**

Methodology

2. **This appraisal is a sociological/anthropological type of study of the evolution of shrimp culture in the Satkhira region and its impact on the lives of the poor. The study was limited primarily by the lack of adequate data and reliable statistics and secondarily by lack of time, which if available would have enabled the researchers to gather data from the field and fill in the gaps in secondary knowledge. The study is therefore based partly on available literature and existing secondary data (which was not only scarce but often misleading and contradictory) and mostly on in-depth, un-structured interviews with government officials of various sorts, officials of the BOBP, big and small shrimp farmers, farm labourers, beneficiaries of shrimp farming, those who have not benefited from shrimp farming, and an assortment of local opinion makers and residents.**

The Setting

3. **Satkhira district forms the extreme south--western portion of Bangladesh and comprises an estimated area of 1451 sq. miles. Physiographically, Satkhira district constitutes a part of the saline tidal flood plain of deltaic origin and is therefore, composed of alluvial soil. The soil is to a great extent uniform in character and varies only by more or less admixture of sand. The percentage of sand is greater, along the river courses and smaller in those areas where deltaic action of the Ganges has ceased. In old *bee/* (marsh) areas, the decayed vegetation produces a stratum of black soil.**

4. **In Satkhira, the tidal effect is much stronger than in non-saline tidal flood plains and in the dry season the river water turns brackish. It has been observed that the tidal flow is strong and the scouring effect is quite noticeable. Satkhira district is criss-crossed by a number of rivers and estuaries which again are connected by innumerable interlacing channels. The area is mostly flat, the surface being only slightly raised above flood level. The banks of the rivers are higher than the adjacent lands, so that the land sloping away from them on either side forms a series of depressions between their courses and there are numerous marshes. Some basins in the interior are deeply flooded in the monsoon. Silt deposition is continuing at the mouth of the larger rivers. The villages cluster along the river banks, but large tracts are swampy and the people who cultivate them are obliged to reside elsewhere and commute by boat or on foot.**

5. **From December to June, the river water remains brackish but after the rains have set in the salt water is usually driven beyond the limits of cultivation by a volume of fresh rain water and upstream drainage. The river banks are almost invariably higher than the land they enclose, and are cut up by numerous little inlets, by which the water penetrates to the lands within.**

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6. The climate of the district is similar to that of other districts of the country bordering the Bay with certain locational variations. One of the distinctive features of the climate is the salt-laden air almost round t5he year, particularly while the winds blow in from the sea. The winter sets in the beginning of December and lasts till the middle of February. These are cool months with a prevailing north west wind and heavy dew at night. The maximum and minimum mean temperatures during the winter season are 79.9^{0}F and 58.3^{0}F respectively. From mid-February the land heats up and southerly winds prevail till the monsoon breaks. The weather becomes very hot in April and continues to be so till the middle of June, when the temperature is lowered by the setting in of the monsoon. During this dry summer, i.e., from March to June, mean temperatures vary from 96°F to 80°F. The rainy season begins about the middle of June and continues till September. During this period mean temperatures fluctuate from 78.5^{0}F to 87.4^{0}F.

Evolution of Shrimp Culture in Satkhira

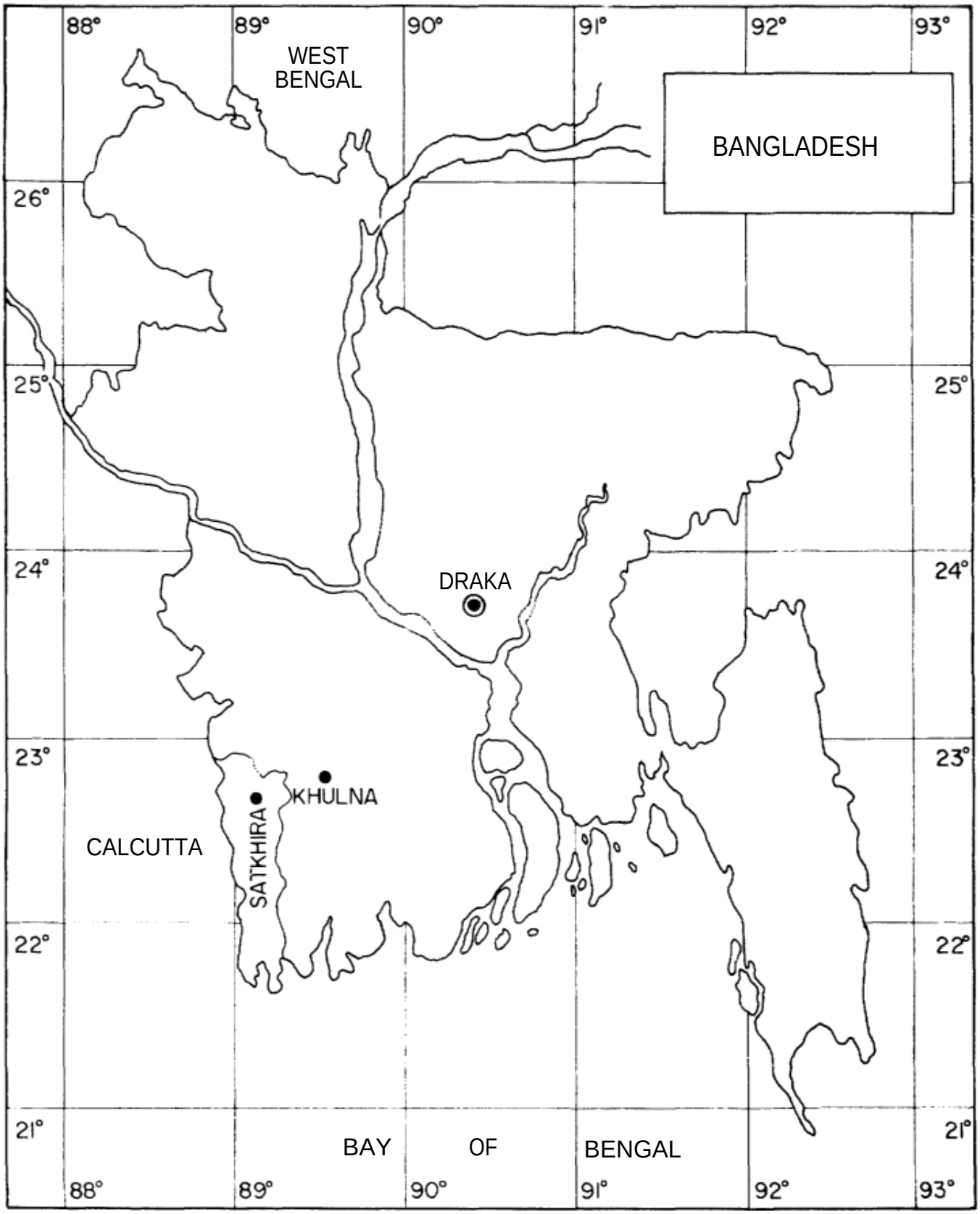
7 Farmers in Satkhira district have traditionally practised *Bheri* or dyke type aquaculture. They built small enclaves of embankment along the saline/brackishwater rivers to trap shrimp fries and/or juveniles and shell fish that ascended the channels with tidal water. Species like Penaeus monodon or Bagda chingri and Macrobrachium rosenbergi or Galda chingri were reared in such dykes or embankment enclave fisheries in sequence with transplanted aman paddy. Such shrimp culture practices have evolved over a long time and are still practised in pockets. However, organized shrimp farming as an industry and on a commercial basis is a relatively recent phenomenon. And while it has learnt from the received tradition and adapted it, it is essentially a new technology.

8. Satkhira district contributed, and still conrribuies, significantly to the total production from coastal aquaculture. The shrimp fisheries of the estuaries is important since roughly four-fifths of the shrimp catch is from this source alone. Satkhira farmers have been practising aquaculture, particularly shrimp culture, for many years in paddy fields within the coastal embankment called polders. With the completion of the phase of the coastal embankment by the Water Development Board/WDB (erstwhile Water and Power Development Authority: WAPDA) in 1965, the practice of shrimp culture in this area virtually came to a standstill and suffered setbacks.

9. There was reportedly no export market for Bangladesh shrimp prior to 1971. It was the post-independence era which saw Bangladesh shrimps exposed to the world market for the first time. During the early years shrimp had the largest share of all fisheries exportable by value and tonnage. Japan and USA were the most important markets for Bangladesh shrimps. In 1972-73, Bangladesh exported shrimps worth Taka 22.60 million followed by increased earnings in successive years. For example, in 1974-75, the shrimp export earning registered a sharp rise to Taka 145 million. As a result, shrimp farming began to expand at a rapid pace and gradually engulfed Satkhira, Kaligonj, Pikegacha, Syamnagar, Asasuni and other areas. Fortunes were made overnight and shrimp farming became temptingly lucrative, inducing increasing numbers of fish farmers and big landowners to take up culture.

10. An extract from the Khulna *District Gazeteer* of 1978 (p.125) gives us a retrospective view of shrimp culture as it prevailed :

"A very lucrative trade in dried shrimps has been established in the district and is carried on throughout the rainy season, chiefly in Satkhira and the Khulna subdivisions. Before the rains set in, drying stations known as 'Kuthis' are established on the banks of rivers where shrimps abound during the rains. The 'Kuthidar,' as the man in charge of the enterprise is termed, arranges with local fishermen to supply him daily with their catch of shrimps. These are caught by stretching a long net, locally known as beutinet, across the river when the ebb begins The net is hauled in at low tide and the catch is taken to the 'Kuthi'. Several methods are employed for preserving shrimps. They are either fire-dried on a mat platform within the 'Kuthi' or are boiled and then sun-dried and husked. The shrimps are measured by baskets of a standard size, made of holga reed (Typha elephanlina), a square cubit at the base and four cubits in length; two such baskets are estimated to contain a maund of fresh shrimps. About six fishermen are attached to each 'Kuthi' and the average catch from June to October is about 30 baskets per month. The usual destination of the fire-dried shrimps is Chittagong.



Location of Satkhira

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The boiled shrimps are not consigned to their destination by the 'Kuthidar' but are usually bought by a Rangoon broker at the 'Kuthi'. The price varies with the season."

11. **Gher : The Practice of Shrimp Farming**
They call it a Gher, which is the vernacular word for an ericlosure (embankment of earth) usually put around paddy fields into which small poyans/channels enter from the river/estuary nearby. Bheri, again a vernacular word, conveys the same meaning. In the beginning of the monsoon, with every high tide, the river water rises and enters into the channels taking with it shrimp fries and juveniles as well as finfish. The channel mouths are closed as soon as a sufficient quantum of shrimp fries and juveniles is judged to have entered. In the rainy season the water level rises and water accumulates in the Gher-enclosed fields, with the remnants of the previous paddy crop. The shrimps and fish grow out in these enclosures and are harvested with nets and traps after October as the fields dry out.

12. It was observed that traditional fish/shrimp farmers did not practise predator control, selective stocking, supplementary feeding, fertilization and water management of any sort. They essentially trapped shrimp and fish washed in by the high tides and harvested them after the grow-out period. In a sense it was just a step removed from capture fisheries.

13. An official document reveals that in spite of the low technology, the estimated production per acre per six month grow out period is about 142 kg of fish and shrimp. High priced p. monodon accounts for 15-20% of the catch, other lower priced shrimp a further 30% and fin fish the remaining 50%.

14. Shrimp farming on large blocks of land in Satkhira is at present controlled by a small minority with above average wealth and influence, having connections with the local power structure. Generally, a few such people form a group and take all the private plots within a polder on lease from the land owners during the culture season. The size of such operations can range from several acres to literally a thousand acres. Medium and marginal land owners have no choice but to go along as they cannot use their lands for independent shrimp culture. It is technically and economically not viable to do so. More importantly, due to lack of organization, neither can small farmers join together and practise cooperative farming of shrimp. The annual lease value of the land is usually substantially more than what farmers expect from paddy and other agriculture and this is a further temptation for the small farmer to go along with the big.

15. The Bangladesh Water Development Board/BWDB lands are also leased out on a yearly basis, and the organization claims that people of limited means can and do compete for such lands to practise shrimp culture. However, in spite of getting the lease, small farmers often do not have the shot--term liquidity to invest in shrimp farming and practise an inefficient aquaculture that makes their earnings much less than that of their well endowed fellow big farmers.

The Area under Shrimp Farming

16. An official document says that the narrow strips of land, 50 to 100 feet wide, between polder embankment and the river bank is suitable for paddy-cum-shrimp production. Such land presently amounts to nearly 247,000 acres. In order to protect agricultural lands from saline/brackish water, the Water Development Board/WDB (erstwhile Water and Power Development Authority/WAPDA), over the years, has almost completed the construction of a colossal embankment enclosing a wide range of areas in Satkhira district. In late 1984, the total length of the embankment was 253 miles. Polders have been developed covering a gross area of 260,000 acres so far, which includes 221,724 acres of cultivable land. The people of Satkhira region have for years been alternatively growing paddy and practising dyke aquaculture in the fields now within the embankment, but a systematic invasion of the polders by shrimp farmers began around 1977. One official who prefers to remain unnamed, said that while the construction of the polders was meant to keep out brackishwater and augment transplanted aman paddy growth, in a way the polders have created just the right conditions for controlled and scientific brackishwater shrimp culture in the region.

17. The acreage brought under shrimp farming under the Satkhira Water Development Division-I was 8,816 in 1979-80, 11,104 in 1980-81, 12,066 in 1981-82, 18,286 in 1982-83 and ultimately 25,952 in 198384. Thus, in terms of coverage, shrimp culture accounts for 10.34% and 12.16%, respectively, of the total gross and total cultivable or benefited areas of the four polders under

WD Division-I in 1983-84. But where do these constantly increased acres of land brought under shrimp culture come from? The answer is simple from the agricultural sector, precipitating a perturbed productive relationship coupled with a deranged wage-employment pattern by contraction of paddy acres in the polder areas.

18. The following table presents the shrimp culture facts and figures of the polders under Satkhira Water Development Division-I, as a whole. The table shows the gross and cultivable/benefited land areas, all polderwise, as well as the distribution of Gher shrimp farms with acres and percentage.

Shrimp Culture Facts and Figures/Satkhira WD Division-I

Polders	Upazilla areas	Gross polder areas (acres)	Areas of cultivable! benefited land (acres)	No. of Gher! shrimp farms	Total area of Ghers (acres)	% of Gher with respect to cultivable land (Col.4)
1	2	3	4	5	6	7
1	Satkhira, Debhata, Asasuni	70,100	52,224	103	13,800	26.43
3	Debhata, Kaligonj	45,400	42,000	83	8484	20.11
5	Syamnagar Kaligonj	1,36,500	1,20,000	101	4678	3.90
15	Syamnagar	8,200	7,500	2	25	0.33
	Total	2,60,200	2,21,724	289	26,987	12.16

Source : Satkhira WDB Division-I

19. However, this table does not represent the complete picture, because apart from the polders under Satkhira Water Development/WD Division-I, there have also been some other polders harbouring shrimp farms under WD Division-II. There are 159 Gher shrimp farms located in the polder areas under Satkhira WD Division-II. These Ghers occupying 4905 acres in aggregate, amount to 3.29% of the cultivable land of the polders. The following table accumulates shrimp culture facts and figures relating to Satkhira WD Division-II.

Shrimp Culture/Satkhira WD Division-II

Polders	Upazilla areas	Gross polder areas (acres)	Areas of cultivable/ benefited land (acres)	Nc. of *Gher*/ shrimp farms	Total area of *Ghers* (acres)	00 of *Gher* with respect to cultivable land (Col.4)
1	2	3	4	5	6	7
2	Satkhira, Asasuni	35,500	25,000	25	850	3.40
4	Asasuni, Kaligonj	25,500	18,000	20	2,000	11.11
6-8	Tala Asasuni	84,400	54,000	35	1,400	2.59
711	Asasuni Syamnagar	9,600	7,000	20	120	1.71
7/2	Asasuni	2,69,000	19,000	40	300	**1.58**
13-14/2	Koyra	36,200	26,000	19	235	0.98
	Total	288,100	1,49,000	159	4,905	3.29

Source : WD Division-II, Satkhira.

20. As many as 448 *Gher* shrimp farms of various sizes and significance exist with a total coverage of 31,892 acres of land of the polders in Satkhira district. In aggregate, cultivable or benefited land area of the polders measures 3,70,724 acres. Thus, total shrimp farm areas account for 8.60 % of the total cultivable or benefited land of the polders.

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Issues and Impacts

21. The shrimp culture scenario in Satkhira is beset by a complex socio-economic configuration.

22. Mokabber Hossain of Alipur village is a shrimp farmer. Both Galda and Bagda chingri are cultivated in his *Ghers.* He owns a *Gher* comprising 367 acres of land which is particularly meant for rearing Bagda chingri. In fact, he is not alone; he has formed a group of nine farmers. The *Gher* includes lands of several small and marginal farmers. But they do not share the ownership of the Gher.It is interesting to note that despite being share-holders of the *Gher,* some group members who come from far-flung areas do not have rights to shares of shrimp. They have just leased out their lands and that is all! They participate neither in production nor in the management of the *Gher.* Of course, they have been paid the lease value, at the rate of Taka 3000 per acre, for the inclusion of their lands in the Gher. This payment of lease value is made in two equal instalments, at the commencement of production and after the harvest is over. When we visited the *Gher,* the water had receded down to the channels surrounding the *Gher.* Land had surfaced high above the water level. But the farmer did not prepare for cropping paddy on the assumption that salinity had rendered his land non-conducive to good paddy cultivation. All his other neighbours also maintain similar views regarding paddy cultivation. Neither aman nor aus is grown here anymore!

23. Another shrimp farmer of the same village has cultivated Galda chingri and paddy simultaneously and in sequence with his Gher. He is rather happy with the yields of both the crops. He believes that cultivation of Galda chingri does not affect the paddy field. A Debhata shrimp farmer reflects his insight gained over years while talking about his experience. According to him, *Ghers* 20-25 years old are suitable for shrimp farming only, and not for paddy-cum-shrimp cultivation. Shrimps grow better in these *Ghers* in terms of both quantity and quality. And the shrimp farmers owning these *Ghers* earn more too. This Debhata farmer, however, opines that poor farmers hardly benefit from shrimp culture since they do not have any share of the shrimp produced. Breach of contract takes place often and yet they fail to assert their rights.

24. Khodabaksh, an agricultural labourer, was previously a farm labourer. He had a piece of land measuring about 0.33 acres. He used to crop this land and the yield was 15 -- 20 maunds of paddy per year. Apart from cropping his own land he also worked for other farmers as a farm labourer. He heads a 7-member family, and is the only employed person in his family. But now, the family is struggling hard for its very survival. Khodabaksh has leased out his land to a cooperative engaged in shrimp farming. As lease value, he has got Taka 500 for the first year of contract from the cooperative; but this amount of money is hardly enough for buying five maunds of paddy. Moreover, he does not find work as a farm labourer to earn his living. And now he is moving around Satkhira town in search of work. A wage labourer who has been working in a shrimp farm for the last four years says that, “Shrimp culture is extremely profitable, the shrimp farmers are earning a lot by selling fish. But what about us? We have lost our work, and are getting nothing.” Many people think that Satkhira, once a food surplus area, has turned into a deficit area due to shrimp culture alone. In the not too distant past the landless poor, small and marginal farmers and even some farm labourers could afford to store rice for consumption during the aman and aus seasons. But now the situation has changed altogether and the plight of the poor has worsened. Even skilled labourers are not getting work due to acute unemployment. They contend that had a plot of land been cropped for both Aus and Aman paddy they could get work for two successive seasons in a year. But shrimp culture required barely one-fourth of the labour force employed in agriculture, with the land acres remaining the same for both the crops. For example, according to their estimates, one acre of land required 93 to 108 man days for cultivating Aus and Aman while 25 to 30 man days suffice for shrimps.

25. A study conducted by a group from the Chittagong University has revealed that 70% of the labourers involved in agriculture have gradually lost their employment upon the introduction of shrimp culture and in its aftermath. The database for the study included Debhata, Kaligonj and Syamnagar upazillas.

26. As a consequence of the pervasive expansion of shrimp culture, hundreds of agricultural labourers have been thrown out of the production process. And they are afraid that in all probability it will not be possible to generate sufficient employment for those agricultural

labourers in the foreseable future. This they apprehend with a sense of pessimism since there is no rehabilitation plan forthcoming for the unemployed agricultural labourers.

27. A farm labourer of the village Padmobil said that poor farmers become panicky as the shrimp culture season sets in. They do not even dare to crop IRRI in their lands because in the dead of night their lands are often inundated with brackishwater. This is done by cutting the embankments; IRRI or whatever may be the crop, is damaged deliberately with little concern for the law since law-enforcing agencies are allegedly in collusion wifh the rich farmers.

28. Poverty is stark, naked and very deep. Landlessness and land concentration have been increasing at an alarming pace. The existing land-holding system in this area presents extreme inequality in the ownership and control over land which is characterized by a small minority monopoly. Thousands of farm labourers'have been rendered jobless, and a large number of share-croppers have been evicted from their lands.

29. Here is a story told by a poor woman. She was married three years ago. Her husband owned about an acre of land. He used to produce about 16 maunds of paddy, Aman and Aus combined, from this land and somehow managed to pull on. He leased out his bits of land for shrimp culture in the very year they were married. He was supposed to get Taka 1800 as the lease value every year. In the first year he received Taka 500 and in the next year, Taka 400 And that was it! The shrimp farmer stopped paying him. Two years have elapsed since he left home for town. She heard that her man had married once again. On one occasion she went to the shrimp farmer for the lease money, only to be maltreated and insulted.

30. It appears that share croppers have been among the worst sufferers of shrimp farming. With the dramatic expansion of shrimp farming, share cropping has declined drastically, hitting the small and marginal farmers hard. Almost as a rule most small and marginal farmers are share-croppers too. Large farmers, and sometimes absentee land owners, could not manage and utilize their lands. Both the groups could afford to lease out their lands to others for share cropping. However, thanks to the present state of shrimp culture in the Satkhira area, these groups of people are no more in a "either crop the land yourself or give it to others" type of situation. Now, they are fortunate enough and have their options. And hence the crisis for share croppers.

31. *Employment impact*

Some of the impacts of extension of shrimp culture on the employment pattern of the region are as follows :

32. *Employment in shrimp farms*

Agriculture is labour-intensive, while shrimp culture is not. Shrimp farming has itself evolved as a source of employment in the non-agriculture sector. A relatively large number of fishermen and wage earners has been working in shrimp farms. However, shrimp farming seemingly robs wage labourers of their jobs first and then absorbs some of them, often a tiny fraction.

33. Here is a comparative case study illustrating the employment paradigm in a shrimp farm. Kumarikuni Gheri is a 50 acre shrimp farm which has been in operation for the last few years. A total of 268 man-days has been spent to construct the ring embankment around the Gher. It took 20 man-days to make a sluice box, 10 ft. in length and 3 ft. in breadth, required for water control. Guarding against the poachers is an important activity in a shrimp farm. Eight people are employed to guard against poachers for a period of nine months. The salary contract was effected on a monthly basis. Apart from keeping poachers away, the guards were made to maintain and repair the embankment, remove pests, as well as catch and sell the shrimps. Thus, 8 x 9 x 30 or 2160 man-days of employment were generated.

34. Bamboo trap making is another major activity in shrimp farming. During the production period as many as 40 bamboo traps were used. It took 2 days for a labourer to make one trap. Thus, for 40 bamboo traps, employment generated was 80 man-days.

35. In addition, the farm required 60 man-days of employment for work related to maintaining and repairing *Gher* embankments. The total shrimp yield (mostly Bagda) was 60 maunds, and the farm last year earned about Tk. 440,000 from the sale proceeds. The total labour demand was 2,588 man-days.

36. **In contrast the employment need to cultivate 1 acre of paddy within the Gher is :**

Production Phases	*Man-days*
Land preparation (including seed bed making)	18
Plantation	18
Weeding (no weeding was done)	
Harvesting and threshing (manually)	35
Total	72

Paddy cultivation on one acre of land claims about 72 man-days in all. Thus a total of 3312 man-days of employment was required for cultivating paddy in approximately 46 acres of land constituting the shrimp farm. The difference in demand is 724 man-days – quite a sizeable figure. Therefore, a given farm area remaining the same, the man-days required for paddy cultivation are significantly more than that required for shrimp. Paddy cultivation in a *Gher* in sequence with shrimps, results in a single crop being taken out of the land. The instance cited above relates to unicropped land. The loss of employment would be proportionately higher if double or triple-cropped lands are brought under shrimp cultivation.

37. Wages Rate Impacts

Wages of the *Gher* shrimp workers have also become a critical issue, These workers are mostly drawn from among the landless agricultural labourers and fishermen. Some of them are recruited from among the small and marginal farmers who ceased to be share croppers when their lands were included in shrimp farms. Landless wage labourers account for about 70% of the total, while land-poor villagers including fishermen account for 20%. In the Debhata area, children between 8 and 14 years of age reportedly account for 8% while womenfolk and skilled labourers account of 4% and 20%, respectively of the total work force employed in shrimp farming. Employed in a *Gher* shrimp farm, a worker usually earns Tk 600 per month. We talked to a number of such shrimp workers. However, it is only workers employed on a regular basis who earn such a wage. In most areas, the daily wage rate of labourers varied from Tk 10 to 12. It may be mentioned here that the minimum wage rate as determined by the government for agricultural labourers is the market price equivalent of 3 1/2 seers of rice which amounts to Tk 27. Wage rates in Satkhira are much lower than even the average wage rates prevailing in the greater Khulna district.

38. **Deheading of shrimps is primarily a processing task. It is usually women who are employed in this work. Engaged in deheading of shrimps, they earn Tk 10 for a 8 hour work day. A large number of women are employed in deheading. They are destitutes, disgraced and mostly from the lower social strata. Some of them had no other options, some are unmarried and have no hopes of getting married. Widows and abandoned wives too are in their midst.**

39. **Some opinion makers felt that the presence of such women in the labour force was responsible for the higher-than normal occurrence of sex crimes reported in the region!**

Kadbanu is a wage worker. She has been deheading shrimps for a living for the past two years. Her father was an agricultural labourer. And Sattar, her husband, was an agricultural labourer too. Some 14 years had elapsed since the couple arrived from afar and settled in Sultanpur village near Satkhira town. They have four children. Some four years ago Sattar had an affair with another woman and eventually married her. He has since stopped supporting his family and has been living with his second wife. Kadbanu was forced to go out and earn a livelihood. She managed to find work as a maid servant and get a similar job for her young daughter too. Two years ago she switched to deheading of shrimps, and started earning Tk 10 for an 8-hour workday. Though this is more than what she earned earlier, it is not enough to sustain a family of five. A workday has two shifts : 10 a.m. to 1 p.m. and 3 p.m. to 8 p.m. During the peak season Kadbanu often works right through the night to earn a little extra. Virtually abandoned by her husband, Kadbanu is not yet divorced.

41. **Self-Employment Generation**

Some poor folk, including women and children, have taken to catching shrimp fry for rearing farms. This activity, seen more and more during the past 3 4 years, is relatively rewarding: the reward varies from place to place and fluctuates from season to season. But Tk 100

per day is perhaps the average. And women and children earn just as much. Yet the fry collectors do not get a fair price for their catch and are exploited by middlemen who make enormous profits.

42. Development of Small Industry

With the growth and expansion of shrimp culture, some small industries have been set up in the local areas. The most important of these is a modern shrimp processing plant at Satkhira. Others include ice factories and cold storage plants aimed at transitory preservation of shrimp and fish product. Obviously these plants and factories have become workplaces for a considerable number of local people including women.

43. Non-Party Politics of Shrimp Culture

Shrimp culture has become a question of crucial concern to the Satkhira people. On this pivotal issue, not only the parochials but also the politicals have got polarized into two groups. Processions and demonstrations have been organized here for and against shrimp farming, and several confrontations have taken place even leading to loss of life.

44. The non-agriculture sector is overwhelmingly dominated by shrimp farming, which in turn is characterized by big land owners' hegemony. Very often, the big shrimp farmers constitute the most powerful political lobby as well. It is quite evident that big shrimp farmers with various party/political affiliations belong to the same social classes and represent identical power bases.

45. Recently a committee has been formed to resist further ,expansion of shrimp farming. A professedly militant forum, this committee draws its members mostly from democratic and petty bourgeois left wing political parties including the Awami League, Communist Party of Bangladesh/CPB (with a fairly strong base in the midst of the farm labourers), Jatio Samajtantrik Dal/JSD and others. Mr. Abdur Rahim, a lawyer, previously associated with the radical left, and Mr. Alauddin, an Awami League leader and ex.-M.P., have been leading the 23-member committee. A prominent member (a young CPB member and college teacher) of this Committee told us that they would fight to keep shrimp culture within rational limits, they were not for doing away with it altogether. They would also campaign for planned shrimp farming, upholding the interests of the resource-poor, he added.

46. Conclusion

For the fisheries sector, the development thrust stressed accelerated production of shrimps to augment export earnings and to increase employment opportunities fo the rural poor, amongst other objectives. It was expected that Bangladesh would be exporting shrimps worth Tk 108 crore during 1982-83. In fact, by December 1982, that target had already been exceeded. And Satkhira district had contributed significantly to the production from coastal shrimp culture. Ironically, however, this did not mean increased employment opportunities for the rural poor in Satkhira.

47. None, not even the staunchest critic of shrimp culture, demands that shrimp culture should be stopped completely, since it has had some positive impact. But the benefits have not trickled down to the lower strata of society and have been cornered by a few at the top. Most farmers who entered shrimp culture were already well-established in local society – and the benefits are being eaten up by them. Shrimp culture has aggravated income differentials, thereby further worsening the already precarious social resources imbalance situation. In some areas of shrimp farming concentration, lack of employment opportunities has affected a large number of villagers – share croppers in- general and landless labourers in particular. It is clear that there is no easy solution. A proper approach could be arrived at only on the basis of a thorough analysis of the conditions. And for real development to take place, nothing short of a total approach to reality is required.

48. Yield of Bagra chingri in Bangladesh is the lowest among the shrimp producing countries of the world – only 60 kg per acre. And this is mainly due to the old and unscientific system of cultivation which still dominates the Satkhira shrimp scenario. Optimistically, it was envisaged that introduction of simple improvements in the existing culture system, e.g., predator and competitor control, selective stocking of more desired species, species and stock manipulation and appropriate water management, could greatly augment the production. Research and development should be stressed and streamlined in order to promote intensive rather

than extensive shrimp culture. Augmenting shrimp production is of course very desirable, provided it is done by adopting appropriate technology, is ecology conscious and is tuned to the genius of local people – and not simply by bringing in more acres of land under shrimp cultivation indiscriminately.

49. We could read the following manifest preferences of the local people with regard to shrimp culture :

a. No more land should be brought under shrimp cultivation. Intensive and not extensive cultivation is preferred fdr increased production;

b. It is very important to rehabilitate the landless agricultural labourers thrown out of the production process and the small and/or marginal farmers practising share cropping evicted from their lands;

c. Organization of the landless agricultural and shrimp farm labourers would be a crucial precondition to implementing such rehabilitation programmes if undertaken;

d. Khas lands, *bils* and depressions hitherto forcibly and illegally occupied by the big shrimp farmers should be reclaimed and distributed amongst the landless labourers and fishermen, the latter being already on the verge of total extinction as a community. This has reference to the expressed government policy decisions regarding *Khas* lands.

All our efforts should be to ensure that this effort is not frustrated by the vested interests;

e. Organised properly and given some initial government support in the form of loans on soft terms, technical know-how, etc., the small peasants could be directly involved in shrimp farming for their own benefit;

f. Planned and ecology-conscious shrimp farming addressed to the betterment of the local society at large is needed.

GLOSSARY

Bil	:	Low lying lands under water, marsh/swamp depression
Chingri	:	Prawn, shrimp
Seer	:	A little less than 1 kg or equivalent to approximately 2 pounds
Maund	:	A weight measurement equivalent to 82 pounds
Gher	:	Enclosures (embankment of earth) particularly erected for shrimp farming
Khas land	:	Government owned land
Khet Mojur	:	Farm labourer
Taka	:	A unit of Bangladesh currency equivalent to 4 or 5 U.S. cents

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Case Study on Shrimp Culture in Satkhira, Bangladesh

CASE DISCUSSION GUIDE

1. Satkhira is really quite different from the other cases being considered in this Consultation. It does not involve an agency that planned development and extended technology. The people of Satkhira responded to market conditions, and using a slightly modified version of a technology that they had used for years, and which they spread on their own through informal farmer-to-farmer contact, tapped an environmental opportunity made especially unique by an embankment which was built to keep out brackishwater but which ended up containing it.
2. The two notes on the evolution of shrimp suggest that the impact of the development of shrimp culture in Satkhira has been quite large and good or bad depending on whose side you are on. It is also obvious that the government is in favour of what is happening and that the BOBP is interested in improving the yields by introducing essentially simple technology inputs.
3. The questions before the case discussion group are :
   (i) What has been the impact of the growth of shrimp culture on various groups, especially on the poor?
   (ii) What are some of the problems that may grow out of this expansion of shrimp culture and how do you see it affecting the growth of shrimp culture in turn? How would it affect various socio-economic stratas of people?
   (iii) Should the government regulate the activity to ensure just and equitable development? How should it do so?
   (iv) Why would the government think in terms of regulation? What forces, if any, could move it to do so and what is the potential for such forces to arise?
   (v) Should an agency like the BOBP be approached to support, promote and enhance shrimp culture growth in Satkhira. how should it go about trying to determine social feasibility? And for whom?

Case Study on the Expansion of Shrimp Culture in Satkhira, Bangladesh

CASE DISCUSSION SUMMARY GROUP I

1 *Objectives*

The Government of Bangladesh wants to promote prawn culture to earn foreign exchange, in the environmentally suitable coastal regions. The *Bay of Bengal Programme* wants to develop a more efficient and intensive technology for prawn culture in Satkhira for the small-scale farmer. The use of simple techniques would not only increase productivity but also increase labour demand and therefore employment

2 *Shrimp* culture *for whom?*

Marginal and small-scale farmers and the landless poor should *a/so* benefit from the expansion of shrimp culture. There should be a possibility for groups like landless women who are not in the mainstream of the activity to benefit frorn ancillary activities like seed collection and processing.

3 *Social changes*

The apparent social impact of the shrimp culture expansion are

(a) reduction of the area under paddy culture and the subsequent loss of work opportuniities for the landless farm labourers; paddy farming apparently demands more labour per hectare than extensive shrimp farming;

(b) several new employment options have been generated by shrimp culture expansion, such as processing, seed collection, support industries like ice making and transportation. However, there is not sufficient data to indicate whether this new employment generation compensates for the reduction in labour use suggested above. So it is difficult at this stage, to judge the real impact on labour opportunities and labour demand patterns;

(c) The case material does indicate qualitatively that the poor in the region have been affected adversely.

4. *Other changes*

(a) further expansion of shrimp culture will increase the demand for seed, which seems to be already under pressure as indicated by increasing prices.

(b) there will be increasing need for hatcheries, feed formulation units, and processing plants which would increase labour demand (of a special nature) but may have several other social and economic impacts.

(c) the increasing emphasis on shrimp culture and its increasing demands for fertilizer/feed/ labour may deprive people and other occupations of their inputs and needs.

(d) it is difficult to identify the groups who will be most affected by these changes and the extent to which they will be affected with the given database.

5. *Strategy*

The Government of Bangladesh in order to benefit the poor and ensure equitable development in the region should :

1. ensure fair access to land/water areas/rights;
2. make available credit to the poor to promote their involvement in shrimp culture;
3. promote cooperative ventures in government owned land/water areas;
4. make available technical training and extension.

The Bay of Bengal Programme should :

1. undertake a detailed socio-economic survey of the Satkhira region to understand how the expansion of shrimp culture has affected various strata of society and recommend socially feasible programmes to ensure benefit to the poor of the region;
2. develop technologies and test them to ensure transfer of shrimp culture to the poor.

Case Study **on the Expansion of Shrimp Culture in Satkhira, Bangladesh**

CASE DISCUSSION SUMMARY : GROUP II

Impact of the growth of shrimp culture on various groups, especially the poor

Groups of people in the Satkhira area who are involved in shrimp culture or are affected by it are :

- land owners turned shrimp farmers;
- absentee land owners;
  small land owner/paddy cultivators;
- landless share croppers;
- women of the poor group

2. It is obvious from the case material that the landowner turned shrimp farmers group has benefited financially from the innovation due to favourable export markets.

3. The absentee land owners also benefited from shrimp culture as they received lease rent which is higher than their usual profit from share cropping.

4. The groups most affected by the expansion of shrimp culture are the poor and some of the adverse effects are :

there is displacement of labour as the small land owner/paddy farmer and the landless share croppers are no longer able to engage in paddy cultivation. There is an indication that the total job availability in the region has been reduced as extensive shrimp culture requires less labour inputs;

there is a change in the occupation pattern among the poor; their income has become more unstable and uncertain; some migrated to towns to look for jobs and some cases of dislocation of family ties resulted;

the poor were deprived of the by-products of paddy planting, i.e., paddy straw for fuel, thatch for houses, and feed for cattle;

the displaced poor no longer produce their own rice and have to depend solely on purchases;

poor women were forced into independent non-family jobs and were often subject to harassment.

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5. On the other hand, some of the positive effects were :

-- creation of new jobs related to shrimp culture such as seed collection, ice making, prawn processing, basket making, etc., which often specifically benefited women and children; by-products of shrimp farms such as fish and crabs were made available in the local market thus increasing the community's protein food intake;

- increased incomes led to surpluses which were locally invested thus stimulating the local economy.

6 Some of the environmental impacts were :

reduced availability of drinking water due to saline intrusion;

change in suitability of land for agriculure;

-- change in vegetation -- economic vegetation replaced by non-economic saline resistant species;

-- possible effect on marine capture fisheries resulting from seed collection.

II *Possibility of social conflict*

7. The people of Satkhira seem divided into two distinct and opposing camps over the shrimp expansion issue : there is a pro-shrimp farming group and an anti-shrimp farming group. The pro-shrimp group, made up of the landed rich, have government backing and are motivated by increasing profits while the poor are being drawn to the anti-shrimp group. The anti-shrimp group is not so much against shrimp farming, as it is against, the exclusive hold that a few have over the process.

If the government does not regulate shrimp farming to ensure a more equitable expansion and growth there is a *very* real possibility cf social conflict of a violent nature. In fact, there aiready have been violent incidents. Such conflicts will adv ersely affect all the parties concerned including the government

III. *Should rhe government regulate .shrimp farming?*

8. The Government of Bangladesh would like to promote shrimp farming to earn much needed foreign exchange. However, it cannot ignore the social infeasibility of the present mode of expansion which not only adversely affects the poor but may eventually lead to violent social conflict. There is a strong case for government intervention and regulation.

9. The yovernrnent could contemplate the following actions :

-- existing minirnum wage regulation should be enforced to enable the poor to get their rightful share;

- land beionging to the government suitable for shrimp culture should be made available to the displaced farmers with government providing financial and organizational support;

– ensure fair negotiation on lease rent and ensure actual payment of tease rents by the shrimp farmer;

– provide protection to women employees;

--- set-up extension efforts to promote intensification of culture and the practice of shrimp cultureipaddy planting rotation system to create more jobs and retain paddy production in the area.

IV. *Should BOBP be approached to support, promote & enhance shrimp culture growth in Sarkhira?*

10. The major probiems resulting in the poor feeling deprived are the displacement of occupation and loss of jobs.

Technically this problem can be lessened by :

upgrading of existing extensive shrimp culture method into a more intensive shrimp culture method to increase productivity and create more jobs;

reintroduce,, wherever possible, the technique of shrimp culture/paddy planting rotation as demonstrated by BOBP experirnents.

11. BOBP being a development promoter should participate activitly in the demonstration and transfer of technology and the undertaking if successful, will benefit all in rhe region, especially the poor.

Case study on the expansion of shrimp culture in Satkhira. Bangladesh

CASE DISSCUSSION SUMMARY GROUP III

Structure of discussion

1. Vote on the aquacuiture as practised now in Satkhira.
2. What instruments are available to government to Intervene in such a situation?
3. Feasibility of such intervention.
4. Issues to resolve.
5. Overall strategy of intervention.
6. What could BOBP's role be in the strategy:'
7. A final vote on shrimp culture expansion in Satkhira.

The initial vote

Generally in favour of aquaculture	5
Generally opposed	3
Abstention (don't know)	2

The instruments available to government

There are a number of things that, theoretically, government could do to influence the situation **either** to promote or to regulate aquaculture These can be grouped under various headings :

regulation of land holding tenure:

- regulation of land use:
- protection of *the* rights of certain social groups:
- changes in policy environment to influence incentives;
- provision of inputs and funds;
- cmmmunity development and mobilization;
- changes in structures of marketing /processing;
- further research in the area leading to better understanding of the problems;
- creation of employment and income oppertunity.

These instruments might be technical and/or socio-economic. They migiht be **used** for production of prawns and/or distributing its benefits in society.

Feasibility of intervention

There were limits on doing anything to redistribute benefits : the powerlessness of the **poor,** difficulty faced by the government in enforcing laws, the sheer dynamism of the historicel process. However, some small cooperative efforts in Satkhira and the developmental experience from other parts of the world makes the group hopeful that redistribution may be a real possibility. The group, however, felt that it needed to know a lot more before it could judge the reality of this particular situation.

Issues to resolve

We reached a tentative assessment of the issues as follows :

(a) Income

- shrimp has a high income generating potential for the area;
- the income is mainly earned by landowners;

(b) Employment

- shrimp has a high employment potential if made intensive;
- the present pattern of employment however causes concern:

(c) Land use

- **a system of shrimp culture is prompted by various technical and economic factors;**
- **there is some technical advantage in the system;**
- **there is concern that shrimp monoculture is socially regressive;**
- **multi-species aquaculture plus rice may be more positive;**
- **there is concern over environmental damage in the long term;**
- **there is concern over long term land use pattern.**

Overall strategy

1. **Start with extension work among poor farmers, lease holders, the landless and the share-croppers to establish :**
   - **a. the groups and their location;**
   - **b. their resources;**
   - **c. their needs and demands.**
2. **This would lead to motivating/organizing the poor to :**
   - **a. ensure that inputs reach them,**
   - **b. resolve conflicts that emerge.**
3. **To adopt this strategy we would need to :**
   - **a. assess political feasibility;**
   - **b. consider other determining factors (e.g., proposal for a technical project in the area).**

BOBP's role

1. **Small farm research in different zones to establish methods to intensify production.**

   This would necessitate defining "small farm" locations in relation to zones and channels, land use zones in consultation with people.
2. **The lease of governmen? water/land areas to the landless, share croppers and lease holders, could be promoted.**

   This would necessitate a study of their resources and of the trends in relationships with other groups. Zoning was felt to have a role in limiting the extent of the adverse impact on some of these groups.
3. **There is a need to seek out appropriate organizational forms for channelizing the benefits as required.**
4. **A study of the impact of changes on society is required. There might be a need to provide means of protecting women while encouraging the positive aspects of the changes.**
5. **To implement a strategy for the poor there might be a need to provide a technical/managerial advisory service for them. Fees could be charged for such services.**

The vote again

The group had changed by the end, so results are not directly comparable. However, those who had been against were now convinced to try to set up a project. The newcomers to the group also felt the same. Two people modified their vote from "against" to "abstain".

There is one dissident. Although we could design a project in the classroom, the likelihood of transferring such a scheme with so many imponderables to rural Bangladesh seems remote.

Whilst the majority felt it was worth a try, we were not able to consider whether there were better schemes elsewhere for BOBP to spend their money on.

Appendix 7

Case Study on Shrimp Culture in Chilka Lake, Orissa, India

Case Material

CONFINED TANK SHRIMP CULTURE FOR THE ECONOMIC REHABILITATION OF THE RURAL POOR : HAVING THE RIGHT MAN AT THE RIGHT PLACE HELPS

by

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I. The Process : Evolution of Brackishwater Culture in Orissa

1. **In** a state where brackishwater resources are abundant and where a substantial percentage of the total fish production comes from brackishwater capture fisheries, why is it that brackishwater culture fisheries came to be evolved only in the early '80s? This is the question that motivated a study of the evolution of brackishwater culture in the region.

2. There have been occasional attempts at brackishwater culture by the Department of Fisheries, starting from its earliest days.

   - In 1958-59, some attempts were made at tidal fed culture of mullets and shrimps in Paradeep; these were thwarted by hydraulics and crab damage to bunds;
   - In 1962-63, confined tank culture of mullets and shrimps was attempted in Keshpur, Ganjam district; it did not do too well;
   - In 1975-76, confined tank culture of mullets and shrimps was revived under the ICAR-funded All India Coordinated Research Project on Brackishwater Fish Farming;
   - In 1981-82, some minor cage culture experiments were undertaken in Keshpur and Balugaon; all it did prove was that the potential existed to produce as much as 1300 kg/ha in Orissa.

3. In 1978-79, every-thing changed. The Government of India, encouraged by rising prices of shrimp in the world market and constrained by high fuel costs in capture fisheries, was promoting brackishwater culture. Money became available urder the Sixth Plan and the head of the department, an IAS official, leaned towards brackishwater culture. The time was right and the fisheries department initiated a detailed study of the state's brackishwaters (SBW). The effort went on till late 1983, covered 16,000 ha in the four coastal districts and identified about 14,000 ha as suitable for brackishwater culture. Most of this land was government owned and only 6-7% was privately owned. The SBW also estimated that the availability of shrimp post-larvae in the state per year was about 970 million which was considered enough to stock the possible 14,000 hectares.

4. Meanwhile the FD was actively promoting fresh water aquaculture especially through the Economic Rehabilitation of the Rural Poor Scheme (ERRP) that attempted to help the very poorest by making available tanks/ponds and inputs. In one such exercise, the Assistant Director of Fisheries, M G Rao, in the Polur Canal region of Ganjam, came across a few ponds with saline soil, which of course, ruled out major carp culture. Not wanting to disappoint the beneficiaries, he took a chance and stocked the saline tanks with P. monodon juveniles which were abundant in the Polur canal and found to his surprise that they grew quite well. The surprise was due to the fact that it was assumed then, as now, that in confined tanks salinity would rise and fresh water would have to be pumped to rectify the situation, thus affecting cost-effectiveness. M G Rao had disproved it. The time was late 1981. He reported his findings to the SBW and the Fisheries Department and was, soon after, transferred.

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5. Obviously there were enough brackishwater development enthusiasts in the upper regions of the department. The findings were discussed in the department, particularly at the SBW District Review Meeting which suggested that a 3 pond/3 crop trial should be undertaken to test the new technology. The problem of course was that there were no funds to do so. Undaunted, Mr Badapanda, the new Assistant Director of Ganjam and his superintendent, Mr. Patnaik, persuaded the ERRP beneficiaries with saline ponds to allow their use for controlled experiments and in course of time found that the technology not only worked but also had very encouraging production rates. The Fisheries Department was rightly proud of its finding and the Rrector took the Finance Minister along to look at the experiment. In fact he saw to it that a catch of *P.* monodon was shown to the Chief Minister when he had visited the College of Fisheries in Gopalpur.

6. At the end of 1982, there was a high level meeting in Bhubaneswar to review ERRP programme. Obviously the Chief Minister was not very pleased with its performance. Fisheries programmes in ERRP had done better than the others provided you were satisfied with relative positions. The Chief Minister, whose pet project the ERRP was, wanted to see if the project could not be given a shot in the arm. He remembered being told about the shrimp farming in Polur area and ordered that 3000 such ponds be taken up in the same year under the ERRP fallowed by another 2000 the next year.

7. The Fisheries Department, with limited funds and its brackishwater staff already stretched thin in the SBW, took up the task and tank excavation began in Puri and Ganjam districts in February-March 1983 and stocking of few ponds was undertaken in August 1983 and the first harvests came in November 1983. It had been exactly 2 years since M G Rao had quite by accident come across the possibility.

8. Even as the work had been begun. the Director of the Fisheries Department and his colleagues had realized that a government department with its bureaucratic rigour and financial constraints and administrative regulations was not the best engine for such development work. They suggested to the government that a new agency be created, funded by a planned budget and manned by the fisheries department officers, and essentially under the technical guidance of the fisheries department, but as an independent and autonomous agency with a multi-organizational board to undertake the development of brackishwater fisheries. The government, or perhaps the Chief Minister, okayed it and the BFDA came into existence in August 1983. With the creation of the BFDA it became possible to offer subsidies to brackishwater , culture the same way as FFDA did for fresh water aquaculture.

II. The project

9. The fisheries department implemented the ERRP scheme by giving technical help and inputs thiough the SBW while identification of beneficiaries and the financial and executive support came from the Block Development Officer. In the new BFDA, the fisheries department still gave the technical guidance but through officers deputed to the BFDA who answered to a Chief Executive Officer who in turn answered to a board at the district level. The Board has the Collector as its chairman plus representatives from the fisheries department and all other concerned departments and from nationalized banks. Four BFDAs were planned, one each for the coastal districts, but for the time being only two have been formed, each with two districts under them.

10. There are essentially five modes of brackishwater culture promotion in which the BFDA is involved. But only two of them are completely executed by the BFDA. In other cases the BFDA monitors and provides inputs of one or the other sort. They are :

(a) Area Development Approach Programme (ADAP) aimed at marginal farmers. The pond is constructed free of'cost to the beneficiary and 25% of the working capital is provided as subsidy for a fixed period, usually the first year. The size of ponds is usually 1.25 acre. The schemes are financed 50% by the Government of India and 50% by the Government of Orissa. The programme is monitored by the BFUA.

(b) Integrated Rural Development Programme (IRDP) implemented by the DRDA. The scheme is aimed at small and marginal farmers and provides 33 1/3 % subsidy for the, scheduled. castes and a 50% subsidy for the scheduled tribes on capital investment and working capital,

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and the rest is offered by banks under DRI of 4%. The scheme offers 0.5 acre ponds. The BFDA monitors the scheme.

(c) Economic Rehabilitation of the Rural Poor (ERRP). The programme is implemented by the Block Development Officer and is aimed at the poorest, those whose earnings per year are less than Rs. 1200 and who own no economic assets like land. The pond is given free of cost and the first year's inputs are covered by 100% subsidy. This programme is monitored by the BFDA. Pond size is 0.5 acre.

(d) Bankable scheme. Implemented directly by BFDA, this scheme is open to anyone at all and offers a 25% subsidy on capital cost and helps in getting soft loans from the nationalized banks.

(e) Own Resources Scheme. Implemented directly by BFDA, this scheme is open to anyone who has his own resources. BFDA offers a subsidy of 25% on capital cost and technical support.

11. The latest available figures of accomplishment in these schemes to which BFDA offers technical, financial and other services are (October 1984 figures) :

Scheme	No. of beneficiaries	Area (ha)
1. ADAP	7	4.00
2. IRDP	80	18.63
3. ERRP	540	134.98
4. Bankable scheme	89	57.74
5. Own Resources Scheme	34	73.94
Total	810	289.29 ha

The ERRP scheme is the largest, covering 66 % of the beneficiaries and 46% of the land.

12. It must be pointed out that the Government of Orissa, at the suggestion of the Fisheries Department, has frozen all land identified by the SBW as suitable for aquaculture, exclusively for shrimp culture. Alternative use would require the permission of the Fisheries Department. Further, it has reserved 75% of this land for the ERRP programme.

Considering the fact that a majority of the programmes will be under the ERRP and considering that this programme caters to the very poorest, this case study will concentrate on the ERRP and restrict itself to the efforts in Puri district, where most of the activity has taken place.

III. The **Technology : Confined Tank Shrimp Culture**

13. The way it should be :

When the waters recede in the Chilka Lake, excavation of ponds begins. A metre of soil is removed and used to build dykes all around. Surrounding a clusfer of ponds is **a** protection embankment faced with stone. The pond bottom is ploughed. !n June-July the rains come and fill the ponds. After 3 days, 50 kg of lime is added. All numbers are for a !/2 acre pond. Soon after, 650 kgs of raw ccwdung, 10 kg of single super phosphate, and 10 kgs of urea are added. The pond is stocked with about 4000 25-40 mm P. monodon juveniles. The feeding consists of groundnut cake and chopped snail meat in the following protocol :

(0.25 kg of cake + 0.25 kg of snail meat)/day for 30 days.
(1 kg of cake + 1 kg of snail meat)/day for 30 days.
(2 kg of cake +2 kg of snail meat)/day for 30 days.

In three months, the shrimp reaches 180 mm size (or 40 counts per kg) and the production is expected to be about 62.5 kg and sell for an average of Rs. 65/kg.

14. The way it is :

During the first culture when all inputs are paid for :

no one ploughs the pond bed;
cowdung is used but very few use fertilizer usually because supply and availability is erratic;

– snail meat is fed in excess because they believe it fattens the shrimp; Chilka Lake mud is also fed (and the logic seems sound considering the benthic algae in the mud!).

Upon harvest the sales take place to middlemen under the supervision of BFDA officials who ensure proper rates. The farmers are required to set aside half their earnings in post office savings banks to be used for the next culture's working capital when subsidy ceases.

15. During the second culture, when subsidy and inputs cease :
   – no one ploughs;
   – time is added if available and affordable;
   – cowdung is added if available
   – no fertilizers are added'
   – the groundnut cake ratio is reduced and often stopped altogether;
   – snail meat is increased.

16. The actual implementation goes somewhat like this :
   (a) Village level workers enumerate the community to fit criteria;
   (b) The BDO with village leaders selects beneficiaries at meetings in the village;
   (C) The BDO's office gives out contracts for pond construction and this is supervised and certified by fisheries department/BFDA engineers;
   (d) MPEDA arranges 5-day training camps for beneficiaries where participants are given an allowance of Rs. 5/day;
   (e) BFDA with MPEDA support arranges for inputs of fertilizers and feed;
   (f) The fisheries department supplies seeds at 20 p/seed;
   (g) Fisheries department/BFDA offer technical backup in the field;
   (h) BFDA supervises harvest/sale/savings.

   After the first harvest, all this ends and the farmer has to fend for himself though he still can and does seek technical help from BFDA/Fisheries Department.

17. Very few beneficiaries undertake soil preparation and treatment with fertilizers because they are not completely convinced of its necessity, especially since, they say, shrimp in Chilka Lake seems to grow well without treatment. Some are convinced when problems arise and are overcome by timely treatment with fertilizers.

18. The five-day training often ends up as little more than two to three days of lectures in batches of 50, and the allowance of Rs 5/day is paid till resources last. MPEDA claims it has very little funds; the fisheries department claims it has no funds for such activities. The main points retained from the training are that if you add cowdung and lime and stock and feed the shrimp, provide shade during the moulting period, and call the fisheries department/BFDA man at the sight of trouble, all will be well. Symptoms of trouble are juveniles coming to the top or near embankment, juveniles being carried by adults and change in water colour/taste.

19. The fisheries department is prompt with help. Earlier the solutions were to fertilization, agitation and oxygenation or harvest to make the best of a bad deal and shift to a new pond. These days one makes the best of a bad deal and tries one's luck the next year in the same pond.

20. Harvesting is done with traps and leaders. The technology is very similar to the traditional 'jano' culture where areas are enclosed with dykes and bamboo fences and flooded as high tide (along with fry + seed) and dosed for culture and harvested. One finds that the new technology is being transferred freely among the people and being adapted. Protocols are rarely followed but one notices a learning process in action. The attitude of the farmers towards shrimp seems the same as towards domestic animals. They share their food with the shrimp and choose to live near them.

21. Some of the technical problems that have already arisen and that may arise are :
   – a shortage of juveniles; already they are being transported across the state and local juveniles sell at 2 to 3 times the cost of Govt. supplied juveniles; the need for a hatchery seems obvious;
   – there have been some questions about the long-term viability of confined tank culture in terms of soil salinity sustenance and soil ecology;

- some questions have been raised about the impact of the ponds and seed collection and collection activity on the lake shore ecology and on the capture fisheries;
- dyke erosion is a serious problem and will, if not checked, reduce the life of ponds;
- there seems to be a need to develop water management technologies that will make possible two crops/year.

22. *Financial viability*

The financial viability of a 1/2 acre confined tank/pond is estimated (without subsidy) to show its essential feasibility. A second crop calculation is done to show why it is necessary to try and develop second5 crop capability. The labour is assumed to be a family contribution and in practice is. The labour demand, daily and seasonally, is such that it can be, and is an activity complementary to existing fishing activity and does not substitute or clash with present activity.

23. *Costs and returns of 1/2 acre confined tank shrimp farm (1 crop)*

(a) **Capital** *investment*

(a) 1. *Earth work :*		*Expected life*
1350 m³/Rs 307/100 m³	*4144.50*	**10 years**
450 **m³/Rs 335.60/100 m³**	*1510.20*	*10 "*
(a) *2. Harvesting gear*		
10 traps/Rs 10 each	**100.00**	1 **year**
5 bamboo fences/Rs 20 each	**100.00**	1 "
40 poles/Rs 0.70 each	*28.00*	1 "
(a) *3. Guard Hut*	**100.00**	
Total	**5982.70**	
Depreciation annual	**893.47**	
(a) **4. Pond maintenance 30 m-d at Rs. 8**	*240.00*	
(a) **5. Depreciation + repair + maintenance**	*1133.47*	

(b) *Operational costs*

(b) **1.** *Lease value* **of ½ acre water area D.875 composite area @ Rs. 250/ acre/year**	*218.75*
(b) **2.** *Fertilizer*	
(a) **Lime 50 kg @ Rs. 2.5/kg**	*125.00*
(b) **Single super phosphate 25 kg @ Rs. 1.5/kg**	*37.50*
(c) **Urea 25 kg @ Rs. 1.5/kg**	*37.50*
(d) **Cowdung 1250 kg @ Rs. 50/1000 kg**	*62.50*
(b) **3.** *Prawn seed 4000* @ **Rs. 0.20**	*800.00*
(b) **4.** *Feed* **(.25 kg groundnut cake + .25 kg snail meat) x 30 days**	
(1 **kg groundnut cake + 1 kg nail meat) x** *30* **days**	
(2 **kg groundnut cake + 2 kg snail meat) x** *30* **days**	
Groundnut cake @ Rs. 2.60/kg snail meat @ Rs. 0.40 kg	
Composite cost at 1 : 1 mix Rs. 1.50/kg 195 kg @ Rs. 1.50 kg	**292.50**

(b) 5. *Labour* **input to culture**

(contributed by family at no cost)

Fertilization (purchase + activity)	**9 m-d**
Seed (purchase + stocking)	**1 m-d**
Purchase of feed	**6 m-d**
Feed preparation and collection	**25 m-d**
Harvesting	**10 m-d**
Purchase of gear	**1 m-d**
Hut construction	**1 m-d**
Total	**53 m-d**

Opportunity cost **of 53 m-d @ Rs. 8/m-d = Rs. 424**

Total operational cost *1997.75*

(c) Total costs **3131.22**

(d) *Returns* **(60% survival 40 cts/kg)**

(e) Net income **1243.78**

24. Costs and returns of ½ acre confined tank shrimp farm (2 crops)

(a) Capital investment *5982.70*

Depreciation + repair + maintenance **1133.47**

(b) Operational costs

(b) 1. First crop **1997.75**

(b) 2. Second crop **1779.00**

(c) Total costs **3776.75 + 1133.47 =** **4910.25**

(d) *Returns*

4375.00 x 2 **8750.00**

(e) Net income *3839.78*

IV. The people

25. The programme of ERRP in confined tank shrimp culture in Puri District is restricted mostly to Krushna Prasad and Bhramgiri Blocks along the Chilka Lake coast (north-east coast of the largest brackishwater lake in India). Six clusters of ponds were studied, which included 203 beneficiaries from 17 villages and two hamlets which included 10 interior villages. Of the total beneficiaries 107 (52.7%) belonged to fishermen's castes and practised fishing; 41(20.19%) belonged to non-fishermen's castes and *also* practised fishing and 55(27.09%) belonged to non-fishermen's castes and did not practise fishing.

26. Almost none of the beneficiaries owned any land; the few who did, owned patches of less than half an acre and did not cultivate their lands themselves, prefering to lease them out to share croppers. The predominant occupation was fishing and the non-fishing occupations were share cropping, agricultural labour, general labour (road work, pond construction), and odd jobs like running errands, collecting firewood, bamboo basketry and trap making. Almost none of the families owned cattle though a few of the agricultural families did have a cow or two.

27. The only outside influences the community is exposed to is the visits and contacts with middlemen/traders and contacts made at tea shops, freezing plants, markets and during trips to Puri. Government officers, extension workers, radio and the print media seem to have little or no influence on the community.

28. The seasonal routines are :

Chilka Lake fishing goes on all year and the peak seasons are April-June and November-December. Jano fishing also goes on all year but peaks during October-December.

29. Daily Routines

The fishing activity consists of going out to Chilka early in the morning for a few hours before sun-up to collect traps and going out again late in the evening to lay the traps. Occasionally, especially so after the advent of mini-trawls, some of the fishermen stay back to prevent

destruction of their traps. The rest of the time is spent in leisure and a iittle time in repairing traps and boats. The men spend most of their leisure playing cards and gossiping. Women collect firewood and help out with oil seed gathering from the wild and, of course, look after domestic chores. They also concentrate on marketing the catch at the local markets. Children usually drop out of school at the age of 10-12 when they begin to practise their profession in earnest.

30. Houses are thatched with mudwalls and common possessions include bicycles, radio sets, some silver jewellery, aluminium vessels; the odd man wears a watch. The economy is overwhelmingly dominated by fishing and fishing-related activities. A small percentage, less than 5% owned boats, which they shared freely with others, to reach the traps. A large majority owned traps, often 40-100 of them per family and a small majority had no assets and worked as labour. Interestingly the gear usage in Chilka area is castewise and the communities studied are exclusively trap users.

31. Indebtedness is a common and accepted phenomenon. Some loans are handed down through generations, others are acquired for celebration of rituals, to finance purchase of fishing assets, and often for medical expenses. The sources of loans are primarily moneylenders who are the upper caste traders/middlemen. The moneylenders in this region do not charge a direct interest. tnstead they acquire exclusive buying rights of produce at rates less than market rates which can be as little as Re. I/kg for ordinary shrimp to Rs. 10/kg for P. monodon.

32. The market chain begins at the lake shore to middlemen and passes through at least two levels before it gets to urban markets and exportersiprocessors. The margins, as expected, are phenomenal.

33. With 60 days a year on an average lost to bad wather and festivals, trap owners and boa? owners (who also own traps) were making Rs. 20-25 minimum per day and as much as Rs. 60 Rs. 150 during the peak season adding up to Rs. 10,000, while labourers made about Rs. 12 a day or a share of the catch that put them in the Rs. 3500-6000 income bracket. While they cannot be classified as well-to-do, they are definitely not the poor that the ERRP seeks. However, the difficulty in computing incomes and a lack of land holdings affords easy entry with ERRP schemes. Major expenditures are marriages (Rs. 5,000) and festivals which can cost as much as Rs. 500/family for clothes and ritual costs and buying fishing gear.

34. When asked what they did with savings and what they would do with increased earnings, the people said they would repair and upgrade their houses, buy agricultural land and slowly shift to agriculture because they see no future for Chilka Lake fishing due to environmental damage of silting/pollution/overfishing.

35. The fishermen practise two types of fishing : traps in Chilka lake and Jano fishing (enclosing near shore areas with dykes and bamboo fences and doing tidal-fed pen culture). The former accounts for 75% of the fishery and is individual/family based and the latter community run and fished individually and often shared equally. Jano fishing accounts for about 25% of the fishery. Jano earnings are often used for community activity, feasts, rituals and for temples. Most Jano lands and several parts of Chifka need a lease for fishing and this is taken by cooperatives from the revenue department. Sharing of lands is traditional and informally negotiated by villages and trespass is dealt with swiftly and ruthlessly.

36. The ERRP scheme directly affects the Jano culture. Where the Janos are not productive there is no conflict in the conversion. But well-organized villages with productive Janos want their areas untouched and the conflict level is high and tensions exist.

37. The restriction of 75% of the land for ERRP does not seem to concern anyone as with unreliable income data and no land holdings all of them are technically acceptable into the ERRP scheme and the Fisheries Dept/BFDA does seem to have spread the word that eventually all will benefit. So selection has not generated any conflict. Also the swiftness of the implementation did not give much time to opinion-and-influence-peddlers to get into the act. Should enough allocations not be available in the future, this is a potential high-conflict issue because the people insist that all should benefit and that productive Janos should be left alone. With the allocation of Jano lands to the BFDA programme, community rituals and activity have been affected, and the community does feel upset about this. Even with increased incomes they are unorganized and are unable to collect funds for such activities.

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38. There seemed to be no reservation about undertaking new culture activities, as the people felt that this was merely an improvement over Jano culture and they also felt attracted to the financial return as the programme was completely free, at least for the first crop.

39. The community has a good working relationship with the Fisheries Dept/BFDA and is not afraid to express its views. Its feelings are not so cordial to other departments.

40. Some of the positive and negative impacts of the new culture method were identified as :

(a) people, especially agriculturists, are beginning to object to free gathering of snails from their property. With increasing demand, the price of snails and the conflict potential may increase. On the other hand, people report that relatives are coming closer together by helping out with snail collection.

(b) Cowdung gathering is also becoming difficult. There are conflicts with those who have other uses for cowdung. With little livestock resources, this is a factor that can limit rapid expansion.

(c) Seed collection has become a thriving occupation and adds substantially to people's income; even children participate in this activity.

(d) The time taken to stock ponds is increasing because of seed scarcity.

(e) People complain that technical support from BFDA/fisheries department during the second culture period is poor.

The shift from daily earnings to deferred earnings is causing some problems. There is a tendency to overspend, then use up the savings kept aside for the second crop.

(f) The elderly are getting closer to the family as they are seen as economically useful providers of watch and ward and not merely as dependents. People, especially the elderly, seem very happy about this.

(g) On the one hand, the hold of moneylenders on people is loosening, as higher earnings help people pay up their debts in cash instead of buying rights; on the other hand, it delivers those who face an emergency into the clutches of the moneylender. The people feel that the enterprise is risky and they need some programme (insurance?) to help them out when in trouble.

(h) Illegal pond construction is going on, often blocking shore access and fishing access, thereby leading to conflicts.

41. The people were asked what their needs were. Their response :

(a) better road connections,

(b) drinking water,

(c) electricity for their villages,

(d) soft loans for working capital during subsequent crops,

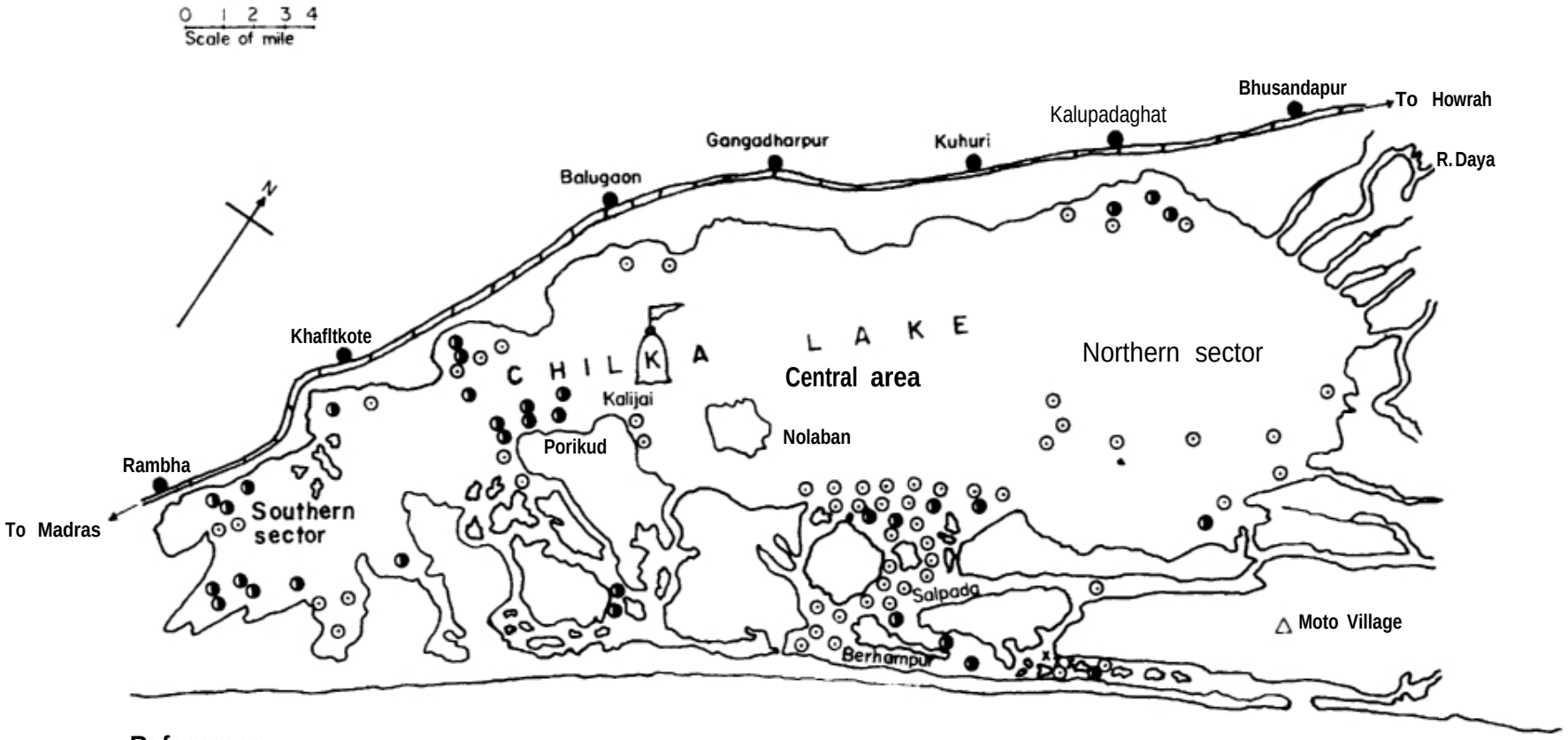
(e) local depot for inputs,

(f) that everyone should be allotted ERRP and that their Janos should be left alone.

42. Finally some of the factors that might mitigate conflict were identified in in-depth discussions and they were :

1. The people being poor as a rule, there is not much variation in lifestyles and earnings.
2. The proposed new activity is similar to their present activity (fishing), so no new status is attached to acquiring new technology.
3. Everyone believes they will get it eventually.
4. The community is poorly organized and politicized unlike in Ganjam where the conflict level is higher, especially in selection of beneficiaries.
5. Single-caste villages and small communities.

Chilka map showing the prawn fishing and crab catching grounds and the oyster bed



References:

- Prawn fishing grounds
- Crab catching grounds
- Oyster bed

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Case Study on Confined Tank Shrimp Culture in Chilka Lake, Orissa, India

Case Discussion Summary

Structure of Discussion

The following plan **was followed :**

1. Explanation of technical and socio-economic aspects
2. Questions of success on social terms
3. How to expand the project

Is the project a social "success"?

A number of issues were raised :

-- proportion of inhabitants who benefited
- effect on family income
- tensions arising in society
- changes in land tenure
- subsidies and self-reliance
- benefits to middlemen

This led to questions of criteria for success

- are there time boundaries?
- is it a numbers game?
- does tension imply failure?
- is it a process leading to other positive developments?

The group concluded that the Orissa experiment did seem relatively successful and worthy of expansion

Design for socially feasible expansion

The Department requests funding for 2000 ha expansion. To ensure that this is socially feasible we recommend :

Appointment of extension staff :

- to survey villages
- to assist with the technology transfer
- to assist in processing lease forms

Better management of funding :

- a search for an appropriate organizational form to ensure that loans are timely and the loan recovery good (cooperatives? village committees?)
- title to the ponds could be mortgaged to the banks

Rethinking of land tenure

- need to study the likely effects of the project on 'jano' land
- study the ways in which 'jano' is managed and income from it is generated and utilized
- there might be a need to consider compensation to the community for use of jano land how would that operate?

Other forms of expansion be considered :

Expansion might not just be *on* a geographical basis. We should also consider :

inclusion of other social groups

- intensification of present scheme, including a hatchery
- integration of scheme vertically with marketing/or seed collection.

There may be trade-offs between these ideas and geographical expansion.

The government should further explore social consequences in the pilot scheme before expanding it.

Appendix 8

CASE STUDY ON EXTENSION OF CAGE AND SHELLFISH CULTURE IN PHANG NGA, THAILAND

Case Material I

PLANNING NOTES ON COASTAL AQUACULTURE IN PHANG NGA, THAILAND

by

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Policy Background

The project to extend cage culture and shell fish culture to small fishermen in Phang Nga has to be looked at in the context of the characteristics of Thailand's economic development policy. Fish is one of the most important items of the Thai diet, second only to rice. The Government has accorded a very high priority in its national development policy to the twin tasks of enabling development and the improvement of the socio-economic conditions of the rural poor, and of providing adequate supplies of important food items at the lowest possible price to its citizens. Thailand is one of the very few developing countries which (being basically an agricultural country) has not only been able to produce enough to feed its population but also has become a major exporter of food.

Fisheries Development

Fishing, both in terms of capture and culture, has had a long tradition in Thailand. Until quite recently, in fact until the Second World War, fishing was a subsistence activity in which people participated to provide fish for their own consumption rather than for trade. The main activity was in inland waters while the fishing along the coastal region was limited. Two factors predominated in converting fishing from subsistence to a production activity. On the one hand, with increases in population and therefore demand, there was a need to intensify fishing technology and effort to increase the catch: This called for full-time rather than part-time activity, which led to fishing as an occupation. On the other hand, during the post-Second World War period, Thailand, caught up in the world development trend of industrialization of fisheries, went into joint ventures and for considerable investment on modern fishing craft and gear. The focus was on the marine sector and away from inland fisheries. Marine production increased dramatically until there were too many craft and gear exploiting a limited resource. Commercial fishing moved out to sea to overcome resource depletion in the coastal areas. But the small fishermen remained and their socio-economic conditions were severely affected.

Why Aquaculture in Phang Nga?

The situation was unusual. Larger commercial craft which wanted to go out to overcome resource depletion in coastal waters were constrained by energy costs. The large numbers of small fishermen and farmers who did, and do, contribute substantial amounts to the total landings, found themselves being edged out of fisheries which was depleted to a level where economic exploitation was not possible.

In Phang *Nga,* incomes of fishermen declined far below the national average, and this forced them more and more to switch to manual labour in tin mines or into various tourism-based operations, and fishing activity receded. The government wanted to rehabilitate the poverty-stricken fishermen by providing them with viable fishery-related alternatives. And this was the beginning of the process that resulted in the coastal 'aquaculture' project being executed by the Department of Fisheries in collaboration with the BOBP.

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The Planning Process

The aquaculture project in Phang Nga set out to develop fishermen and fisheries. This, at the time, ran counter to trends. Most small-scale fisheries development projects were either developing technologies or testing them for their techno-economic viability. Very few of them saw beyond the technology stage or for that matter had the funds to move into action programmes of technology transfer to actually take the technologies into the mainstream of fishing communities in order to benefit them.

Four Basic Questions for Planners

The formulation of the Phang Nga Project addressed itself to four basic. questions that would establish the viability of the project :

1. Who is the beneficiary of the project?
2. Who will implement the project?
3. Who will plan the project?
4. Who will make the decisions?

Who Makes the Decision?

While it was obvious that in the case of Phang Nga, being a Government project, the planning and implementation would have to be undertaken by the Department of Fisheries personnel, the crucial first question was to understand the decision making structure which ultimately would decide on the project plan and its content. Most decisions are taken by politicians who are responsible and accountable to their constituencies. So it would seem that working on a rural aquaculture project to benefit poor fishermen would fit exactly into the needs of such decision-makers and, therefore, into the Government's guidelines. Unfortunately, the voices of the poorer groups, in spite of their large numbers, are not strong enough to influence their leaders. So the fisheries development officer's role had to expand to include a form of advocacy on behalf of the beneficiary to his or her superior, to persuade them to take the "right" decisions. Thus a need was felt to carefully consider the political decision-making structure during planning to ensure that the effort and the resources would benefit the beneficiary group maximally.

For Whom is the Project?

The project set out to benefit small fishermen of Phang Nga. Closer viewing of this group by the planners made them realize that socially, economically and culturally, small fishermen were not a homogenous group and there was a need to understand them and their needs at the village level. For, only out of such understanding would the project be able to evolve technologies to answer their needs, fit their environments and abilities and successfully blend into the mainstream of their lives. Two socio-economic surveys were undertaken for the planners by independent groups of social scientists to give them a better understanding of the beneficiary groups.

The Concept of Advantage

Several issues surfaced as the planners went about understanding the problem and trying to evolve solutions and programmes. First was the concept of advantage. The planner looks at the productivity and the efficiency of economic rent of land, labour, capital used in the project, as well as its viability and profitability. Small fishermen were found to have a different way of determining the advantage to themselves. They worried about what the technology would make for them (rate of return), the amount they would have to invest, how long would it take to recover their investment, what would be the risks. While the perceptions of the planner and the fishermen are reasonably compatible they differ dramatically in terms of priorities of concern. And it was realized that the success of the plan would depend on how well the planners/implementers would be able to communicate to the concerns of the fishermen. This of course would require not only an understanding of the fishermen's perspective but more importantly rapport and credibility. There was a need felt to get the fishermen to have faith and confidence in the planner/implementer to ensure the success of the project.

Technology Transfer : Seeing and Doing Helps!

Seeing is believing. And practical and visible demonstration (without recourse to too much abstract calculation) of profit and returns was found to be necessary to convince fishermen of the economic viability of the scheme.

The technical staff decided on some basic criteria to decide on the species and the technologies : the species had to be a fast growing one; fish seed had to be easily available either from the wild or from hatcheries; the species had to be disease resistant and easy to raise in confined areas; the fish species had to be in demand and had to fetch high prices. Considering the environment and the market conditions, the technicians selected seabass, grouper and shell fish like cockle, mussels and oysters, all of which were and are in high demand in the Thai internal market and fetch competitive prices. The culture technology was also well known. Knowing and doing are quite different. Fishery technologies are site ecosystem specific and require local demonstration, debugging of problems and development of technologies. Consequently fisheries technologists must work with fishermen to see the technologies to success. This aspect was found to be crucial. Doing creates confidence. Once the fishermen learn by doing and realize that the process is vulnerable to their management they will make it their own. However, there was found a need to assure the fishermen that fisheries technologists would be always accessible to them in case of special and unforeseen problems. The combination of doing all trials and tests on-site with fishermen and promoting self reliance by slowly handing over activities to them on the one hand and ensuring the facility of referral for special problems were found to be the key factors leading to successful technology transfer in Phang Nga.

Interestingly, when gross harvest data after the first harvest turned out to be dismal, making the planners seriously reconsider the viability of the technology, it was the fishermen who noticed that gross aggregate figures hid the occasional success stories. They studied the reasons why a few of them had done well, adopted the methods and overcame the problems. Non-involvement of the fishermen in the research and development process would have in all probability led to a closure of the programme or at least to change of technologies!

One Technology, Many Problems

As the project evolved, the planners noticed that while the technology was being adopted and was increasing incomes and producing fish, several socio-economic needs of the people were going unmet. Problems like poor sanitation and, lack of health services, drinking water, education, family planning or diversified employment, were eroding the benefits that tha fishery programmes were bringing in. The planners realized that they had to go beyond the functional confines of their department and help make available a variety of technologies and services in order to help fishermen and not just the fishery. This needed a modification and expansion of the programme to ensure holistic development.

Flexibility and Continuity

Learning by doing was the main approach of the project. That not only made it possible to involve fishermen in technology development but also made extension easier because success spread from fisherman to fisherman. Learning by doing also required a certain flexibility in planning as new problems came up, requiring new solutions and mid-course changes.

The project is still in progress, and problems are arising as the technology and the community are evolving · problems like a tendency for the benefits to be concentrated in few hands; environmental problems of aquaculture; the effect of the sites on water traffic; the non-availability of some types of seed; shortages of cheap feed; diseases of certain species; and the control of the marketing by a few middlemen. But we hope that in working with and for the fishermen we will be able to evolve solutions and apply course corrections so that the basic objectives of the project are met.

Case Study on Extension of Cage and Shellfish Culture in Phang Nga, Thailand

Case Material II

SCRIPT OF AUDIO-VISUAL ON
PHANG NGA AQUACULTURE DEMONSTRATION PROJECT

Note : This *script* was written for an audio-visual *prepared* early 1983 and reflects project *progress till then.*

Visuals	Voice and Sound Effects
1. Bay of Bengal Programme presents (text superimposed on waves)	Surf sound and music
2. Aquaculture demonstration project at Phang Nga, Thailand (Text super-imposed on aquaculture shot)	Music
3. Map	Phang Nga bay lies in the south of Thailand, bordering the Bay of Bengal.
4. Scenic shot	It is known for its scenic beauty, and attracts many tourists.
5. Limestock rock formations	The bay is dotted with numerous islands. Some of them are just limestone rock formations jutting out of the tranquil waters.
6. Mangrove vegetation	The land fringing the southern shores of the bay is covered with dense mangrove vegetation.
7. Wide-angle shot of the villages: on shore and in tidal zone	Quite a number of villages are found here, either on the shore, or on stilts in the tidal zone.
9. Fisherfolk portraits	More than 8,000 people live in these villages. Many of them make their living by fishing in the bay.
10. Fisherfolk	Their catches are poor, their incomes and living standards are very low. Now, thanks to a new project, this unhappy situation is changing.
11. Map of villages *Text slide :* Ko Pan Yi Ko Khiam Sam Chong Ko Mak Nai Ko Mai Pai Bang Patana	Why? Because six of these villages – Ko Pan Yi, Ko Khiam, Sam Chong, Ko Mak Nai, Ko Mai Pai, Bang Patana – are the site of an "aqua-culture demonstration project".
12. Happy fisherfolk	This pilot project seeks to provide a model for rural fishery development and for improving the living standards of poor fisherfolk.
13. Text slide : Thailand Department of Fisheries in coopera-tion with FAO/SIDA Bay of Bengal Project	It is being executed by the Thailand Department of Fisheries in cooperation with the FAO/SIDA Bay of Bengal Project which provides external funding.
14. Close-ups of finfish, oyster, cockle, mussel	Foltowing studies from a survey, four fish species were recommended as suitable for fish culture in the area : finfish, oyster, cockle, and mrussels
18. Cages	The goals of the project include setting up of pilot pens, cages or rafts for aouafarming

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Visuals	Voice and Sound Effects
19. Demonstration	Practical demonstrations of modem aquafarming techniques and training of villagers are essential for the project.
20. Villagers in assembly hall	Stimulating community development through self-help and collective action is also essential to the project.
21. Cage culture	Cage culture of finfish has been the biggest success of the project so far.
22. Long shot of cages	At present, finfish are being cultured in more than 500 cages in six Phang Nga villages.
23. Sketch Masses of finfish; cash	So far the finfish yield in Phang Nga has exceeded 30 tons. Their total farm gate value is nearly 1.5 million baht or about 60,000 dollars.
24. Cage	A typical cage measures 3m x 3m x 3m and is made of synthetic webbing. It is rigged to a floating raft built of *sawn* timber and polyfoam floars.
25. Sketch	This is how the cage looks under water.
26. Fishermen constructing cage	The fishermen make the cages themselves. Material needed includes timber, webbing anchor, floats and anchoring ropes.
27. Raft of six cages	A raft consists of six cages.
28. Sketch of intelligent Phang Nga fish farmer	Normally a cage should cost more than a hundred and fifty dollars, bu? the Phang Nga farmers have shown great ingenuity in bringing down the cost.
29. Mangrove poles	They use mangrove poles available in the area in plenty to build rafts.
30. Float shot	Polystyrene (discarded by tin mines in the near by Phuket area) is used as floatation material.
31. Trash fish	The trash fish (they catch in their regular fishing operations) is used to feed the fry and thus is a "zero-cost" item.
32. Money	These innovations have made fish cage culture profitable at Phang Nga.
33. Text slide : seed -- feed – space -- market	What factors influence the growth of finfish cage culture? They are four – seed, feed, space and market.
34. Seabass fry	For seed, the project gets seabass fry from government hatcheries in the area.
35. Grouper fry collected through traps	But grouper was also artificially spawned last year at a hatchery in Satut province. This promises to be a new source of supply.
37. Close-up of trash fish	Trash fish is caught by using dipnets and push nets and used for feed.
38. Expanses of water	As for the third factor, space, there are large expanses of water spread suitable for cage culture.

Visuals	Voice and Sound Effects
39. Guard cottage on raft	But the cages have to be set up close to the villages to ensure regular feeding and to safeguard against poaching.
40. Restaurants -- people eating finfish	Seabass (plakapong in Thai) is one of the most popular table fish with the Thai people.
41. General shot of oyster trays	Let us now turn to oysters. These are cultured in trays suspended from rafts. This is known as the "hang drop" method.
42. Oyster culture on rocky bed	Here we see oyster culture on the rocky bed at Ban Ko Khiam village.
43. Trays housing oysters	A tray (1 m x 2 m) in size can house 200 to 300 oysters.
44. Oyster spat	The oyster spat or seed (that is cultured to marketable size) is caught or lured by using spat collectors.
45. Close-up of oyster spat	A deposit of oyster spat forms on the collectors in course of time.
46. Transfer of spat collector	The spat collectors are later transferred to the rafts for culture.
47. Oyster after one year of growth	Here's cultured oyster after one year of growth. It is 7-12 cm in size.
48. Oyster culture by private agencies	Progress of oyster culture at Phang Nga has not been spectacular. But the project work has generated interest in oyster culture among some private agencies.
49. Close-up of cockle	Cockle culture was the first success achieved by the Phang Nga project.
50. Cockle culture	There was a good cockle harvest from a 3,000 sq.m demonstration plot in 1980. It fetched more than 20,000 baht.
51. Text slide: $90,000 for cockle culture development	The provincial government of Phang Nga then provided $90,000 for further development of cockle culture.
52. Cockle farms	At present cockle farms like this one cover 180 acres in six villages.
53. Fishermen and cockle culture sites	Fishermen are shown here demarcating their cockle culture sites.
54. Transfer of cockle seeds	Cockle seeds are being transferred from truck to boat for culture.
55. Poaching sketch	Last year the harvest was lower than expected, partly because of poaching.
56. Private parties : cockle plots	But the viability of cockle culture is not in doubt. Private parties have now received permission from the government to set up cockle plots.
57. Mussels on poles	Mussels are cultured on poles.
58. Spiking of mangrove poles	To collect mussel spat, mangrove poles from the area are spiked at various water sites but collection so far has been meagre.

Visuals	Voice and Sound Effects
59. Transplanting of mussels	Large quantities of new green mussels have therefore been transplanted into Phang Nga to increase spat fall.
60. Transport of mussel spat	Poles with mussel spat are transported to the culture site.
61. Community hall	The Phang Nga project has also tried to improve the basic facilities available in the area through "collective action"
62. Windmill and 63. Walkways	A wind-mill driven water pump, a water tank, a shallow well, jetties and walkways – these were constructed with the help of voluntary labour.
64. Engineer in discussion	Here we see an engineer discussing (with fisheries biologists) a suitable site for a fresh water tank.
65. Equipment for tank	Villagers are helping to move heavy equipment for a fresh water tank.
66. Discussion slide	Following the success of the Phang Nga project, BOBP and the Thai Department of Fisheries agreed to extend it beyond 1981, when the first phase terminated.
67. Aquafarming	In the second phase which started in October 1981, more stress is being laid on extension of aquafarming activities.
68. Satul (map)	A second aquaculture demonstration project has also been launched, based in Satul province.
69. Cage culture at Satul	Here are some glimpses from the Satul project : – cage culture shows good promise.
70. Community hall	A community hall has been provided for the project at Ban Bakan Koei village. It serves as the base for culture trials there.
71. Training courses	Study tours and training courses will also be held for project staff at various levels.
72. Map Krabi and Trang in relation to Phang Nga	Finfish cage culture is now spreading to two other provinces – Krabi and Trang.
73. Fishermen shots	"We have encountered numerous problems" says Cdr. Swarng Charenpol, Director General of the Fisheries Department, "but we have proved with this project that even an indifferent fisherman can increase his earnings by 50 per cent. An able and energetic fisherman can more than double his earnings."
74. Happy fisherfolk	In other words, the Phang Nga project has made good progress in fulfilling the objectives of BOBP – of a better quality of life for fisherfolk.

Case Study on Extension of Cage and Shellfish Culture in Phang Nga, Thailand

CASE DISCUSSION SUMMARY

The group understood that :

1. **The project objectives were to increase incomes and to improve living conditions,**
2. **The beneficiaries were identified as small-scale fishermen in Phang Nga Bay of whom there are about 1400 households. The project presently involves 300 households in fish cage culture and 200 households in shell fish culture.**
3. **The benefits accruing to the fishermen are, initially, increases in income and employment which would reduce the need to migrate to Malaysia for work. Subsequently the project has evolved to include community benefits like non-formal education, family planning and public health schemes, drinking water facilities and cottage industries.**

The group felt that the feasibility of the project would depend on

A. *Environmental aspects such as :*

- **siltation where mussels are cultured, as experienced with similar schemes in Northern Panay, the Philippines**
- **cages obstructing navigational waterways**
- **overcrowding of cages and cockle/mussel farms resulting in productivity drops**

B. *Technical aspects such as :*

- **the shortage of grouper seeds which have become quite scarce in the wild**
- **disease problems of seabass which may affect the success of cage culture**
- **the inadequacy of trash fish availability for feed purposes with rapid expansion in cage culture.**

The group felt that the *project* **was** *socially feasible* **for the particular social situation in Phang Nga and felt that the community had accepted the project.**

Recommendations

The group felt that :

1. **there was a danger that the cages would become concentrated among a few owners and recommended that the cage culture development be regulated by an equitable scheme of licenses and permits**
2. **there was a need for research on**
   - **nutritional requirements and pelletted feeds for seabass and grouper**
   - **diseases of sea bass**
   - **hatchery technology for groupers**
3. **there was a need to monitor and study the environmental impact of cage culture and shell fish culture on a continuous basis**
4. **there was a need to monitor and study the socio-economic impact of the project on a continuous basis**
5. **there was a need to promote some group technologies and that the community development efforts be continued.**

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Appendix 9

BIBLIOGRAPHY ON SOCIO-CULTURAL, ECONOMIC AND INSTITUTIONAL ASPECTS OF TROPICAL AQUACULTURE AND SMALL-SCALE FISHERIES

Compiled by

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CLASSIFICATION

1. Aquaculture
   a. Socio-cultural Aspects of Aquaculture
   b. Socio-economic Aspects of Aquaculture
   c. Technology Transfer in Aquaculture
   d. General Issues of Aquaculture Development
2. Selected References on Social, Economic and Institutional Aspects of Capture Fisheries
3. Bibliographies *on* Socio-economic Aspects of Aquaculture and Small-Scale Fisheries

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INTRODUCTION

Published material on the socio-cultural aspects of aquaculture is scanty, as the following preliminary bibliography shows. The staff of the International Center for Living Aquatic Resources Management (ICLARM) conducted a search of its own library holdings, previously published aquaculture bibliographies, personal collections of the staff and literature retrievable from the Aquatic Science and Fisheries Information Systems (ASFIS). This search was confined to tropical aquaculture, both coastal and inland.

Social feasibility of development projects has long been a subject of inquiry in aquaculture and rural development. No attempt has been made to incorporate this large body of literature into this bibliography.

That so little literature directly related to the social feasibility of aquaculture was uncovered by this search is not surprising. It reflects the fact that technical and economic issues get priority when aquaculture potential and project feasibility are assessed. Moreover, many aquaculture feasibility studies conducted by development banks and governmental planning agencies are never published and thus are very difficult for outsiders to retrieve.

After turning up so few references directly related to social feasibility of aquaculture, it was decided to broaden this bibliography to include :

1. Socio-economic aspects of aquaculture : This category primarily includes financial and economic analysis of aquaculture. Some of these make token references to socio-cultural issues.
2. Technology transfer in aquaculture : This category includes a small number of references that deal with the process of technology transfer in aquaculture. It does not include the very large number of available references on aquaculture technology per se.
3. General issues of aquaculture development : This category includes broad regional or country overviews that assess the current status and potential of aquaculture systems. These generally deal primarily with technical, economic and institutional aspects, though occasional mention is made of socio-cultural issues, usually related to consumer preferences.

Coastal aquaculture systems and projects often have special impact upon coastal fishing communities. Therefore, a further category was included in this bibliography :

4. Selected references on social, economic and institutional aspects of capture fisheries. References included are limited to small-scale fisheries and fishing communities. The primary focus is on the Asian and Pacific regions.

This fourth category is certainly not complete, as numerous studies of individual fishing communities are not yet included. ICLARM staff plan to continue their literature search in this category and to publish a more complete bibliography at a later date.

The final category includes a listing of previously published bibliographies on the socio-economics of aquaculture. These include references on both tropical and temperate zone aquaculture.

Individuals who have difficulty obtaining locally available copies of any references in this bibliography may contact :

ICLARM's Selective Information Service
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Makati, Metro Manila
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ICLARM can provide up to 50 pages of xerox copies of desired articles free of charge. This will be forwarded via surface mail. The charge (including surface mail postage) is U.S. 90.20 per page for each page exceeding 50 pages. If you wish to receive your requested materials via air mail, ICLARM will bill you separately for the actual cost of postage.

Suggestions for additional references to include in this bibliography are more than welcome.

Norma I. Jhocson
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ICLARM, Manila
October, 1984

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