The journal of BINSP For Fisheries Management BAY OF BENGAL PROGRAMME Sponsored by the Governments of Denmark and Japan





- Encouraging fisherfolk to manage their fisheries
- Aquaculture can be a self-cleaning industry
- Finding a role for fisherfolk in Malaysia

# **Reaching Out for Effective Grassroots Management of Fisheries**

In 1990, the Buy of Bengal News published a wide-ranging interview with Dr Armin Lindquist, then Assistant Director General of Fisheries of FAO/ UN, who emphasized that "management is the only solution" to' the world's fisheries problems. In that interview, Dr Lindquist pointed out that fisheries management was the only way to ensure the future productivity and biodiversity of the marine environment and secure a livelihood for millions of fisherfolk. This is still true today. In fact, management practices have to be implemented more effectively today than ever before. This is what the Food and Agriculture Organization's (FAO's) Bay of Bengal Programme, or BOBP, as it is better known, is striving to help with in its third phase.

At 15, BOBP is a regional fisheries institution that has established itself in its member countries on both sides of the Bay: Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand. Over the years, BOBP has focussed its activities on the efficient exploitation and development of the national fisheries of these seven countries. Because of this orientation expected by member governments, much of BOBP's earlier work has been geared towards increasing fisheries production and fisheries technology development and transfer, mainly at the pre-harvest level and, to an extent, at the postharvest level. This technology-driven development thrust has led to significant expansion of the fisheries output. But it has also contributed to some of the fisheries problems we face today: too many fishers chasing too few fish, especially in the coastal nearshore fisheries; in other words, excess capacity and resource depletion.

To tackle these pressing problems, there is increasing awareness and recognition of the need for more **knowledgeintensive intervention** to manage increasingly scarce natural resources and protect the fragile environment, while still meeting the growing demand for fish, a daily and major source of animal protein in many parts of the Bay of Bengal region. Lasting solutions to the problems can only be built on a solid knowledge base and understanding of the fisheries. In future, production decisions cannot be based only on present knowledge alone. Threatened with the possible collapse of the world fisheries, the future productivity, stability, sustainability, socio-equitability, and biodiversity of the marine environment call for collective action in applying the power of management, power of persuasion, and power of enterprise to solve the persistent problems of fisheries. There needs to be a clear vision of the future. Exploiting knowledge and information to benefit its fisherfolk and people is the key to the region's future well-being.

Building awareness of the need, benefits and practices of fisheries management among the various stakeholders, however, does not stop at just'information dissemination. Such awareness must be translated into strong public opinion and pressures and behavioural change in the target clientele in the entire fish marketing chain in each country. That is, from the fisherfolk to market intermediaries and housewives, for fishers as producers will continue to catch undersized or immature fish if there are market intermediaries, housewives and those eating away from home willingly buying such fish.

To ensure sustainability of this management process, the activities of the third phase of the Bay of Bengal Programme will be re-directed and executed differently compared to the past. During this phase, the Programme's activities will be nationally executed through the existing administrative and management structure of the national implementing agencies, with facilitating or enabling assistance from BOBP.

BOBP's task will, therefore, be catalytic. It will offer advisory services on specific management issues, drawing on the expertise that BOBP and FAO/UN have accumulated over the years worldwide, and co-ordinate regional interaction, learning and feedback. Such an integrated approach will ensure that project-induced changes are not only internalized but institutionalized and. thus made sustainable. This will be made possible by the implementing agency being committed to making the necessary budget requests to the government and the treasury being committed to making the financial allocations that will enable the continuance of the BOBP-induced changes.

To facilitate fisheries management through sustainable development in the coastal communities of the member countries, BOBP's third phase envisages achievement of this through an integrated coastal area management (ICAM) approach. Programme components will include, among others:

- Conservation of fisheries resources
- Identification of endangered fisheries or species for management intervention

Community-based fisheries management

- Special area management planning
  - Economic diversification
- Identification of needed infrastructure and social services investments
  - Environmental protection

The third phase, being primarily concerned with fisheries management, its operational concentration will be on the containment and regulation of the fishing effort. It will promote other inputs and coordinate its activities within such efforts with other like-minded agencies or projects. In this context, it needs to be remembered that the membercountries' development strategies for fisheries are still, by and large, production-oriented. But with the steadily growing concern with overfishing and resource depletion, even collapse of resources, the benefits of managing these resources are also becoming more and more obvious to these countries. In the third phase, the member countries and BOBP will have to develop an operational consensus and mechanism to marry the two seemingly opposing strategies and come up with an implementation strategy acceptable to the countries and consistent with BOBP's mandate from the donors.

BOBP's task, therefore, is twofold. At a time when many development agencies are switching their focus to environmental protection and resource sustainability issues, BOBP has to, from the point of view of the member countries, remain committed to fish production (ready food supply for a rapidly growing population) and addressing the continuing impoverishment fisherfolk. of At the same time, it must work towards ensuring the long-term sustainability of fisheries resources that supply high quality fish to the people. Both BOBP's objectives can be achieved through building greater and more widespread awareness of the benefits of managing fisheries resources.

The awareness-building must clearly send out the correct signals and messages

that fisheries management can, and must work and that there is no other alternative to management if the fisheries resources are to provide a continuing supply of fish to the people. Management is not only the solution to pressing fisheries problems, but it is the only solution to fisheries threatened with possible collapse. It can and must be done!

In creating greater and more widespread awareness, it is critical that we use the fisherfolk to influence and bring about lasting change in the attitudes of resource managers, planners, policy-makers and other resource stakeholders to the vulnerability of the fisheries resources under rapidly growing fishing pressures. The time has passed where the need for fisheries management can be advocated without offering any explanation or clarification to the fisherfolk of what managed fisheries can do for them. The key now is to help them organize themselves; not only must fisherfolk and resource managers provide total support to management, but they must be convinced of the need for, and benefits of, management and be committed to it. To ensure their commitment, they must closely identify with the ideas and concept of management. They must possess a sense of ownership and pride in the idea and concept.

There is now a new and different generation of fisherfolk who are relatively more vocal and radical. Their



*KEE-CHAI CHONG, Pmject Co-ordinator BOBP, and Editor and Publisher of the* Bay of Bengal News, addressing a workshop on training and research for community-centred aquaculture at the Manonmaniam Sundaranar University, Tirunelveli, *Tarnil* India.

voices can be effectively used to influence the older generation and their peers and bring about the needed changes. To achieve this, it is critical that we actively seek out their ideas, their perceptions of fisheries problems and what they see as potential solutions. We must go to the fisherfolk and hear them out. Their ideas and potential solutions should then be evaluated and incorporated at the outset. This then will constitute the base on which to build on and collaborate \_\_\_\_ a collaborative and, in some cases, consensus-based management action plan – which will be carried out by them with assistance from fisheries specialists, managers in the fisheries departments and other government agencies. It will be a plan they have a stake in... their own plan.

Such implementation will have a threepronged approach:

- Mass multimedia campaigns targeted at different levels, from policy-makers to fisherfolk, to increase awareness of the conditions of their resource, of the need for fisheries management and of the benefits and workable mechanisms of such management.
- National and regional seminars and workshops on management strategies, methodsand practices for key personnel of fisheries administration, research organizations and fisherfolk, especially the strong opinion-making leaders among them.
- Development and implementation of solutions to the fisheries problems identified by all the stakeholders. This would include provision of advisory services on specific management issues, when requested by member governments.

The Bay of Bengal Programme will ensure effective coordination of the work, a multidisciplinary integrated approach and cost-effective use of common services and resources. It will also ensure continuous monitoring and evaluation. But in the end, the success of the third phase of the Bay of Bengal Programme lies in the hands of the fisherfolk and national agencies, particularly in how they reach out to each other with BOBP's help.

### Encouraging fisherfolk to manage THEIR fisheries

# How communication and awareness can help

There is a crisis in fisheries all around the world. While increasing human populations want more and more fish to eat, fishers around the world are having difficulty in meeting the demand because they are catching less each year despite increasing efforts. With awareness of the problems growing, people and governments are now becoming concerned whether the seas, rivers and other waterbodies will be able to meet the demand for fish in the future. Which brings us to what the Bay of Bengal Programme, like several other organizations, is trying to do: fisheries management.

The issue looked at in a broad sense is rather simple:

- fish are a natural resource, which grow, reproduce and die;
- fishers capture fish;
- if they catch fish faster and in larger quantities than the stock of fish can grow and reproduce, then catches are affected and so is the stock;
- as fish grow scarce they are more expensive to catch and become more expensive;
- which gives an incentive to fishers to try harder, and that only makes matters worse.

The answer is to be rational and to ensure that fishers capture only so much of a stock of fish which enables them to keep doing it! But, of course, there is more to it: fish stocks can be affected not just by the act of irresponsible capture, but their stocks can be affected by the quality of their environments, which in turn are affected by humans through pollution of waters, destructive fishing methods and so on. So, to cut a long story short, what is of concern is what people do to fish and their environment.

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* Senior Communications Adviser; BOBP
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#### by Rathin Roy\*

Fisheries management is not so much about managing fish, which left alone seem to do just fine; it's all about managing the way people and fishers capture fish and affect their environment. **Fisheries management is really people management.** 

Before concerning ourselves with how, or if, communication and **awareness**building can help with fisheries management, it would be useful to better understand the problem itself.

# Why bother with fisheries management?

Fish is food, and for a lot of people the major source of their animal protein. Some have traditionally eaten fish and feel deprived when they cannot get enough, others like the taste, some others are beginning to eat fish instead of other meats for reasons of health. With populations increasing, and expected to double some time during the next two decades, depending on whose calculations you care to believe, the demand for fish is going to increase worldwide. The problem is that marine fishcatchpeakedin 1989andhavebeen stabilizing since.

Aquaculture, the growing of fish in controlled conditions in enclosed waters, and mariculture, the ranching of fish in natural open waters, are seen by some as an answer. Although their contribution to fish production is growing, the industry is already beset with its own problems, such as water and land use conflicts, pollution, of water, and diseases.

When supply cannot cope with demand, prices rise and it is the poor, and often traditional consumers of fish, who find fish disappearing from their food baskets.

Increasing populations of fishers, using more efficient craft and gears, targeting decreasing and stressed populations of fish, is a good recipe for conflict. And conflicts abound in the fishing world.



Getting women in Thailand involved in additional income-generation for the household.

The need to sustainably provide people with fish as food, ensure the profitability of an industry that provides livelihood to millions of fishers, quite a few of whom are considered poor even amongst the poor, and to do so in a socially sustainable manner, by reducing conflicts, are the major reasons why everyone concerned with fisheries is talking and worrying about **manage-ment.** Something has got to be done! The question is, how?

### Purpose of fisheries management

Fisheries management enables communities and governments, together with their fisheries agencies, to have control over a number of important factors. Namely:

- The exploitation, conservation and sustainability of fisheries resources.
- The profitability of the fishery to fishers and others in the industry.
- The way in which the fisheries resource is allocated among the community.
- The need to address wider social issues, such as conflicts, unacceptable fishing methods, by-catch issues and the environmental impact of fisheries and of fisheries on the environment.

The alternative to management is free access to the resource by all interested parties without any limitation. In such situations, there is historical evidence that fishers tend to increase their capacity to fish through increase in numbers of craft and gear and fishing intensity, with a consequential decrease in catch of individual fishers. The profitability of the fisheries decreases and fish stocks get depleted.

But there is more to the objectives of fisheries management. At the best of times, fisheries management is a delicate balancing act. The environment sets the limits of the maximum (ecologically) sustainable yield, the means of production determine the maximum economic benefit that can be derived from the ecosystem, and the fishing community and society have to choose options that provide maximum socially feasible yields to meet their needs. The nature of fisheries management goes beyond exploitation of a resource in an ecologically sustainable manner, and the



Afisherfolk consultation in the Maldives.

reaping of maximum economic benefits, to the art of the possible, determining what is socially feasible. The complexity of multitiered objectives is further aggravated by the fact that there are often, at least in multispecies, multigear, tropical fisheries in the Bay of Bengal region, several stakeholders, each of whom have their own needs and aspirations and, therefore, differing objectives.

#### Whose problem is it?

Fishing is the business of fishers; if fisheries management means changing the very way fishing is practised, we are talking about changing the behaviour of fishers. Government fisheries agencies do not fish, but they regulate fisheries, and often promote them. Fishers, whose livelihood comes from fishing, would not fish unless there is a market for the fish they catch. Fishers in Bangladesh who target juvenile *Hilsa* for instance, do it because there is a ready market for it; for some, it is traditional fare which they like, for most others it is the only form of the prized Hilsa they can afford. Customers, through their purchasing power, drive demand with their preferences and dislikes.

Then there are groups and agencies with environmental, human rights and socioeconomic concerns who object to, advocate and agitate against certain types of fisheries and their impacts. It is easy to write them off as troublemakers and adversaries, but they have a voice, and often can mould public opinion and move the legal system to bring the fishing industry to a grinding halt. So, it would be foolish to ignore them, even more so because in many cases they may be right or have a valid or legitimate point. All these and still others are stakeholders in fishing, and it is also their problem.

Too often in the past there has been a tendency to see fishing and fisheries management as the task of the government fishery agency alone. The risnery agency determined what needed

to be done, enacted rules and regulations, and then spent enormous amounts of time and money to try and enforce the rules and regulations. People rarely support laws and regulations governing their lives unless they believe in them. And it is difficult to believe in something in whose design and development you have had no role. Participation is not just a fashion in development; it makes sense, ensures better development acceptable to all, makes enforcement easier, and reduces costs to the government by getting the involved stakeholders to manage their own business.

Fisheries management deals with multiple stakeholders, and sustaining a fishery resource requires the active participation of **all** stakeholders, sitting together, setting objectives, devising means and methods, agreeing on fisheries management plans and, finally, implementing and enforcing what they have agreed to. It is time fisheries agencies set aside their notions and perceptions and realized that **participatory, negotiated fisheries management** is not just the way to go, but **the only way** to go.

# What kind of a problem is fisheries management?

Traditionally, fisheries management has been done by fisheries biologists, resource assessment experts, fishery agency officers, police and coast guard, all of whom have important roles. However, fisheries management is all about how to catch fish, where and when to catch them, which fish to catch at what size and, most importantly, how much to catch, to ensure basically two things:

- One, that the fishery resource will be sustainable into the future; and
- Two, that the business of fishing will continue to be profitable.

Looked at this way, fisheries management becomes more complex it is about livelihood and survival, it is about who has the right to fish and how much of it; in other words, it is about the allocation of user-rights. These are political, social and economic issues, which are not only highly emotional issues but issues about which people are ready to fight. The fact that most waterbodies in which fishing is practised are common property resources makes matters more complicated. Anybody with craft and gear, technically speaking, can go out and fish in the sea or in a river. How do you go about managing and controlling an activity which, by its very nature, is an open resource with unlimited entry?

Fisheries management, stripped of all its drama, reduces to not only deciding what and how much fish can be caught but who should catch it. Since we are talking about a limited but renewable biological resource, it is obvious that the people who can benefit from it are also limited. The problem is that this means there will be people left out of sharing in the pie, as it were. Traditional fishers, who have fished for generations, and often know no other form of occupation, have at least a historical or traditional right to fish. And they are the majority of fishers in the Bay of Bengal region. With the recent boom in fishing, particularly in offshore fishing and coastal aquaculture, a lot of 'outsiders' have got involved in, and invested in, fishing and aquaculture. And this has naturally generated envy and illfeeling. Particularly in the case of coastal aquaculture, when 'wasteland' overnight starts generating large earnings for outsiders, it is only reasonable for the

local person to wonder 'Why not me?' and look for environmental, social and economic reasons upon which to build their challenge.

In fisheries, unlike in agriculture or forestry, the ecosystem is more complex, and while science has developed a lot in the past, it is still not easy to come up with answers quickly to questions such as 'How much of this species can we catch to ensure sustainability?' Given this problem, we are dealing with a situation where no one stakeholder has the 'right' answer. To a certain extent everything is negotiable. This is even more so the case when we include the sociopolitical and economic aspects of the problem. The nature of the beast is such that the only hope is to bring stakeholders together to negotiate management.

What makes such negotiations complex is that several stakeholders are involved, with different perceptions of the situation, the problems and of the solution options. The stakeholders, as they involve fishers, fisheries biologists, and consumers, to mention just three, also have different levels of awareness of the issues. Worse, the different stakeholders have different levels of organization and political clout. For example, a small nongovernmental group, or a seemingly insignificant group of activists, can get more media coverage, use better legal leverage and sway local, national and international public opinion and bring enormous political pressure to bear, unlike a fishery agency shackled by rules, regulations and bureaucracy.

To summarize, fisheries management, by its very nature, requires the involvement of multiple stakeholders, with differing levels of awareness and political power, to reach negotiated agreements. The issues are multidisciplinary, are not firmly grounded in clear logic, and the state of the knowledge does not allow for black-and-white answers to questions. Stakeholders often see each other as adversaries rather than groups on the same side working together to solve the same problem. One group's benefit is seen as another group's gain, and this is unacceptable. So, bow do you go about promoting, facilitating and enabling fisheries management? And, what role can communication and awareness-building play in all this?

### What can communication and awareness-building do?

Given the nature of the problem, the first task would be to bring the stakeholders ogether, to better understand their problems, to agree on:

- the need for, the benefits of and the methods of fisheries management;
- the objectives of fisheries management;
- the solutions;
- who does what and how; and
- how it should be enforced.

Which is quite a handful to say the least.

Let us take it one step at a time. A problem in fisheries that requires management can manifest itself in many ways. Catch per unit effort could be declining, the size of fish caught could be getting smaller, more juveniles are being caught, or even fish not targeted by the fishery are being caught, all leading to waste of resources, poor landings, and reduced earnings and profit. There could be conflict between groups targeting the same species or fishing in the same area. Or, as in the case of aquaculture, the people living in the coastal region could be complaining about the environmental and social impacts of aquaculture.

The first task would be to identify all the stakeholders: those interested in the activity, those dependent on the activity, those affected by it, those opposed to it and those in government whose responsibility it is to regulate it. This can only be done by communicating with the stakeholders, starting with the most obvious ones, and evolving a stakeholder map through discussion about the activity and its various stakeholders.

Problems affect people but rarely are enough justification to bring people together to solve them. This is especially so if stakeholders see each other as adversaries, and this is often the case in fisheries. They will come together only if-they stand to gain by doing so, and then it will be only if they have commonly held beliefs and aspirations. To find these commonalities, communication helps by understanding each stakeholder's perceptions of the situation, problems, aspirations, interests and solution options and by culling out the areas of agreement from these. Once stakeholders can be shown that commonalities of purpose exist among them, there is incentive to come together to, first, talk about the agreements and, then to discuss adjustments to differences. Thus, communication can be a tool not only to bring people together but in generating new platforms or fora for discussion.

When stakeholders gather around the table to talk and negotiate, the success of such consultations depends on whether :

- they are speaking the same language (in terms of worldviews and levels of awareness), and
- they feel powerful enough to make a difference.

In other words, a scientist and a fisher can discuss a concept, like maximum sustainable yield or the need to declare a closed season in spawning areas during particular seasons, only if they understand each other's perceptions of the ecosystem and each other's logic frames. If they are different, no amount of persuasion will help. In such situations, communication can help improve the understanding of perceptions, worldviews and frameworks of logic. Appropriate awareness-building can bridge the difference by building new structures of learning on traditional foundations of knowledge.

The second criteria for success deals with empowerment-there cannot be a fruitful, consultative and participatory negotiation when powerful government scientists and bureaucrats are pitted against ordinary fisherfolk. The fishers, in order to arm themselves, will need to be helped to organize themselves and be empowered further by government, by giving them control and use-rights over the resources they have relied on for their livelihood-security for generations.

Negotiations for conflict resolution are complex as they are. To expect the involved parties to be able to run them and come up with mutually beneficial solution options for consideration is farfetched. There is a need for mediators or facilitators who, using communication, group dynamics and negotiation skills, will mediate in the negotiations and consultations and help the stakeholders in reaching agreements and decisions.

Finally, good two-way communication builds understanding and trust among stakeholders and acts as the lubricant to facilitate improved management implementation, monitoring and enforcement. For too long, communication and extension have been a oneway exercise of those who know, imparting their knowledge to those who do not; sharing the Word, as it were.

#### What communication and awareness-building cannot do

Awareness does not guarantee practice. People who know about and understand that smoking is not good for them do not always stop smoking! It takes more than just communication and awareness-building to do fisheries management. Fishers will not reduce fishing effort unless, say, price structures or alternative employment opportunities give them the opportunity of increasing their incomes. Communication and awareness-building are necessary but not sufficient conditions. Communication and awareness-building are neither public relations nor propaganda – you cannot use them to fool all the people all the time. Good communication and awareness-building cannot sell a bad programme or an idea indefinitely, nor can it make up for inadequacies and incompetence in other parts of the fisheries management package.



Advice on fisheries management being offered in Bangladesh



Making Sri Lankan fisherfolk seen and heard.

The AIMS of good communication can be derived from the very letters that spell the word:

A-Good communication Attracts the receivers and holds their attention.

I-Communication Informs people in simple understandable language and pictorials.

M-Communication Motivates people to do something.

s---Communication Satisfies the needs of the receivers.

Communication and awareness-building can use a variety of media:

- Person to person,
- Group communication,
- Print,
- Audio, such as radio or audio cassettes,
- Video, such as films, TV and video tapes, and so on.

But no matter the medium or the means, it still has to achieve its AIMS in order to be successful. Communication, as described in this article, goes beyond transferring information and is seen as the means of bringing people together and helping them to manage their resources. This not only uses various media as described above, but, most importantly, employs people as the medium, people trained in communication as a tool.

### What communication and awareness-building can do are:

- help identify stakeholders.
- improve understanding of stakeholder perceptions.
- bring stakeholders together around common issues.
- provide new platforms for consultation and decisionmaking.
- help empower stakeholders.
- generate transparency and accountability in the consultations and negotiations.
- enable sustainable participation and committed implementation.

#### Implications of using communication and awareness-building

Communication and awareness-building are powerful tools to facilitate and enable participatory fisheries and aquaculture management. They involve the very way their user thinks about such efforts. For example, the goals of fisheries management in a participatory situation cannot be determined just by the fishery agency and biologists and economists. They will emerge as a negotiated agreement. Participation, which is the vehicle and the goal of communication and awareness-building, affect the ways and means of enforcing fisheries management, it affects who will control the process, it will affect outcomes and the relationships between stakeholders. Consultations and negotiations take time and will delay the process. It might even

cost more to do. It will raise a whole host of problems, which would have come up anyway, even with conventional approaches, except that with communication and awareness-building you get advance notice of problems and this allows the agency to be proactive rather than reactive. A fishery agency, when confronted by all this, may well wonder whether it is worth going in for communication, awareness-building and participation. The answer is 'yes', because, given the nature of the problem being addressed and its peculiarities, it may be the only way of successfully doing it. The history of natural resources management and conflict resolution in general, and the more limited history of fisheries management, point in the direction of participatory management, and that can only be done with communication and awarenessbuilding.

#### How to make a beginning

A beginning can be made by committing the fishery agency to the approach, and by training its fisheries staff in participatory management, communication, awareness-building, and negotiation. All the work need not be done in-house, as media production is an expensive and skill-intensive task. As the private sector is already good at, it can be subcontracted to them. However, the fishery agency needs to understand and to manage the process. It also needs to start using communication, awarenessbuilding and participation in its own internal working and dealings. It is extremely difficult, if not impossible, to promote and use these approaches if you do not practise it yourself. Practising what you preach is a hard reality in this business but the dividends make it worthwhile. By encouraging all levels of the fishery agency to become good communicators and educators and by becoming more participatory, there is no real need to establish a separate department of communication. This way, everyone takes responsibility and it gets incorporated at every level, instead of becoming the responsibility of any one particular department. Communication and awareness-building, used in a participatory mode, do work, as experiences in health, forestry, conflict resolution and general development show, and could be THE ingredient in fisheries management which makes the difference between success and failure.

# If there is proper crop sanitation and farm management...

# Aquaculture is a Self-Cleaning Industry

Growing pressures to recover capital investment costs in the shortest time possible and make the greatest profit in that period have led to aquaculture forgetting, or ignoring, control of water and bottom soil quality. The result has been loss of production quality and rejection of shrimp by international buyers. Unless responsible farming and care for the environment are introduced in aquaculture, the immense prospects the industry holds are likely to be dimmed. Let us look at why the need for improved and better quality farming methods are necessary in aquaculture.

#### Background

Global landing of fish (used generically here to include all seafood) has grown fivefold since 1950 through the introduction of modern fishing technology, discovery of new fishing grounds and new, under- or unutilized species. The increase has mainly been attributed to the growth in capture Culture fisheries have fisheries. developed only in the last few years. Although its practice has been known for over a thousand years, the need for culture fisheries was not recognized till recent times because capture fisheries was able to meet consumer needs.

But that scenario has changed. For example, due to overfishing and enviromental degradation, increases in the landing of shrimp off the coast of Thailand, its traditional source of supply, cannot be expected. The country has, therefore, had to turn to shrimp farming as both a supplementary and alternative means of supplying the growing demand for shrimp. They have been highly successful in this. In the mid-1970s, Thailand was an insignificant shrimp producer. Today, the country is one of the two largest producers and is still growing.

#### by Kee-Chai Chong\*

In India it has been pointed out that investing in aquaculture, such as in shrimp farming, would yield 20 times more shrimp compared to similar investment in capture shrimp fishing. Following this course, India has become the fourth largest producer from an insignificant producer a decade ago.

The current global demand for seafood is about 80 million tons; it is projected to increase to about 130 million tons before the end of this century, that is, in less than five years from now. There is thus a demand supply shortfall of at least 30-45 million tons or 30-50%. In another 30 years, or in 2025, demand will increase to more than 200 million tons, given present population growth rates.

To bridge the gap, aquaculture has in recent years been seen as the answer. Aquaculture production has been growing worldwide at an average of 10% per year. In Asia, it is increasing even more rapidly, at an annual rate of 20% during the last five years. By 2025, aquaculture will need to produce almost 80 million tons to meet the demand for seafood, from its present output of about 20 million tons.

In 1992, world fish production was 105 million tons of which the marine and aquaculture sectors produced 92 and 19 million tons respectively. The distribution of the aquaculture production was as follows:

49% fish (41% freshwater fish)
28% seaweed
18% mollusc
5% crustacean (1% shrimp)

The rapid expansion of aquaculture, however, has not been without growing pains and problems. Its' rapid and unplanned expansion has been accompanied by serious impairment, degradation and, in certain cases, destruction of the natural resource systems and environment. The successes and gains from aquaculture have been, in many cases, achieved at high environmental and social cost.

#### Rural Transformation

Besides preparing to meet the demand shortfall of seafood, aquaculture has also been looked upon in many developing countries as being able to socioeconomically transform rural areas through the gainful employment of rural labour. Unfortunately, this has



Good crop sanitation pmctice calls for cleaning the pond environment before birds spread disease to noninfected areas.

<sup>\*</sup> Programme Coordinator/Senior Fisheries Management Adviser, Bay **of** Bengal Programme (BOBP), Madras, India

not happened. This is because the labour absorption capacity of aquaculture is limited to certain stages of the aquaculture development process, namely during land clearing, pond- and farm-construction, and not during the farming and harvesting processes. Labour cost as a percentage of total cost of production is only 6-10%. Aquaculture is thus not the great employer it is made out to be.

In many countries, it has, in fact, impoverished and marginalized the weaker segments of the country's population, especially the rural poor. Public unrest and agitation in the rural areas of some countries, where the rural have-nots have been further 'disenfranchised', are symptomatic of the social costs of aquaculture.

#### **Producer Behaviour**

Aquaculture's dependence on Nature, its resource system and environment, in particular, its climatic vagaries, gives rise to considerable yield uncertainty. Uncertainty in yield arising from natural, biological and climatic conditions, in turn, gives rise to profit uncertainty. Because of the natural biological requirements and the weather-bound orientation of production, aquaculture producers are under pressure to recover their capital investments in the shortest possible time. They, therefore, tend to adopt a 'make hay while the sun shines' attitude. As a consequence, they tend to environmentally-unsound employ production 'shortcuts' to keep production costs to the minimum possible. These factors directly influence water quality. And water being the medium of production, its quality affects the entire system of production and environment. The end result is environmental degradation and loss in final product quality. The indiscriminate use of aquaculture chemicals and antibiotics is a good case in point.

Further, investment in aquaculture from outside the industry, that is from the agriculture, forestry, commercial/ business, industrial and service sectors, has greatly, and unnecessarily, expanded the production capacity of the industry. Such capital transfer into aquaculture, especially into shrimp farming, from outside aquaculture, has largely been driven by the prospects of quick-yielding returns on investments.

Management lapses in aquaculture in general and in coastal shrimp farming in particular, driven by short-sighted profitmaking motives, have led us to our present environmental woes. Being careless about, and/or indifferent to, the environment, the mandatory planning necessary and the application of aquaculture engineering (if not even engineering) methods in the design, layout and construction of shrimp farms, comprising a network of nursery and growout ponds, central reservoir or water supply, and a drainage system, are often overlooked or hastily applied.

Aquaculture sustainability and environment is all about natural resource management in aquaculture production that will benefit society, community and economy. This, in turn, implies the use of science, technology, economics and other bodies of knowledge in producing aquaculture products to improve the quality of life for the people. The key here is balancing and harmonizing man, technology and environment.

The immediate and urgent task before us is, therefore, how can we harness science, knowledge and technology not only to rehabilitate, restore and rejuvenate the existing haphazardly planned and designed farm complexes but also improve the system.

#### Water Cultivation

In agriculture, for instance, in irrigated rice production, the irrigation and drainage system is designed as a large and independent system with a large, main central water reservoir linked to water distribution and drainage networks. In aquaculture, no such design has been developed; only haphazardly designed and constructed individual pond systems, frequently with poor pond layout, incapable of rapid water exchange, are all that have been designed. The absence of a reservoir in an aquaculture system compromises the maintenance of good water quality. Because of the lack of such infrastructure as separate water supply and water drainage canals to move water and keep pond effluence from mixing with clean water, disease is able to rapidly spread from one pond to another or from one farm to the next.

#### **Self-Cleaning Possible**

In Thailand, pond overcrowding and unsanitary conditions have been linked to disease outbreak. In India, prior to 1990, there was hardly any intensive system of shrimp production in the country, let alone any superintensive systems. Shrimp disease was scarcely heard of in the early years. But as India's shrimp output increased considerably, as a result of extensification and intensification, shrimp disease outbreak was reported in 1994. According to Macintosh and Phillips (1992), close to 80% of the nitrogen and 90% of the phosphorous input in shrimp feed are not utilized by the cultured organisms and, as a result, are wasted. They, in turn, pollute the water and accumulate at the bottom of the pond as toxic wastes. Without sound management and crop husbandry, aquaculture is, thus, self-polluting. But at low intensity of production, it is selfcleaning. Likewise, in larger facilities, it can be made self-cleaning with management. Because it is more a biological system of production rather than a physico-chemical production system, all the organic and inorganic properties of aquaculture production can be imaginatively employed to make aquaculture an environmentally-sound industry.

#### Making it Clean

As unsanitary pond conditions cannot be totally avoided, sanitary measures must be instituted in aquaculture. For instance, birds picking diseased shrimp beached on the sides of the ponds or embankments can quickly spread the disease from one farm to another. If care is taken to remove such diseased shrimp and disposed of in a proper manner, as in good crop sanitation practice, the spread of shrimp diseases can be contained.

There is really very little economic sense in producing a product in unsanitary conditions, because the end product will be a contaminated product which will not pass quality inspection at the port of entry. It makes sense to produce a product in a clean environment. The cost of production will vary little between growing aquaculture products in a clean, sanitary environment and in environmentally-neglected pond conditions. If growing shrimp in an environmentally-

neglected pond condition is thought to lower costs, the producers will be in for a surprise; in fact, they will find they are the losers when products are rejected by importing countries.

#### Conclusion

In agriculture, the practice of crop sanitation is well accepted. Elaborate techniques of crop sanitation, such as removal of crop residues after harvest, field burning, soil disinfection and fumigation, and removal of diseased tree stumps, roots and other vegetative parts by digging and pruning to contain disease spread, have been well developed. But it is not so in aquaculture. Such techniques must be mandatorily introduced forthwith if aquaculture is to play the role envisioned for it.

### Integrated Management in Malaysia's Coastal Zone

# **Finding a Role for the Fisherfolk**

by Donna J. Nickerson<sup>1</sup>, Lui Yean Pong<sup>2</sup>, and Ahmad Hazizi b. Aziz<sup>3</sup>

Coastal areas contain some of the most ecologically complex common property resources, having a complex biological and fragile nature. The coast could be thought of as a sink, collecting all pollutants, nutrients, and other impacts from upland uses. Compounding these upland influences are the direct impacts along the coastal zone from residential, industrial, and agricultural sources, mangrove area development, and indiscriminate or destructive fisheries practices. Coastal areas are also effected by oceanic conditions. So, while its high biological productivity and diversity is largely because of its function as a sink, collecting nutrients and serving as a transition zone for many ecosystems, its environmental quality and sustainability are at the same time dependent on and particularly vulnerable to changes in any of these ecosystems.

Management of the coast is as complex institutionally as it is biologically, requiring a management framework which can respond to the jurisdictional fragmentation inherent in coastal areas. Experience has shown that for coastal zone management to be comprehensive, there needs to be activities at two basic levels; the national and local levels. Where actual tangible impacts to the coastal resources and communities are concerned, these two levels and the coordination between them will determine change.

The Department of Fisheries (DOF), Malaysia, has undertaken activities at the local level, under the third phase of the Bay of Bengal Programme for Integrated Coastal Fisheries Management, which will feed into the development of a national Integrated Coastal Area Management (ICAM) Programme. At the national level, the results of Malaysia's BOBP third phase project will be used to initiate a proposal for a national Integrated Coastal Area Management framework to both horizontally and vertically coordinate jurisdictional authority and activities in the coastal zone. This coordination is needed not only to ensure consistency between agencies, but it is equally important to make sure that local level efforts are harmonized. Malaysia's national level ICAM efforts will be designed to motivate and help implement



Pulau Payar Marine Park contains the only clear water coral reefs on the west coast of Peninsular Malaysia. (Photo courtesy of DOF, Malaysia)

<sup>&</sup>lt;sup>c</sup>Coastal Zone Management Adviser BOBP. 2Head, Resource Management Branch, DOF, Malavsia.

<sup>3</sup> Officer (Resource Management), Resource ManagementBranch, DOF, Malaysia.

local level activities and programmes. In turn, findings at the local level will help determine national level standards and policies.

The local level activity will be focused on Pulau Payar Marine Park, established seven years ago, and located about 35 kilometres forn Kuala Kedah, in the State of Kedah. Pulau Payars Marine Park is comprised of a group of four islands which possess the only clear water coral reefs on the west coast of Peninsular Malaysia. The reefs are abundant in commercial and non-commercial fish species, and were once a favoured fishing area for smallscale fishers, including anchovy fishers.

The project activity will involve development and implementation of a Special Area Management Plan (SAMP) for the management of the marine park as habitat enhancement for the conservation and sustained production of the area's reef fishery resources. The interrelationships of the impacts, many of which ate caused by all stakeholders using the coastal zone resources, will be incorporated in the SAMP. By looking at the practices and issues within the fisheries sector and the environmental effects from nearby coastal land-use practices on the mainland and islands adjacent to the Marine Park, comprehensive solutions or strategies to resolve these issues can be developed. For example, a potential strategy in the SAMP will look at promotion and encouragement of eco-tourism as a supplement to employment and income of the local traditional fisherfolk.

The DOF will approach SAMP development through a two-tiered process. In the first-tier, the DOF will develop a consensus-based preliminary draft SAMP This preliminary draft will be used as a platform for discussion in the second tier. The second tier will bring in all the key agencies with jurisdiction in the coastal zone to develop the detailed SAMP through consensus, and in consultation with the fisherfolk and other users of the resources at various steps in the process.

One of the first steps in the programme will be to quantitatively determine the beneficial aspects of the marine park in relation to the broad management objectives of conserving the living marine resources and biodiversity, while promoting fisheries production in the surrounding areas and improving fisherfolk livelihood. To accomplish this,



Maintaining the naturally abundant living marine resources of the area will be a key component of the project. (Photo courtesy of DOF, Malaysia)

the DOF will draw on the talents, data, and experience of its many branches, including the Aquatic Ecology Research Branch, the Marine Parks Branch, the Sector Planning Section, in addition to the lead Resource Management Branch. Information from ongoing monitoring programmes of DOF and universities will be used and additional monitoring studies will be undertaken to determine changing conditions over time of the resources. Change will be measured using a simple status and trends analysis of key indicator species to show health and productivity of the reefs under different management alternatives.

Once the beneficial aspects of the marine park are determined, the next step will involve disseminating this information to the fisherfolk. The information will be written in layperson's terms, clearly summarizing the key findings that quantify the benefits of conserving the coral reef and fisheries resources. The fisherfolk can then understand and accept the need for habitat preservation and establishing the marine park, and therefore will be encouraged to take part in the conservation and maintenance of the marine park. The fisherfolk will also be able to serve as naturalist guides, and pass this information on to the tourists, who will become more aware of their responsibilities as users of the resources and comply with park regulations. The fisherfolk are needed in the maintenance of the park, and have a natural role in ecotourism. The fisherfolk have a good knowledge of the coastal resources, through 'extensive field experience', are

'resource-dependent' as direct users of the resources, and can share this unique perspective directly with the tourists, who are 'temporary users'.

The project will be monitored to observe whether the SAMP strategies implemented in the marine park are able to increase or simply sustain the fisheries resources in the vicinity of the protected area. The results of this observation and other parameters will be built into the broader ICAM framework at the national level. Other lessons expected to come out of the local level activity which will be fed into the formation of national policy are approaches towards promoting consistent economically and ecologically sustainable land-use activities on the islands both within and surrounding the marine park, ecotourism as an alternative employment for the fisherfolk, the visitor-carrying capacity of the park, zoning, and the socioequity issues and distributional effects of these zoned allocations.

Malaysia's plan is comprehensive, balancing conservation of valuable resources with economic and livelihood improvement of the users of the resources. New fisheries management approaches which consider environmental effects to the fisheries (*I.e.*, habitat, land-use, water quality, etcetera), reduced pressure on the fisheries by encouraging alternative incomes, and limited access through zoning and licensing, will result from Malaysia's project, and can be of interest to other BOBP member countries.

# **Improving Management and Performance of Fishing Harbours**

by Kee-Chai Chong<sup>1</sup>, Kent Blom<sup>2</sup>, Pramuan Rugjai<sup>3</sup>, and Maizar Hassan Maniku<sup>4</sup>

#### Background and Overview

Several major fisheries harbours and hundreds of minor fish landing centres and private jetties are found in the member countries of the Bay of Bengal Programme (Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand). Some of these landing sites have been established by the Government, others by the private sector. Many are at least 50 years old.

4 Director, Marine Research Section, Ministry of Fisheries and Agriculture, Republic of Maldives. Except for a few modern fisheries harbours, constructed in the last five years or so, the majority of the landing centres, in particular the smaller facilities, are in a total, or near-total, state of disrepair, characterized by rundown and congested conditions.

While fisheries have steadily expanded over the last half a century, with fishing fleets increasing in number and the fisherfolk population growing, the infrastructure and landing facilities have been left as they were, with little or no renovation or upgrading of facilities. New investments have typically been made in new sites, which are often isolated and inaccessible to traditional smallscale fisherfolk.

Most of the new fishing ports have been overbuilt and are not designed to service

the traditional smallscale fisherfolk. Consequently, the older and smaller fish landing facilities continue to be used and are, as a result of overuse and overcrowding, congested and filthy.

Furthermore, many of these new fisheries harbours or fishing ports are found either as a part of cargo harbours/ports or adjacent to them and, not infrequently, double as cargo ports. Because of greatly expanded port activities due to increasing national, regional and international trade, distant water fishing and general economic growth, the volume of port traffic is considerable and handling congestion commonplace. This results in serious pollution and degradation of the harbour environment. Good cases in point are the Vishakhapatnam and



Vishakhapatnam harbour, the first BOBP- IMO Project.

Programme Coordinator/Senior Fisheries Management Adviser, BOBP.

<sup>2</sup> Special Adviser to Secretary-General, IMO/UN.

Port Manager; Phuket Fishing HarbourAuthonty.

Madras, India, Negombo and Colombo, Sri Lanka, Phuket, Thailand, and Sibolga, Indonesia, fishing harbours.

Fish, being highly perishable in tropical conditions, require well-developed and efficient landing and handling facilities, market storage centres and distribution channels to move the fish to the final consumers in the shortest possible time. Of immediate concern are the less-than-sanitary floors used for unloading/reloading the fish. It is on these same floors that the fish lie while being inspected by buyers. The specially-designated auction floors are as unsanitary and so are the equipment/ machinery used to hold, weigh and move the fish. The present practice of using harbour water, because of the lack of running freshwater to wash down and freshen the fish catch before unloading, also poses health hazards to seafood consumers. In other words, the fish landed are not treated as food in the way they are handled. Allthese practicesneed immediate attention.

#### HACCP Enforcement

The US Food and Drug Administration (USFDA) is expected to enforce its

'Hazard Analysis and Critical Control Point' (HACCP) programme in 1996. Announced. in January 1994, the programme provides for a period of two years within which countries exporting seafood to US markets mustcomply with the new USFDA requirements. Countries which do not meet these new product safety checks will be denied access to US markets, which at present import more than 5.5 million tons of seafood valued at about US\$3.3 billion, a substantial amount of which is from BOBP member countries.

To comply with HACCP requirements, seafood exporting countries will have to invest substantially in upgrading and improving the overall hygienic and sanitary conditions of their existing fishing port facilities. Potable running water, waste (water) treatment and drainage systems are infrastructure areas that will need particular attention and considerable capital for improvement. The HACCP requirements not only call for organisational modifications to the existing fish distribution and marketing system in the interim, but also dramatic innovations and drastic changes in the long-term.

Fishing ports and landing sites, and the fish markets which develop around them, should be viewed by countries as a significant part of the nation's physical, infrastructural, community and social capital. To protect these investments, and obtain the most economic and efficient use from them, the BOBP member countries unanimously agree on the need for improvement to infrastructure and facilities and more rational and costeffective management of them.

In addition, a more regular repair, operational and maintenance routine has to be introduced to improve the services and performance of these facilities. Revenues from the fees, commissions and cess collected from the users of the fishing port or harbour facilities can, and must, be ploughed backs to improve harbour administration and management, not only for regular repair, operations and maintenance but also for upgrading and modernising the facilities and infrastructure.

It is also observed that the existing harbour-use fee structure is now out of date; it has not been revised in keeping with the changing cost structure of



Phuket fishing harbour, the second BOBP-IMO Project. The state it was in, in 1994.



The clean-up at Phuket Fishing Harbour in 1995.

harbour administration. As a result, the revenues collected do not adequately cover routine expenditures, let alone enable upgrading of facilities and modernisation.

# Organisms and Pathogens in Ballastwater

With increasing intranational, regional and international trade and commerce, as well as distant water fishing, marine pollution has become a very real threat. This has been caused by the introduction of unwanted aquatic organisms and pathogens through marine ballastwater and sediments. Further, biological contamination of fishing gear of the distant water fishing fleet has also arisen. Awareness of such problems is still very low, especially among port authorities in developing countries.

#### Cleaner Fisheries Harhours Project

The BOBP has implemented pilot projects in Vishakhapatnam, India, and

Phuket, Thailand, with financial assistance from the International Maritime Organization (IMO). The projects were intended to mitigate pollution of fisheries harbours

- by upgrading waste receptacle facilities for garbage and oily wastes, and
- through awareness campaigns among the various fishing harbour stakeholders, thereby, promoting a clean and sanitary harbour environment.

The projects achieved their purpose and objectives by:

- -- determining the types, sources and extent of harbour pollution;
- categorising the types of pollution into nondegradable and degradable waste materials;
- reviewing harbour deepening, channelling and dredging policies and programmes;
- studying the frequency and method of disposal of harbour bottom mud and waste;

 investigating the physical proximity of fuelling/refuelling stations for fishing, cargo and transportation fleets and the extent of oil spill;

determining the existence and physical proximity (distance) of any primary handling and secondary processing fish plants or cold storage plants in or near the fishing port and the extent of pollution from such sources;

- investigating the existing availability of solid and liquid waste disposal and receptacle facilities; and
- evaluating the services offered by the fishing port authority and the fees, commissions and cess charged in relation to the services offered [including docking, mooring and berthing, unloading and re-loading of fish, boat-cleaning and disinfecting (if any), disposal of bilge or waste water from fishhold,

engine/boiler room waste (solid or liquid or oily discharge), minor boat repair and maintenance, supply of ice, running freshwater supply, and dry-docking facilities].

It is clear that the sources of fisheries harbour pollution are many and varied.

At present, BOBP is working on two more pilot projects on cleaner fisheries harbours in Sri Lanka and the Maldives. In addition, IMO is considering a similar pilot project for Indonesia.

The present IMO support to BOBP is primarily directed at encouraging the project countries to adopt the MARPOL 73/78 Convention with reference to the provision of waste receptacle facilities for oily wastes and garbage. While the provision of waste receptacles is necessary to minimize harbour pollution, it is more important to educate all the stakeholders to refrain from pollutioncausing activities, such as careless dumping of waste and waste recycling. At the same time, the stakeholders should be encouraged to utilize to the fullest all available raw materials resources in their production and consumption activities.

#### Site Inspection

Just as oyster-importing countries make regular site inspection of oyster beds to ensure compliance with the importing country's product safety requirements, site inspection of fisheries harbours from which seafood are exported will soon be mandatory too under the USFDA's HACCP programme.

#### Other Projects with Similar Purpose

Besides the IMO/BOBP initiative in cleaner fisheries harbour management, the Asian Development Bank's Fisheries Sector Project in Sri Lanka is also looking into rehabilitating existing fisheries harbours in the country. In Thailand, the Directorate-General of Fisheries is similarly considering a proposal to replicate the IMO/BOBP pilot project in Phuket at other fishing ports managed by the Fish Marketing Organization (FMO) of Thailand. It also plans further improvements to the existing facilities and infrastructures in Phuket as, it is reported, about 800 super purse-seiners will be based in Phuket soon, futher congesting and constraining available harbour space and facilities. Likewise, Indonesia, Malaysia and Maldives have already embarked on ambitious programmes to modernize their fishing ports. It will not be long before the other countries, such as Bangladesh and India, which also export to the USA, initiate modernization of their fisheries harbours.

#### Conclusions

When the HACCP regulations come into force, countries which import seafood from developing countries will have to impose more stringent sanitation and quality control requirements in the handling and processing of seafood, keeping in mind the periodic site inspections the regulations provide for.

In particular, improved fish landing (unloading /reloading), post-harvest primary handling and secondary processing, and distribution and marketing systems, as in any selfcontained efficient fisheries complex, will be required. These will have to

- minimize, mitigate, prevent and manage fishing harbour and coastal pollution from point and non-point sources.
- improve overall fishing harbour sanitation and hygiene, to ensure sanitary and hygienic fish handling, by improving fishing harbour management performance, including the muchneeded provision of an adequate supply of potable running freshwater.
- maintain port and harbour infrastructure/facilities in good working conditions through regular repair and maintenance as well as modernization programmes.
- minimize product contamination and other sources of health hazards/risks in the fish landed and marketed.
- \_\_\_\_\_ maintain freshness and keeping quality, including shelf-life, of the seafood landed.
- improve export fish packaging to internationally-accepted standards.
- minimize fish waste and improve utilization of fishprocessing by-products through value-added activities with appropriate technology

- promote efficient fish auctioning and marketing.
- review and develop appropriate port rules and regulations to meet the product safety requirements of the USFDA's HACCP programme.
- minimize, mitigate and prevent the introduction of unwanted aquatic organisms and pathogens through marine ballastwater and sediment as well as through biological contamination of fishing gear.

Although the bulk of the fish landed in the fisheries harbour of many developing countries is destined for the local markets and will thus not be subject to the HACCP requirements, an increasing volume is now exported. It is also envisaged that local consumer rights advocacy will grow and will demand food safety or health-hazard-free food. Existing fish distribution and marketing practices, such as inadequate icing, improper handling at sea, washing/cleaning/refreshening with, or in, harbour water and other unsanitary handling practices in ports are causative factors that contribute to rapid contamination and spoilage of fish, posing serious health hazards due to pathogenloading of the fish. All these will need to change.

The fishing industry, especially the smallscale fisheries sector, can illafford the economic losses from lower prices received for spoiled, contaminated or generally low quality fish. More significantly, consumer demand for quality is rapidly gaining ground with the emerging awareness of seafood as a healthy and nutritious product. Further, high quality standards set by importing nations such as the USA insist on clean and hygienic landing places to meet **their** product safety standards.

BOBP has demonstrated over the past 15 years that a regional coordinating programme is an excellent supplement to any national development effort. With its record, BOBP is a regional fisheries institution that is well-placed to spearhead a regional initiative to ensure a cleaner fisheries harbour environment and marketing and distribution system.

# GIS

### a potential information tool for coastal practitioners

# Mapping the Future of Aquaculture

By coincidence or serendipity, the Workshop on the Use of Geographical Information Systems (GIS) in Aquaculture and Fisheries Management was held during the same week that a pathbreaking Act on the regulation of coastal aquaculture was passed in the Tamil Nadu Legislature. The workshop was jointly organized by Bay of Bengal Programme (BOBP), the M S Swaminathan Research Foundation, the Department of Geography, University

of Madras and the Aquaculture Foundation of India.

The passing of the Tamil Nadu Aquaculture (Regulation) Act, 1995, followed agitation by various agencies in the State's coastal belt against the setting up of shrimp farms. There is no doubt that the initial wave of enthusiasm that swept the State, over the lucrative aspects of shrimp farming, has now largely been replaced by an antagonism towards anything to do with aquaculture. Both the enthusiasm and the antagonism are uninformed reactions and attitudes. It is precisely such situations, that result from noninformation or misinformation, that GIS can help to avoid or correct.

As Dr M S Swaminathan pointed out in his inaugural address at the workshop, there is little point in telling people to stop doing something, in this case, the setting up of shrimp farms. **It is much** 



better to tell them how to do it right. And this is where GIS can act as a useful decision-making tool.

Dr James McDaid Kapetsky, Senior Fisheries Resources Officer with the United Nations Food and Agriculture Organization, Rome, made a presentation on GIS at the workshop, describing GIS as "an analytical tool for geo-spatial decision-making". In layman's terms, it could be described as computerized map-making to overlay a variety of complex geographical and nongeographical information into a single map that would improve fisheries and aquaculture planning and management.

A GIS unit consists of computer hardware, software, data collected both manually and by remote sensing, and trained personnel to read, analyze and interpret the data. Two critical components of this system, the provision of data and its analysis, are both subject to the human factor. In other words, the quality of information and its analysis depends entirely on the personnel supplying the information and interpreting it. As Dr Kapetsky pointed out, the availability of quality data is often difficult to find, and the training of personnel to man the GIS is critical. "The GIS is an information tool; it cannot offer solutions to aquaculture problems," he candidly admitted. The question then arises, how can we use GIS information to develop solutions for fisheries management?

GIS can be applied to a variety of agricultural and fisheries management situations. In the case of aquaculture, it helps to reach decisions regarding choice of location and to forecast how various elements, important for aquaculture, will interact. For example, by analyzing the rainfall in a particular location, the GIS can simultaneously give the user an indication of:

- how much surface water will be available for storage in ponds;
- the availability and variety of agricultural by-products as inputs;
- the roads in the area, to enable assessment of the proximity of transport facilities for aquaculture products; and
- the proximity of the farmsite to local markets.

In addition, using a series of overlaid, computerized data maps, GIS can pick the ideal sites for fish farms on a local or even national level.

Not all the maps that GIS uses are strictly geographic. Many are thematic. There are maps to show different income levels and other demographic data of a country. Given that other factors are favourable, government planners might choose a poverty-stricken area to set up a shrimp farm in preference to another location or which might, from another perspective, seems a better proposition. Similarly, an entrepreneur, to whom the profit factor is paramount, would choose a site which the map indicates has commercial opportunities.

If these are the macrolevel uses of GIS, at the microlevel, that is, at the level of the individual site, it can be used to gauge:

- the proximity to fresh and brackishwater;
- the suitability of the soil for ponds;
- avoidance of mangroves, as a conservation requirement;
- proximity to a processing plant; and - current land use.

By combining these data, the potential investor can more confidently make his or her choice of a site for setting up a shrimp farm, based on a widizer selection of synthesized information.

Consider the situation faced by farmers and their detractors in Tamil Nadu, India. The fears of the detractors relate largely to:



Maps of Franklin Paris sh, Louisiana, Showing Suitability for Catfis h Farms

processing plant is also shown.

shrimp farms being situated too close to cultivable lands, or to cultivable lands taken over by shrimp farms;

- loss and destruction of virgin mangrove forest and resources;
- freshwater sources being polluted by waste from shrimp farms; and
- the danger of underground water turning saline in areas close to shrimp farms.

Most of these problems can be avoided if shrimp farms are planned in areas which can be chosen, with the aid of GIS, not only for their suitability for shrimp farming but also to avoid these problems.

As is obvious, GIS is best used as a tool in the planning stage of shrimp farming and is meant for the use of coastal practitioners, including government planners and decision-makers, administrators, as well as aquaculture entrepreneurs. The significance of using GIS in an environment like that of Tamil Nadu, where aquaculture is no longer merely a fisheries or economic issue, but, owing to the widespread public dissatisfaction, has become a political one, is obvious. For those working to set up a GIS unit in India, the message is that it is certainly expensive to start with; approximately five times more expensive than a manually conducted study. However, as Dr Kapetsky observed, the costs come down when the equipment is used again and again and the initial investment has been recovered.

To be viable, a GIS unit should be shared on a cooperative basis. The system should be coordinated and centralized to save costs. If there is only a limited need to use GIS, it is best used on a contract basis; a complete GIS project is viable only if it is used full-time. At any rate, setting up a GIS unit involves a long-term financial and administrative commitment, the establishment of permanent posts for personnel, training of personnel, the frequent updating of hardware and software and the maintenance of quality data.

Constraints involved in running a GIS unit are likely to be :

Lack of appreciation of GIS applications;

 Nonavailability of relevant data; and

- Overall administrative difficulties.

With this understanding, and these ideas of how we can use GIS, the question then becomes can we really afford not to use GIS in aquaculture decision-making? This may best be answered by the observation that the failure to communicate geo-spatial needs for aquaculture could jeopardize development prospects and lead to poor planning and management decisions which could, in turn, affect the environment as well as human communities.

GIS is still to make a significant entry into India. Being a costly investment, the initial attempts to use this potentially important tool will be closely watched over the next few years. A start on this was made when the University of Madras's Department of Geography demonstrated to the 40 participants at the workshop some of the work it has done with GIS.

– JANAKI VENKATARAMAN

# Getting the Message

One of the main objectives of the Bay of Bengal Programme's (BOBP) management-oriented third phase will be information dissemination or "getting the message across". A workshop hosted by the BOBP in Madras in April 1995, clearly demonstrated that the process will not be as simple as it sounds. In fact, the key word in this objective just might be 'dissemination', or what is also known as 'knowledge-intensive intervention'.

The information already exists. In fact, we are actually overloaded with information. Our task is to make it available at the right time, at the right place, and to the right people. As pointed out in an FAO/SEAFDEC Regional Workshop on Fisheries Information in Thailand in 1994, "while information sources have gone high-tech and the amount of information has been rising rapidly, access to it has not improved". In short, how do we put such information and knowledge in the hands of the endusers?

Another problem is that much of the information collected by a centre may not be what is required by its users.

Information, at this point of leaping into the 21st Century, makes the difference between staying in control of a situation or being left behind. To be knowledgeable is to be in command. But then, to be relevant, information has to be

need-based,

- -written and organized for the user audience,
  - understandable to the public,
- up-to-date, and
- easily accessible.

This is particularly true of information concerning fisheries, where the availability of information about a constantly changing situation makes the difference between profit and loss, protection of the coastal environment or its despoliation or, more simply, in the long run, the survival of both fisher-folk and fish .

The current emphasis on information dissemination by the BOBP stems from its own dilemma between earlier successes and some of its present problems. As Dr Kee-Chai Chong,

# Across

Programme Coordinator, BOBP, Madras, said in his welcome address at the workshop, "Part of this success story (the expansion of fisheries production to a large extent) and dilemma (a situation where too many tisherfolk are chasing after too few fish) can be traced to the lack of appropriate and timely information to help key decision-makers and policy-makers arrive at sound decisions in the development of fisheries". In other words, it is not enough that an agency has an appropriate message, it has to make sure that it reaches the appropriate audience at the appropriate time.

Actively disseminating information is different from merely providing it as and when someone seeks and asks for it. As Dr Chong stated, "We (BOBP) were not very proactive in wanting to service needs for information . . In other words, we were not actively seeking out customers and marketing information".

BOBP's new thrust will be to improve its ability to communicate information so as to ensure that it reaches those who



seek *it* as well as those who may not be sufficiently aware to seek *it*, but who nevertheless need it critically. How this may be done was one of the components of the discussions at the Madras workshop. A number of suggestions emerged:

- The BOBP library in Madras be enlarged in scope and services to become a regional library.
- A common database beestablished for information from the BOBP region.
- The library be interlinked by computer with other fisheries libraries, both in India and in centres in BOBP member countries, to provide a wider variety of information.
- Technical publications be translated into local languages to reach a wider readership.
- Training programmes for fisheries libraries in the region be initiated through BOBP and its FAO connections.

The BOBP's Library in Madras.

A positive aspectof this workshop, which was organized in connection with a visit to BOBP by Ms. Jean Collins, Librarian, Fisheries Branch Library, FAO, Rome, was that a number of local agencies committed their support during the workshop to help the BOBP in its information-dissemination efforts. These included the British Council, the Central Institute of Brackishwater Aquaculture, the United States Information Service, the Central Marine Fisheries Research Institute, the Department of South and Southeast Asia Studies, University of Madras, and the International Ocean Institute, Indian Institute of Technology (Ill'), Madras.

By the end of the workshop the direction and goals for BOBP's informationdissemination programme became clear. As Dr Chong putit, "There will be more information-hungry users in the coming years and BOBP needs not only to respond to them but must imaginatively package information useful to them". No longer do users expect to get information for free. They are more than willing to pay for it. In return, they demand information that is not only relevant and timely – users want current statistics, not those two or three years old – but which is also crisp. "This is the age of information, not articles."

However, it was also pointed out, that while it must be borne in mind that there are users willing to pay for information, there are many more, particularly in the developing countries in the BOBP region, who might not be able to pay, but need the information all the same. So, while the BOBP is set to cruise down the information highway, it needs to work out how, at the end of the road, it is able to serve the grassroots users who could make the difference, in the long run, between BOBP achieving, or not achieving, its goals.

—J.v.



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