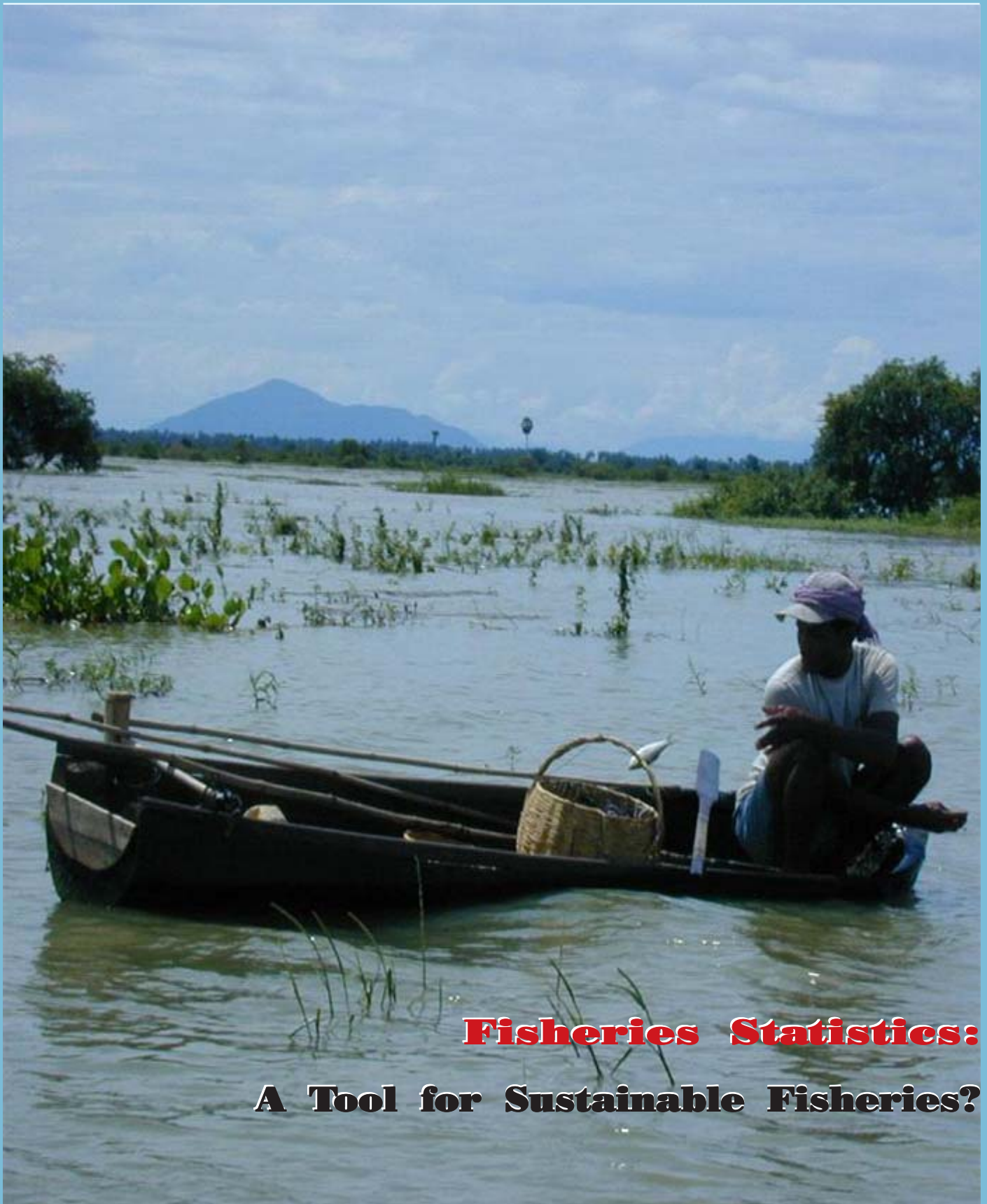


FISH *for the* PEOPLE

A Special Publication for the Promotion of Sustainable Fisheries for Food Security in the ASEAN Region

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**Fisheries Statistics:
A Tool for Sustainable Fisheries?**



Southeast Asian Fisheries Development Center

EDITORIAL

SEAFDEC has long made efforts to assist Member Countries through human resource development (HRD) programs within its technical competence. Recently, in accordance with the rapidly changing fisheries situation in the region, the need to review the direction and content of these programs has been recognized. As in other parts of the world, the economic situation of fishery industries in Southeast Asia has been deteriorating, primarily due to a lack of appropriate fisheries management plans. Without proper management, exploitation of fisheries in the region has been increasing. This in turn has been devastating fisheries resources, already weakened by the negative impact on the environment of rapid economic development in Southeast Asia.

As in other parts of the world, ASEAN Member Countries have policies to promote industrial development and accelerate economic growth. The main thrusts of economic development are often the endorsement of advanced technologies and foreign investment for new industries in the country. Yet it is necessary to consider how such policies affect each country's population, which across ASEAN remain predominantly rural. In direct response, most Member Countries are presently focusing development efforts on primary industries in rural areas.

The international community frequently expresses grave concerns about the current status of fisheries, and through various means, promotes sustainable global fisheries. While appreciating international initiatives, the region needs to develop more specific policies on various local issues, including the direction of HRD programs. If fisheries-related organizations, including national authorities and regional organizations such as SEAFDEC, bear in mind only negative views on the future of the fisheries industry – as expressed by international agencies – what will be the effect on the future of the sector in the region?



Hook-and-line fishing on the floodplain of the Mekong River (courtesy of Theo Visser)

Such views will first be reflected in the directions and implementation of the various programs supporting the fisheries industry, and will then immediately influence stakeholders supposed to receive the benefits of these activities. One important negative effect will be the response of future generations involved in the industry. If we fail to attract young people, including potential scientists, researchers and leaders of the fisheries sector, the future of fisheries in the Region will indeed be bleak.

In developed countries, a wider scope of professions is available, and impacts from such negative views on fisheries may actually facilitate the promotion of appropriate courses of action, and eventually encourage the reorganization of the sector.

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In ASEAN Member Countries, a large number of people depend on fisheries in terms for both livelihood and food security, with far fewer economic options, especially in rural and coastal areas. In these countries, fisheries also play an important role in generating export earnings. One major concern is that overly negative views of the future of fisheries might only further aggravate the existing situation and ensure that a large number of people continue to struggle with daily life, exacerbated by continuously deteriorating fisheries resources.

Therein lies the greatest challenge. If we fail to attract qualified young people to work in the sector, we can only expect a vicious cycle of further devastation of the fisheries industry and fisheries resources. In the current critical period, we need more resources – especially human resources – to address the severity of the situation and to reverse current trends, in order to ensure fish for the people in the long term. We trust that qualified young men and women will eventually provide timely and practical advice and services, helping to ensure proper fisheries management. As such, they will support people and communities who depend on fisheries, while taking full account of the various social and economic problems faced.

In addition to capture fisheries, there is hope that there might be other areas of fisheries, such as aquaculture, post-harvest technologies and resource enhancement, that can fruitfully be promoted in the region. Considering the human resources currently employed in fisheries and the technologies adopted in the region, we believe that a positive way of thinking is one of the most critical issues for achieving sustainable fisheries, as it will promote the development of adequate policies and attract young people through various HRD programs.

Young scientists, researchers and potential future leaders of the fisheries have been identified as the main target subscribers for *Fish for the People*. As a regional organization, SEAFDEC will consult with its Member Countries on the importance of a positive policy for the involvement in fisheries of the next generation, and encourage the implementation of appropriate HRD programs, thus ensuring an important aspect of achieving sustainable fisheries in Southeast Asia.

Yasuhisa Kato

FISH for the PEOPLE is a special publication produced by the Southeast Asian Fisheries Development Center (SEAFDEC) every four months as part of the ASEAN-SEAFDEC Special 5-year Program to promote sustainable fisheries for food security in the ASEAN region.

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Fisheries Statistics: A Necessary Tool for Sustainable Fisheries?

by Theo Visser



Introduction

Fisheries are a major activity for many people living in inland and coastal areas in Southeast Asia and are considered to be the main basis for the livelihoods and food security of many rural populations. Information on actual levels of consumption and catch are scarce, but research data from the Mekong River Commission suggest that inland capture fisheries in the Mekong basin, for example, may produce over three million MT per annum. This estimate is based on a combination of consumption and catch assessment data, collected over a number of years, and including non-fish aquatic organisms like shrimp, frogs and water insects.

Official catch estimates, where available, do not normally include small-scale or subsistence fisheries, and therefore tend to massively underestimate actual fish production. 'Real' production is often at least two to three times higher than indicated by official catch estimates. For example, reported inland fisheries production from all ASEAN-SEAFDEC Member Countries combined (including the Mekong countries mentioned above) for 2000, based on FAO information, is only around 1.3 million MT. The contribution by the small-scale fisheries sector, both coastal and inland, to the livelihood and food security of rural people is in

most cases underestimated, leading to a failure to appreciate the levels of required assistance to these sectors.

Statistics are, of course, essential to making informed decisions on policy, planning and management. At the same time, it is widely acknowledged that there is insufficient use of existing information.

Current statistics do not adequately provide information perceived to be required for policy, planning and management. If this is true, it is time to make the fishery statistics more useful, or to make the outputs of the system ('information') more appropriate.

Targeted end-users of the information do not use the available information properly, and often, not at all.

This is often induced by the low quality or poor focus of available statistics, or simply by political considerations; under good governance, all decision making should be transparent and based on the best available information. In addition, the current fisheries statistics framework and objectives often have not been designed to be used for actions in the future, but are limited to records of past achievements of the industry.

Despite the lack of proper planning and management, inland and marine catches have proved to be quite resilient, at least in absolute terms, such as gross weight.

This is an important observation. Collapsed fisheries have for the most part been mono-species fisheries. In tropical regions, multi-species fisheries are the norm, and species replacement, or fishing down the food-web, is common. Where mono-species fisheries do exist, tuna being an obvious example, they are managed effectively and depend on huge areas and shared stocks often from different origins. We cannot deny that there is over fishing, but it is apparent that relatively healthy ecosystems have ways to compensate.

“‘Real’ production is often at least two to three times higher than indicated by official catch estimates”

Fisheries and statistics

Although in some SEAFDEC Member Countries, marine fisheries are relatively well covered by a statistical system, the general situation of statistical coverage for coastal fisheries in the ASEAN region is very similar to that for inland capture fisheries – really appalling!

At the Millennium Conference, it was concluded that various shortcomings needed to be addressed in order to improve fisheries statistics in the region, in particular with regards to effective usage and collection of required information. In order to tackle such a challenging task, four countries – Cambodia, Lao PDR, Myanmar, and Viet Nam – were identified as initial recipients for training under a project executed by SEAFDEC. The aims of the project are to first mitigate the technical disparities among the ASEAN Member Countries, and to promote this challenging program while harmonizing the situation in the region. The focus of the project is on both inland and coastal fisheries.

As a first step, a set of methodologies appropriate for inland and coastal fisheries were compiled under the heading Guidelines for the Collection of Inland and Coastal Fishery Statistics. Special emphasis was put on the collection of economic and socio-cultural data necessary to answer many management, policy and planning questions that biological data alone cannot

appropriately address. Most of these socio-economic data are not considered part of regular fishery statistics, and are rarely included in a comprehensive manner. As such, these are prominently featured in the Guidelines, while special emphasis on the design of a statistical system is also given.

This article is based broadly on the Guidelines, and will consequently focus mainly on inland and coastal fisheries.

What are fishery statistics?

Traditionally, fishery statistics include data and information that describe the current and past status of the fisheries, and show trends on the development of the sector that can be used for policy, planning and management. The nature of the most commonly collected statistics, catch and effort, is such that time series are required to be able to separate natural fluctuations in species or production from human-induced changes, in order to make them useful. However this classical approach to fishery statistics, to include just catch figures (by species) and effort (by fishing gear) is inadequate for the challenges facing the fishery sector. Moreover, this type of statistics has proved to be difficult to collect from small-scale fisheries.

“the general situation of statistical coverage for coastal fisheries in the ASEAN region is very similar to that for inland capture fisheries - really appalling!”

Statistics for inland and small-scale coastal fisheries are often considered exceptionally unreliable. This is true for both developed and developing countries alike. It is not just a question of available budget, as fisheries statistics for many developed countries are also poor. Inland fisheries statistics, especially, are of poor quality worldwide. This has only become apparent in recent times. It is not that the statistics have deteriorated, although in some cases this has also occurred; rather, it is that demands on statistics have increased due to growing participation in fishing activities and increasing pressure from within and outside the sector.

Whereas in times of expanding fisheries and plentiful unexploited stocks there was no real need for

management, the situation nowadays has changed dramatically. Not only are most stocks now fully exploited, and in many cases overexploited, pressures from outside fisheries on resources have also increased, due to pollution, development of coastal areas, and conflicts between resource users. The situation has changed considerably over the past few decades, with tourism and environmental issues increasingly having to be taken into consideration as well. This has added to the demands on data that needs to be collected.

There are two main problems with inland and coastal statistics:

1. The amount of detailed information required to be useful needs to be more diversified than those for high seas fisheries. The quality of the statistics therefore needs to be higher. For example, exact information on where fish are caught for high seas fishery is rarely available while often essential in order to assess the status of a species. The exact location where fish are caught (habitat information), and other micro information, are central for coastal and especially inland fisheries, with a special mention if the information is to be used for integrated resource management.
2. Collecting statistics for inland and coastal fisheries faces several methodological problems:
 - a. The nature of fishing operations, which are mainly small-scale, scattered in space and time
 - b. Use of inappropriate methodologies, designed for medium to large-scale marine fisheries
 - c. Focus on the most visible components, namely large-scale fisheries with ‘easy-to-collect’ parameters
 - d. Inappropriate management focus, in which the wrong focus is given to classical catch-effort and stock information
 - e. Lack of funds, attention, and support due to the under appreciation of the sector
 - f. Little or no evaluation of statistical system design.

Not all of these issues are typical for inland and coastal fisheries, but the combination of all factors together is unique, particularly for inland fisheries, but to a lesser extent also for coastal fisheries.

For all fishery sectors, the matter of timeliness is an important issue. It is not uncommon for statistics to become available for users only two years after

collection. Since the main purpose of a statistical system is to provide relevant information to policy makers and managers, this kind of delay is unacceptable; for informed decision making, information has to be available almost immediately. The solution is mainly one of system design, unless information relies on reporting or questionnaires that can delay timely collection of data.

“much of the information that may be requested by politicians, planners and managers cannot be extracted from routinely collected statistics”

Collecting more statistics information is not feasible, in view of shrinking available budgets, and the ever-increasing demands placed on statistics agency staff. But for a full understanding of fisheries, the scope of appropriate fishery statistics needs to be as wide as possible in order to accommodate other essential data sources. This scope goes well beyond typical fisheries statistics, and includes livelihood data, socio-cultural information, and economic data, in addition to production (biological) data. This approach is important, as fisheries cannot be regarded as entities separate and distinct from other sectors. For policy, planning and management, a more holistic approach has to be taken, focusing on basins and bays instead of specific fisheries that may cover a wide area and many separate stocks.



Cast net fishing in Vietnam

Obviously, a choice has to be made about what information should be collected by governmental fisheries agencies, and what should be collected by other organisations. Statistics are relatively expensive to collect, so what is collected should be usable and reliable. What exactly is collected depends on what information is required, and since this depends on policy and management decisions often taken at a national level, the requirements and thus the statistical system will differ from country to country. Even so, very similar requirements need to be taken into consideration. In all cases, it is important not to be too ambitious and to limit the statistical system to a certain minimum set of parameters and expand it with other information and research from other sectors, including environment, biology and socio-economics.

Some of the ‘statistics’ required for a bay or basin wide approach are outside fisheries, or regarded as research rather than statistics. Research can also supply statistics, and contribute valuable information on the fishery sector. In fact, much of the information that may be requested by politicians, planners and managers cannot be extracted from routinely collected statistics, and must be provided by auxiliary (non-routine) information from other sources like (scientific) research.

Issues and uses of fishery statistics

Fishery statistics can serve many goals, but for most ASEAN-SEAFDEC Member Countries, inland and coastal fisheries statistics are only used to indicate the importance of the fishery sector in the national economy. Reliability and coverage are often such that there is not much point in trying to use these statistics for other purposes. Even so, official statistics almost always underestimate the actual economic importance of fisheries, which can be more accurately obtained from results of research surveys into fisheries socio-economics.

“The main purpose of fishery statistics should be to monitor the status and trends of the fisheries, providing a focus on specific problematic fisheries”

Fisheries statistics are normally used to illustrate the status of the sector for purposes such as tax and licensing, but such general practice sometimes fails to justify the required costs, and eventually lead to declining resources and support from government budgets with many other priorities. It is rare to find cases where fisheries management is actually based on available statistics. Instead, a combination of statistics and additional research information, as well as policy considerations, are used to provide the basis for management that eventually often says more about the status of fisheries in the national economy than about the status or trends of particular fishery resources. One of the major constraints on current statistics is that they often only illustrate fisheries in general, without showing details of individual fisheries where management actions are needed.

But let’s take a different perspective. The main purpose of fishery statistics should be to monitor the status and trends of the fisheries, providing a focus on specific problematic fisheries where appropriate remedial actions and measures are required, with proper identification of priority needs. The variables that are collected should therefore be used as indicators for changes in fisheries, or support calculations of composite indicators, such as Catch per Unit of Effort (CpUE), that do so. Although biological indicators can



be used to monitor the state of exploitation of a fishery, they are inadequate for assessing the performance of the fisheries sector as a whole. From this perspective, other indicators are required:

1. **Economic indicators**, designed to measure the relative importance of fisheries to the nation or region at the macro- or micro-economic level.
2. **Socio-cultural indicators** that take into account the diversity of needs and practices of different groups of people within the fisheries sector.
3. **Compliance indicators**, to monitor the effectiveness of management measures and to reduce conflict.

So to be able to guide decision making for management, policy formulation and planning, fisheries assessments should ideally combine biological, economic, socio-cultural and compliance indicators. This is often neither practical nor affordable, so in cases where choices have to be made to limit the coverage of the statistical system, core statistics at least should be collected, meaning information on catch quantities and applied fishing effort. But core statistics should only be collected where it makes sense to do so, for fisheries where this information is used for management purposes. This excludes most subsistence fisheries and many small-scale and part-time fisheries, where collection of fishery statistics and management of fisheries can better be replaced by co-management of the environment and collection of selected socio-economic indicators (like fish consumption).

“Although fishing pressure does have an impact on fisheries, environmental changes have in general a much more important impact on the status of fish stocks”

Moreover, for fisheries statistics to be useful, it is often necessary to have comparable and compatible time series available over a long period, with statistics collected consistently, using the same methods and approaches. This is a bit restrictive in relation to the available options to change the system or methodology, but it is not much of a problem for the basic fisheries statistical parameters, for which the methods and approaches are fairly well established and standardised. Time series for biological data are often available for

considerable lengths of time; time series for economic and especially livelihood (socio-cultural) data are either non-existent or consist of largely incompatible data. In-depth knowledge of objectives and methodologies used then becomes even more necessary in order to be able to interpret the data.

Fisheries statistics for management

In discussions with fisheries officials, the use of statistics most frequently mentioned is for management. Although certain sub-sectors, especially inland river fisheries, floodplain fisheries, and small-scale fisheries in general, are seldom particularly well managed in Southeast Asia, management should at least be one of the main focus points for the use of statistics.

Managing fisheries solely through catch and effort restrictions does not work in inland and small-scale coastal fisheries. The bulk of all fishing operations are in effect unregulated, due mainly to practical constraints of enforcing catch/effort based management interventions. Although at a local level, enforcement may work, the costs are quite high, and are often unrelated to the economic value of the resource. Moreover, for inland fisheries and many small-scale coastal fisheries, overfishing by local resource users is not the largest threat to sustainable use of fisheries resources.

Although fishing pressure does have an impact on fisheries, environmental changes have in general a much more important impact on the status of fish stocks, particularly in cases of loss of fish habitats for spawning, nursing and feeding. The concept of environmental management taking precedence over fisheries management is not new. In floodplain-driven river fisheries in particular, it has long been recognised that the only way to understand the fluctuations in fish production is by looking at environmental fluctuations, such as the duration, timing and extent of the flood (the flood-pulse concept). Environmental management still needs information to steer management interventions, but normally does not need the classical fisheries statistics used in stock assessment-based management. This could mean that for certain sectors no regular catch statistics will be collected; rather socio-economic indicators (such as fish consumption) or

resource use indicators (such as livelihood strategies) may be used to steer multiple-use environmental management.

The only feasible way of management of small-scale fisheries is to transfer ownership of resources to resource users, and to allow them to manage the resource themselves. As long as local fishers can limit access to the resources, with good institutional support and rewards for those who participate in the scheme, such a decentralised management approach, both in inland and coastal fisheries, is desirable.

The process of putting such (co-) management systems in place is a complex, time-consuming task, but one that is essential to maintain a healthy fishery and sustained benefits from resources. The advantage of this type of management is that it does not just look at fisheries, but takes a holistic view and effectively works on management of the environment of a community. This means that guiding co-management can be a collaborative effort of all agencies working at the village and community level. In this way, community management and collaborative management (combining different sectors holistically) are combined into a single scheme. An added benefit of community management is that it can work in a data-poor environment, and that it can also be used to produce data. This bottom-up approach to data generation can be used to obtain valuable information on the state of the fishery and

resource use without the need for expensive data collection schemes.

In such cases, where true fisheries management is required, such as for middle and large-scale commercial fisheries, it is important that management decisions are transparent, and that policies and management measures are explained in a way that people involved can understand. In general, the relationship between fisheries staff, on the one hand, and fishers and fisheries owners on the other, needs to be improved, the main challenge being to build trust and mutual understanding. Only when fishers understand reasons for management interventions, such as why there is a closed season and why they cannot use certain gear, will there be a chance that they will implement and enforce management measures themselves.

“The only feasible way of management of small-scale fisheries is to transfer ownership of resources to resource users, and to allow them to manage the resource themselves”

There is no good alternative to active participation, since enforcement will not work if fishing activities are scattered in space and time. It is much more efficient to involve fishers themselves. When there are clear advantages, such as bigger catches, bigger fish or the return of higher valued species, fishermen will cooperate. Cooperatives and reform of marketing structures, improving living standards, and creating alternative livelihoods all play important roles in restructuring and managing the fisheries sector, and this partly explains why co-management is such a demanding task.

Choices and approaches

Methods for collecting statistics are well established. In most cases, the main task is to design a statistical system using available methodologies and adapt these to the local circumstances and data requirements. This might be a complex process, depending on the exact fisheries situation, and beyond the scope of the current paper.



Floating house with mobile fishing gear in Cambodia

Several other documents cover this subject matter. Required reading for anyone involved in fisheries policy planning or management is the FAO's Guidelines for the Routine Collection of Capture Fishery Statistics (1999), which provides an excellent basis for evaluating or designing statistical systems.

“if there are no good reasons to collect statistics, don't”

The design of a new data collection system, or re-evaluation of an existing one, calls for the application of general guidelines to establish the requirements. Once these are determined, methodologies are selected and combined into a statistical system. In short, the focus is on a few key questions:

Why? Why are statistics required, and what will they be used for?

What? What statistics are required, and what information is necessary?

How? How will the statistics be collected, processed and used?

From the first question, it follows that there should be a clear objective for collecting statistics. In other words, if there are no good reasons to collect statistics, don't.

If there are good reasons, these reasons or data requirements will influence the answer to the second question. After having established the objectives of the data collection comes the difficult choice of what parameters to collect to be able to reach the objectives of the data collection system. This is a very important consideration, since what should be collected (and in what detail) will in turn decide the methodologies can be used.

It is essential to evaluate statistical requirements regularly, and design or adjust an appropriate statistical system to meet actual information requirements.

Fisheries line agencies do not operate in a vacuum, and often other agencies are involved in collecting fishery statistics at various levels. Such agencies work either in a supporting role, such as maintaining statistical standards or assisting with system design, or taking a leading role, with fisheries line agencies sometimes merely receiving the final statistics, without any active involvement in collecting them. In almost all countries, the central government statistics bureau at the very least influences how statistics are collected and sometimes collects nearly all statistics for different sectors. But fisheries line agencies normally have the opportunity to influence what is collected. As they should know the sector best, at least they should be able to steer the survey design process, and hence need to know what methodologies are available and be aware of the pros and cons of each method.



Floating fishing villages in the Tonle Sap, Cambodia

Each country and fishery is different. Each will therefore need a different approach for collecting fishery statistics. Differences in policy emphasis, preferred approaches, staffing, and budget make it almost impossible to formulate a ‘minimum’ set of parameters applicable to all ASEAN-SEAFDEC Member Countries. Each fishery will need a slightly different approach, possibly using the same general methodology, but with small differences in the actual implementation. This is the main reason why it is impossible to write a do-it-yourself, step-by-step manual. Even so, it is possible to indicate the different steps that need to be followed for the evaluation and design phase.

“Each country and fishery is different. Each will therefore need a different approach for collecting fishery statistics”



System design in 11 (easy) steps

When considering the design of a new statistical system, or the redesign of an existing system, a number of steps need to be followed:

1. Collect information on the existing statistical system (objectives, data needs, methods used, and information produced)

Every country in the region has a statistical system already in place. It is essential to understand how current systems work, or more precisely what information is expected to be produced by those system, and what does and does not work. A new fishery statistical system will need to be built with the available staff and expertise, so existing structures, resources and capacity of staff should be known and evaluated. This needs to be done on a regular basis, and is in fact being done in several SEAFDEC Member Countries. This information should be readily available if the planning process has been properly performed and documented, and should be an integral part of the planning process.

2. Collect information on who is involved in fisheries policy and planning

It is necessary to be aware of who are the targets for the information produced by the fishery statistical system. This is particularly necessary for answering the question ‘why’. It will also influence what type of information is required, what should be collected and how that information should be packaged. This exercise will not be limited to fisheries agencies; it will also involve irrigation, agriculture, forestry, environment and other organisations that may have conflicting policies that impact fisheries (say resources and habitats). Thus, all these agencies should be aware of the status of fisheries in order to make balanced decisions on the sector. Policy and planning are seldom directly influenced by the state of fisheries, unless it is a policy of the governmental agency involved in fisheries. But fishery statistics are also sometimes used to assess the impacts of policies, as a measurement for changes in the fishery situation.

3. Formulate the objectives of the fishery statistical system

It is necessary to clearly specify what the fisheries statistics will be used for, or more to the point, why there is a need for fishery statistics. Without proper

objectives, it is impossible to define the data needs that the fisheries statistical system has to fulfil. If for example the only information requirement would be an overall production estimate for aquaculture, reservoir fisheries and river fisheries, this can be done without any surveys, and can be based on previous research, Morphological Edaphic Index (MEI) or adapted estimates from previous years.

4. Define the data needs

Before starting collection, data or information needs have to be formulated. Having done so, appropriate methods can then be selected. Each method needs to be fine-tuned and can provide data of different degrees of accuracy. For most statistics, a long-term commitment is needed to their collection.

Some countries targeted by the SEAFDEC training programme have almost no statistics for certain sectors,

which rely almost entirely on ‘guestimates’. In the absence of any policy or management for the capture fisheries sector, this is probably cost effective. Nothing is collected that would not be used anyway, and what is produced is only there to show the relative importance of the fishery sector.

5. Review all existing information pertaining to fisheries

Before rushing out to perform all kinds of surveys, it may be an excellent idea to assess the current availability of information from within and outside the fisheries sector. Often it will become apparent that a vast amount of fisheries related information is already available. An important step in formulating or redesigning a fishery statistical system is to assess what is already there. This can be used in the survey planning process, but also to evaluate if the current information is sufficient, or what additional information is required. If the available information is sufficient for initial data requirements, it will not be necessary to initiate a survey for collecting it again.

Using available information may be a prudent first step in improving the available information on the fishery sector without spending more scarce money on relatively expensive surveys.

Moreover, the amount of fisheries-related information that is collected by non-fisheries agencies is often surprisingly large. General statistical surveys on employment, expenditure, and demographics may sometimes contain fisheries-related information. Obvious sources for fisheries information may be forestry, environmental, irrigation and agriculture agencies. Trade or economic agencies may have information on marketing, transport or even production estimates. Institutes and universities



Artisanal catches are important for local economy

sometimes have excellent research on fisheries issues, and although this information may not be routine, it can provide valuable insights into fisheries.

Aid organisations may also have done fisheries surveys. If these have been done at a local level, the results may not have been distributed to the central government level. Of particular interest are socio-economic surveys, which in rural areas necessarily have some kind of fisheries focus.

This review of existing information is often done as a desktop study, and is an ideal target for external (donor) funding.

6. Determine appropriate methods to collect required data missing from existing information

The Guidelines prepared by SEAFDEC are an excellent basis for reviewing available methodologies and decide whether or not they are appropriate to local fisheries situations. For all surveys, complete documentation is essential, both for training purposes and for evaluating the methodology.

7. Train staff in using the selected methods

Training is an essential component of any statistical system. It is a continuous process, and should be a major focus of the development of statistical capacity at all levels, from data collectors to planners and decision makers.

8. Apply the methods and collect statistics

Collection of statistics may seem routine, but seldom is. Enumerators need to be closely supervised, some surveys may need continuous feedback to assess levels of reliability, and any statistical system has to be constantly reviewed.

In general, a number of steps should be taken in every survey:

1. Identify the survey area and target population
2. Identify what will be monitored and in how much detail. For example, for catch assessment surveys it normally does not make much sense to collect data on all species of fish and shrimp caught. Some species are especially important, because of their high value or because they form

the bulk of the catches during periods of the year. Other species may be grouped. Although the obvious approach is to use local market groups, this may not be viable if survey results need to be compared over the whole country or for a basin that covers two or more countries. This would have to be implemented for the whole area covered. In Southeast Asia, this is usually a most difficult task.

3. Establish the units to be used, and standardise these.

4. Establish the sampling design, how the population will be sampled, and how many samples are required. This is a complex issue, and is covered in the Guidelines in greater detail. Sampling design should result in a field manual with exact guidelines for sampling, covering selection of villages, fishers, markets and households, as well as the composition and tasks for each survey team.

5. Perform pilot surveys to test the methodology and train data collectors and supervisors. It is likely that in the initial stages various problems will surface. This is the main reason for performing pilot surveys, both as training and to check the methodologies and procedures used.

6. Implement the full-scale survey.

9. Process and analyse the data

The term 'statistics' refers both to the methods applied to collect data and the analysed data. Without applying statistics, the raw data collected cannot be changed into something managers, planners and policy makers can understand, let alone want to look at. Statistical analyses can be complex, but for most purposes the statistical tools required for fisheries are straightforward and easy to understand.

Processing and validating survey data is an essential part of any statistical data collection exercise. Fast data entry and analysis is crucial to be able to assess survey methodology and to provide feedback to enumerators or participants in logbook surveys. It is also important to analyse the results of the survey as fast as possible. For standard surveys that will be conducted on a routine basis and the data processing, data handling procedures,

and database should be well established before the survey starts. Data processing should be routine, and data should be available right away for analysis. For catch assessment and other basic surveys, the database should be capable of producing all required standard outputs automatically in order to facilitate use of the data.

The survey results should be representative, reliable and of consistent quality. The level of reliability, or the level of error, should always be indicated, as should be the variability of the survey results.

10. Produce relevant information for policy makers, planners and managers

Data processing, analysis and presentation are at least as important to a fishery statistical system as the fishery statistics themselves. Perfect statistics in themselves are of no use if policy makers and planners do not use them. This is therefore the most important stage of the statistical system, and a test of the applicability of the data collected. Does it provide the information necessary to make policy decisions? Can it be used for effective planning? Does it allow formulation of management plans?

Statistics are valuable in themselves only when the information obtained is used and brought to the attention of policy makers and planners. Publication in a yearly statistical yearbook is not the objective of a statistical system. But too frequently such publication appears to be the goal. Changing this perception takes persuasiveness and persistence if fisheries authorities are to influence the impact of other sectors on fisheries.

11. Analyse the system at all stages of implementation and provide feedback to improve the system.

As mentioned earlier, it is essential to critically evaluate all elements of the statistical system continuously, and discuss problems and suggestions for improvements. The system will progressively be adapted to function more efficiently, and hence provide more appropriate information.

Basic fishery statistical systems

Officials, planners and managers time and again ask what statistical parameters they should collect and what methodology they should use. There is not a single answer to that question that is applicable in all situations.

Proposing a minimum system would in truth be risky, implying that this 'minimum' is all that need be collected, the *de facto* standard. At the same time, a few general comments can be made on the type of statistics required, and on which parameters should be emphasized, given resource constraints. A basic statistical system should provide:

Catch Assessment, giving estimates for catch and effort for different fishery sectors, with appropriate detail on species and effort:

□ For family fishing and small-scale commercial fisheries, an overall annual catch estimate needs to be based on consumption surveys. Logbook surveys can be used for small-scale commercial fisheries, while average species detail is provided by separate species

Mobile traps on the move in the Great Lake of Cambodia



composition surveys. Effort data need not be collected, with the exception of selected important small-scale fisheries in terms of involvement (fishing days).

□ For medium-scale commercial fisheries, conventional sampling surveys for catch and effort should be performed, providing catch/effort estimates by boat-gear type and catch estimates by species.

Catch assessment for inland and coastal fisheries can be done in a number of ways. Direct measurements of catch and effort are only appropriate for well-defined, medium-scale commercial fisheries. Alternatives for this sector include logbooks or interviews with fishers on catch related variables. Medium-scale fisheries should be monitored routinely, with monthly estimates for catch and effort by species and boat-gear type.

For most small-scale and family fisheries, the main methodologies for providing a reliable catch estimate are consumption studies and habitat area production estimates (by length of river, or surface area of flood habitats). Interviews with household catches may also be appropriate for determining catch, but are relatively labour intensive. These statistics require complex surveys, and are relatively difficult to collect. Such a survey could be carried out once every five years, or more frequently depending on resources.

Economic data should at least include fish prices, exports and employment in the sector (including involvement). Fish prices should be collected at points of landing, wholesale markets, and consumer prices at least twice a month. Employment data should be assessed monthly for medium-scale commercial fisheries and annually for small-scale commercial fishing, whereas the numbers of full-time and part-time fishers can be assessed on less than an annual basis for family fishing, in combination with regular population census updates.

Official imports and exports of fish and fish products should also be monitored, but this trade data can often be obtained from customs department. Thus separate surveys will not be necessary. This data should be available annually.

The economic importance of separate, licensed commercial fisheries in macro-economic terms should be assessed every 5 years.

Livelihood data should at least include data on consumption and demographic data on age and gender related to involvement in fisheries activities. These data can be collected on a less than an annual basis, and can be the subject of research studies.

Structural data should be available mainly for medium-scale commercial fisheries. For small-scale and family fisheries, no structural data is required in a minimum statistical system. For medium-scale commercial fisheries, it is necessary to have information on fishing gear, landing sites, markets, processing plants, wharfs, and ice plants. This information should be collected every 5-10 years (with between-survey updates).



In conclusion

Collecting fishery statistics is not easy; it takes skilled and dedicated staff as well as long-term planning. In many situations, there is no need for fishery statistics in the traditional sense for planning and management purposes. An important observation, for both coastal and inland fisheries, is that management of the environment is more important than management of the fisheries itself. In practical terms, this means that as long as the major habitats for different stages of the life-cycles of fish are intact and the migration routes that connect them are not broken, fisheries can withstand considerable fishing pressure, and continue to provide high yields over a long period of time in a sustainable way. A good example is inland fishery in the Tonle Sap River and Great Lake area of Cambodia (see Box).

This in no way reduces the need for proper fisheries statistics, simply shifting the management focus and information required. All involved in policy, planning and management of fisheries should be aware that an holistic approach needs to be taken at a basin or bay-wide level with decentralised management and devolution of power to the resource users themselves. This will dramatically influence the type and scope of information required.

As the fisheries sector throughout the region is presently in flux, it is clear that any design or re-evaluation of an existing statistical system should be carried out most carefully. The steps outlined in this article, and the more in-depth set out in the Guidelines, should provide a consistent and rational tool for adjusting the information system to serve decision makers, planners and managers at all levels of government.



The Tonle Sap's Bountiful Harvest

For further reading, see for example:

Ahmed, M., Hab Navy, Ly Vuthy and M. Tiengco (1998). Socio-economic assessment of freshwater capture fisheries of Cambodia: a report on a household survey. Mekong River Commission Secretariat, Phnom Penh. 185pp.

Coates, D. (2002). Inland capture fishery statistics of Southeast Asia: Current status and information needs. Asia-Pacific Fishery Commission, Bangkok, Thailand. RAP Publication No. 2002/11, 113pp.

FAO (1999). Guidelines for the routine collection of capture fisheries data. Prepared at the FAO/DANIDA Expert Consultation. Bangkok, Thailand 18-30 May 1998. FAO Fisheries Technical Paper: No. 382. Rome, FAO. 1999. 113pp.

Visser, T.A.M. (2003). Collecting Fishery Statistics for Inland and Coastal Fisheries. SEAFDEC report, 180pp.

Zalinge, van, N.P., Nao Thuok, Touch S. Tana and Deap Loeung (2000). Where there is water, there is fish? Cambodian fisheries issues in a Mekong River Basin perspective. In: Common property in the Mekong: issues of sustainability and subsistence. ICLARM Studies and Reviews 26, pp. 37-48.

About the author

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The Tonle Sap's Bountiful Harvest

Cambodia has a unique fisheries sector, based mainly on inland fisheries, with aquaculture and marine capture fisheries playing a relatively unimportant role. As for the majority of the 66 million people living in the Mekong Basin (1997 estimate), fish and rice constitute the staple food of most people in Cambodia. With an annual population growth rate of approximately 2 percent, pressure on natural resources in the country will continue to increase severely in the near future.

Cambodia's Tonle Sap is a vast water body situated in the heart of Cambodia. So crucial is its flood pulse to the Mekong ecosystem that the seasonal expansion and contraction of the Tonle Sap can be considered to be the heartbeat of the Mekong. The Tonle Sap is connected to the Mekong by the Tonle Sap River, which responds to changes in water levels in the Mekong by reversing its flow early in the flood season, and again right after the peak flood. The people of Cambodia are well aware of the significance of these events, and celebrate it with festivals every year. Vast fish migrations are associated with periods in which the flow changes direction, as fish moving between the Great Lake and the Mekong need to pass through the Tonle Sap River. Fisheries there are the most productive in the Basin.

The most comprehensive independent data are largely based on MRC/DoF socio-economic and catch assessment surveys in various parts of the country.

Cambodia's freshwater capture fisheries production of over 400,000 tons per year is large even by world standards, ranking fourth after China, India and Bangladesh. Even this figure is believed to be an underestimate.

Estimated value at landing sites is US\$ 200 million; estimated retail value US\$ 300 million.

Exports are estimated to exceed 50,000 tons/year; this is also believed to be an underestimation.

The Tonle Sap annual catch is about 235,000 tons/year.

More than 1.2 million people in the Tonle Sap area alone depend on fishing for their livelihoods.

More than 100 species are regularly landed, although up to 200 species have been recorded in the Tonle Sap, and more than 500 species in the freshwaters of Cambodia. No species are found only in the Tonle Sap, but several are endemic in the Mekong. No known species have become extinct.

The 1999 socio-economic survey of the National Institute of Statistics estimated that 6,386 Riel per person per month is spent on buying freshwater fish for home consumption. At an average fish price of 2,600 Riel per kg, this is more than 300,000 tons/year. These figures do not include fish captured and consumed by fishers themselves, nor does it include bartered fish.

The intensity of fisheries in the Mekong Basin has led to the popular belief that fish stocks are already suffering from overfishing. But for many decades, several hundred thousand tons of fish have been extracted annually, and overall, there is little indication of 'overfishing.' Were fishing pressure to increase further, it is expected that the catch would actually increase a little.

At the species level, however, the situation is more complex. Even in the absence of proof of decreased catches in absolute terms, the situation is different when we consider trends in catch composition. A few of the larger, more slow growing species, which mature later in life, are decreasing. This is because many other species are opportunists that become sexually mature after one or two years, and lay a large number of rapidly developing small eggs. Species with such a life cycle can be exploited intensively without serious impact on stocks, because recruitment and mortality of these species is much more dependant on the size and duration of the flood than on the intensity of fisheries. Nearly all species are much more sensitive to environmental changes than to overfishing. This implies that it is more important to manage the environment than to manage the fisheries *per se*, in order to sustain the fisheries (Coates 2002).

Overall, the Mekong Basin is still relatively unaffected by pollution, and except for a few locations near major cities, water quality is good. However, increased industrial development and rapidly growing human populations will inevitably lead to a considerable rise in the demand for water, energy and arable land. Pressure on natural resources in the region is building rapidly. Destruction of aquatic habitats is already widespread, and mainly consists in the conversion of natural floodplains into paddy fields and cutting down trees and bushes for firewood and for use in brush parks in the fisheries. Improving navigation through dredging of the riverbed and removal of rocks, now being carried out on other stretches of the river, will change water flow and may also affect spawning grounds of many species (see the article 'Fisheries Resource Management Trials in Cambodia - Fishing Reform and Community Fisheries', in this issue, for further reading on the topic).



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INVITATION TO CORRESPONDING WRITERS

With several issues of *Fish for the People* already published, we hope that we have given you a good idea of the aims and general tone of the publication. So far, we have relied mostly on contributions by SEAFDEC staff. We are now inviting contributions from other writers interested in promoting relevant issues on fisheries in developing countries. While the publication will continue to focus on the Southeast Asian region, future issues can address relevant issues from other tropical regions.

Fish for the People is a policy-orientated publication. It is not a forum for publication of research findings, nor is it intended to provide detailed technical information. The publication targets not only experts or scientists, but also other traditionally less technically-oriented fisheries stakeholders, such as policy-makers, donors, government staff, managers, and more generally, an informed lay public with an interest in how our fisheries are managed.

Readable, accessible articles that address the various issues discussed at the ASEAN-SEAFDEC Millennium Conference are most desired. Articles should focus on newly emerging issues relevant to sustainable regional or tropical fisheries management. They should present important issues with clear regional messages, emphases, thrusts, problem areas, and propositions for improving current situations.

Through *Fish for the People*, we hope that authors will gain the attention and consideration of targeted fisheries stakeholders, and contribute to the future achievement of more sustainable fisheries.

Correspondence related to editorial matters should be sent to:

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Reconciling Fishing and Environmental Protection: Resources Enhancement Strategies for the Conservation and Management of Fisheries

by Theo Ebbers

Introduction

Rapidly declining fish stocks and populations, particularly in tropical small-scale coastal fisheries, are usually attributed to two factors: over-fishing and the deterioration of ecosystems, which are critical for sustaining coastal fish populations.

As noted during the ASEAN-SEAFDEC Millennium Conference, the widespread degradation of coastal and marine habitats has greatly affected the productivity of fisheries, and reduced their contribution to local food security. Measures to stop or even reverse these trends are urgently required, and methodologies to restore and enhance coastal aquatic habitats need to be explored and developed. In the Resolution on Sustainable Fisheries for Food Security in the ASEAN Region, adopted at the Millennium Conference, ministers responsible for fisheries in the ASEAN Region recommended to “work towards the conservation and rehabilitation of aquatic habitats essential to enhancing fisheries resources.” The Plan of Action for ASEAN, formulated during the Conference, reflects this

ministerial recommendation by including the optimization of the use of “inshore waters through resource enhancement programmes.”

“the widespread degradation of coastal and marine habitats has greatly affected the productivity of fisheries, and reduced their contribution to local food security”

Following the ministerial recommendations of the Millennium Conference and based on the Plan of Action, SEAFDEC subsequently designed several corresponding programmes to address over-fishing and the deterioration of ecosystems through the promotion of innovative fisheries management approaches. With the aim of promoting the establishment of sustainable fisheries, programmes include decentralization and the introduction of rights-based fisheries (see *Fish for the People* Vol.1 No. 2) as well as a programme to enhance coastal fisheries resources. This resource enhancement

programme seeks to develop strategies to carefully modify coastal habitats in order to restore or increase their productivity. The feasibility, the potential ecological impacts and the socio-economic consequences of such efforts are the focus areas of SEAFDEC's present resource enhancement programme.

Strategies to enhance coastal fisheries resources were discussed recently at a regional workshop conducted by the SEAFDEC Training Department. Discussion focused on the various methodologies and techniques for resource enhancement suggested at the Millennium Conference, notably artificial reefs, stationary fishing gear, restocking programmes and marine protected areas.

“Resource enhancement strategies aim to restore the productivity of damaged habitats to their former levels, and even to further increase the ecosystem’s natural production capacity”

This article is a reflection of the discussions and results of this workshop, and looks at the various facets of resource enhancement strategies suggested and discussed.

Increasing fisheries production and conservation – maintaining the balance

Abundant fish resources and sustainable fisheries depend on a healthy and productive marine environment, with habitats providing optimal conditions for fish to reproduce. The widespread degradation of coastal ecosystems has severely affected the ability of marine organisms to maintain plentiful stocks. Resource enhancement strategies aim to restore the productivity of these damaged habitats to their former levels, and even to further increase the ecosystem's natural production capacity. This will be achieved through careful responsible interventions and manipulations, which try to ensure that habitat conditions are the most favourable for fish reproduction.

Modifications to increase the productivity of aquatic eco-systems have a long history. For many centuries,



fishers the world over have altered coastal ecosystems to increase fish catch and production. The most prominent of habitat manipulations are the deployment of artificial reefs (ARs), or fish attracting devices (FADs). Other structures have been used to grow and culture valuable marine products like mussels and oysters, or simply to trap fish. Traditionally, the main purpose of structures such as ARs or stationary fishing gear has been to increase catch and production of fish and other aquatic organisms, but it is now recognized that they may also contribute to the general enhancement of the coastal marine environment by providing suitable substrate and habitats for bottom dwelling and other marine organisms.

These artificial reefs and other man-made structures in water bodies are often used to illustrate their value as tools for the rehabilitation and enhancement of degraded coral reefs and other important marine habitats. The workshop therefore focused much of its

Deploying an artificial reef made of concrete cubes



While ARs and restocking programmes are usually directly aimed at increasing fish catch, the establishment of Marine Protected Areas (MPAs), also discussed during the workshop, aims primarily to protect, conserve and regenerate critical habitats and declining fish stocks. Supporters of MPAs claim that they provide benefits to fisheries through spill-over effects from rebuilt fish stocks to fishing grounds surrounding the area under protection. On the other hand, conventional fisheries managers often reject MPAs as a tool for fisheries management, because they fear the socio-economic consequences of excluding large areas from fishing grounds.

Resource enhancement programmes in the region

Box 1 shows that all of the ASEAN-SEAFDEC Member Countries promote at least one, and often more than one, of these resource enhancement tools.

Box 1. Overview of resource enhancement programmes in ASEAN-SEAFDEC Member Countries

Cambodia and **Myanmar** are currently promoting only MPAs, but intend to expand to other potential measures, such as ARs.

Singapore is promoting restocking to increase resident fish abundance, but also has an artificial reef programme. SFGs in Singapore are currently not promoted, as these structures are potential obstacles in Singapore's narrow shipping lanes.

Vietnam is in the initial stage of implementing ARs.

Brunei has a programme to install ARs and MPAs.

Thailand focuses mainly on the deployment of ARs, and is currently conducting a pilot project to promote SFGs. Thailand also has a number of marine parks and protected areas, which are under the jurisdiction of the Royal Forestry Department. The Department of Fisheries has established a three km-wide zone from the shoreline, protected from trawling activities.

Indonesia and the **Philippines** both have extensive programmes for ARs and MPAs. The promotion of SFGs is among one of the priority areas of the Bureau of Fisheries and Aquatic Resources in the Philippines.

Malaysia has established a number of large marine parks, and pursues an extensive artificial reef programme.

discussion on the environmental and fisheries impact of structures like ARs and Stationary Fishing Gear (SFG) on coastal waters.

“artificial reefs and other man-made structures in water bodies are often used to illustrate their value as tools for the rehabilitation and enhancement of degraded coral reefs and other important marine habitats”

Another strategy for fishery resource enhancement discussed during the workshop was restocking. This strategy has a relatively long history, going back more than a hundred years. Traditionally, it strives to rebuild declined or collapsed fish stocks through the mass release of cultured fish into the wild.



An overview of ARs, FADs and SFGs

As mentioned above, the deployment of artificial reefs to increase fish catch has a long history. Fishers have long been aware that any kind of structure in the water attracts fish. Trees and tree trunks, rocks, bamboo, and old fishing boats have all often been used to create such structures and enhance fishing. With the introduction of modern technologies and materials, fishers started to experiment with structures made of used car tyres, concrete, PVC pipes and other materials which promised to be durable enough to withstand currents and wave actions for a long period of time.

“What are the net-gains and benefits for fisheries resources from these resource enhancement strategies?”

A brief look at the objectives of these programmes shows that each of these tools can be used for various purposes, and that each may have various conflicting impacts on the coastal marine environment and fisheries resources. Generally, activities promoted by SEAFDEC Member Countries focus on the following objectives:

- To mitigate habitat losses caused by natural disasters and human activities
- To improve marine productivity and the biodiversity of coastal resources
- To increase fish catch in coastal waters
- To provide physical obstructions against the invasion of trawlers into coastal areas
- To provide productive and alternative near-shore fishing areas to small-scale fishermen, and
- To promote sustainable livelihoods such as eco-tourism and small-scale selective fishing in the use of coastal marine resources.

The ambiguity of these major resource enhancement strategies with regards to fisheries, as reflected by the diversity of the objectives listed above, can be summarized in one question: What are the net-gains and benefits for fisheries resources? Much academic and fisheries management debate revolves around this question, with currently available scientific data not providing any clear answer. This lack of reliable and verifiable data on ecological impacts and economic benefits has led to much vigorous – and frequently very emotional – argument on resource enhancement strategies and tools.

A reef is defined as “a ridge of coral or rock in a body of water, with the top just below or just above the surface,” (Encarta □ World English Dictionary □ 1999) so structures similarly placed by fishers are usually called ‘artificial reefs.’ Floating structures made from bamboo and other materials, which also have a long tradition in creating gathering points for fish, commonly known in the region as ‘payao,’ are usually not considered to be artificial reefs, but are referred to as “Fish Attracting Devices” (FADs). Following this characterization, one can see that all ARs are FADs, while not all FADs are ARs, so explaining the difficulty of distinguishing the two categories. Some countries, like Malaysia, therefore differentiate between ARs and FADs, by referring to their purpose: FADs are installed in order to attract fish and to increase the catch; ARs are installed to rehabilitate a degraded or disturbed coral reef area, and to increase fish abundance.

Unlike floating devices, ARs not only attract fish but also provide substrate and habitats for many benthic, sessile and demersal marine organisms. Among the ASEAN-SEAFDEC Member Countries, Japan is the most experienced and advanced at utilizing ARs to maximize fisheries production through designing specific ARs as habitats, spawning grounds and shelters for specific species. Other countries in the region have tried to learn from the Japanese experience, and have developed similar artificial reef programmes, but often

the investment necessary for assembling such ARs is beyond the budgetary priorities of the economically weaker countries. Nevertheless, with growing concern about environmental degradation and habitat loss, ARs made from cheap and affordable materials have become a common tool for trying to rehabilitate essential coastal habitats such as coral reefs in many countries of the region.

“ARs made from cheap and affordable materials have become a common tool for trying to rehabilitate essential coastal habitats of the region”

The success or failure of an artificial reef programme can be measured only in relation to its main purposes. Case studies of AR projects from all over the Southeast Asian region show that several objectives can often be attributed to the installation of ARs. Usually aimed at increasing fish catches for local fishermen, ARs are often deployed to protect shallow coastal waters from the damaging effects of trawl net operations. The widespread degradation of coral reefs has also led to the deployment of ARs to create an environment that is conducive to the recovery of coral reefs areas.

Stationary Fishing Gear (SFG) is included in this discussion on ways to enhance coastal fisheries resources, because their complex assemblage not only serves as a tool to catch fish but, like ARs, they also provide substrate and shelter for many bottom dwelling aquatic plants and animals. The growth of benthic organisms on structures like ARs and SFGs is often very impressive, and their supporters take this as a proof of their capacity to improve coastal ecosystem productivity and enhance coastal fisheries resources.

“ARs and other structures may actually cause an acceleration of resource depletion, since fish are gathering around these structures can be caught much easier, draining areas around of their fish”

Yet critics often point out that it is not clear to what extent all these structures, especially ARs, actually induce recruitment of more fish to the fishery. They



argue that ARs and other structures may actually cause an acceleration of resource depletion, since fish attracted to and gathering around these structures can be caught much easier, draining areas around the ARs of their fish. To avoid this, it is been suggested that ARs, FADs and SFGs should be installed under a strict management system. Both the fishing effort around these structures and the number of such structures in a given area need to be regulated. In some Member Countries, there are initiatives to allow the installation of ARs only within a no-fishing zone of Marine Protected Areas or in Marine Parks. Under an open-access regime, the potential benefits of all these tools may be quickly dissipated by unregulated fishing activities.

The art of deploying artificial reefs

It is therefore important to carefully choose the right location for the installation of AR structures. Common sense alone tells us that ARs have to be set in areas where the substrate can support the structures – if the sea bottom is too muddy or sandy, the AR may slowly sink into the ground. To be of any use as a fishing ground for local fishers, ARs must be installed in near-shore areas, accessible to small, traditional crafts. If set in too deep water or too far from the shore, fishers will not be able to take full advantage of the potential benefits of the ARs. Meanwhile, ARs installed in very shallow waters may obstruct navigation, will be subjected to wave action, and will be prone to be ruined by storms. In areas of high sedimentation and siltation, ARs may soon be covered by silt. In such conditions,

corals and other sensitive sessile organisms may not be able to settle, because of poor light conditions or because of the abrasive effects of the sediments in the water.

ARs should be carefully designed, not only to meet modern engineering standards of durability and stability, but – of much greater importance – to imitate as closely as possible the natural environment and habitats. While researchers and marine scientists point out that each specific purpose of an AR requires a corresponding specific design, in reality ARs are often established with

little or no ecological consideration, and often without any prior consultation with marine biologists. Case studies from the Southeast Asian region show that local political considerations are often more important in designing and implementing AR programmes than ecological considerations. Usually, the driving force behind such programmes is the promise of a short-term increase in fish catch, while the potential long-term effects and sustainability play only minor roles in the rationale and justification for these programmes.

The pros and cons of Marine Protected Areas

There is increasing, undisputable evidence that MPAs can in fact have enormous positive environmental impacts. Unlike conventional fisheries management tools, which were mostly developed for single species fisheries of temperate zones, the Marine Protected Areas (MPAs) protect whole ecosystems and consequently seem to be better suited to protecting and managing tropical multi-species fisheries. The benefits for fisheries, as claimed by the advocates of MPAs, arise from spill-over effects into adjacent areas. Considering the potential positive effects of MPAs, some fisheries managers and conservationists question the usefulness of ARs in the rehabilitation and enhancement of essential coastal and marine ecosystems. They ask what additional benefits ARs can provide if MPAs can increase fish abundance, density, biodiversity, and total biomass by – in some cases – several hundred percent.

“There is increasing, undisputable evidence that MPAs can in fact have enormous positive environmental impacts”

Still, conventional fisheries managers and fishermen doubt this claim, as they fear that fishing pressure outside and especially along the boundaries of the MPA will increase and rapidly dissipate any spill-over effects. This phenomenon has already been observed outside several MPAs. Positive MPA effects outside the protected area may result in increased competition and fishing effort, which will encourage fishers to apply new fishing techniques that in turn produce higher catches, but at the same time destroy the ecosystems in the fishing grounds around the MPA.

Box 2. The terminology of Marine Protected Areas

The discourse on the fisheries benefits of MPAs is somewhat confused, as it centres on various terms, each used with various meanings. The Regional Guidelines for the Code of Conduct for Responsible Fisheries tries to clarify the various terms, proposing the following definitions:

Marine Protected Areas

A marine area (including offshore and coastal habitats) set-aside by law or any other effective means to conserve and protect part or the entire enclosed environment, and for which management guidelines have been established.

Marine Park

A marine reserve that allows multiple uses through zoning, and in which conservation-oriented recreation, education and research are emphasized.

Closed Area

Closure of an entire fishing ground for a particular fishing gear, or a part of it, for the protection of a section of a population (such as spawners and juveniles), the whole population or several populations. The closure is usually seasonal, but it could also be permanent (FAO).

Two other terms commonly used in the region, *Marine Reserves* and *Sanctuaries*, are not defined in the regional guidelines, but are usually understood to mean ‘no-take zones’ – in other words, areas where absolutely no fishing is allowed.

Taking the lead from the Regional Guidelines, this article uses the term MPA in a generic sense, meaning any area where fishing effort and practices are strictly regulated to protect the area from overfishing and environmental degradation. In practice, most such areas include a ‘core area,’ in which no fishing is allowed and a buffer-zone, in which only very selective, traditional fishing, such as hook and line, are permitted.

Like AR programmes, the establishment of MPAs is often based on political considerations and priorities at the local level. Conservation issues and the potential benefits for sectors other than fisheries, such as tourism, are key motivating factors behind the establishment of MPAs, which often limit fishing in a particular area, but not other human activities. Like AR programmes, any effort towards establishing a MPA should have clearly specified goals and objectives, against which their success and effectiveness can be measured.

The MPA sites need to be as carefully selected as the sites of ARs. Their potential environmental and social impacts must both be analysed before the size and design of the MPA are determined. A large MPA may have excellent results in resource recovery and rehabilitation, but quite negative impacts on the fisheries sector, as the remaining fishing ground may become too small to provide any benefits to fishers. On the other hand, if its designers try to keep as much fishing ground for fishers as possible, a MPA may be too small to have any positive ecosystem effects.

“Conventional fisheries managers and fishermen fear that fishing pressure outside and especially along the boundaries of the MPA will increase and rapidly dissipate any [positive] spill-over effects”

To be most effective, MPAs need also to be accompanied by corresponding coastal resources and fisheries management programmes. The establishment of MPAs to recover critical coastal ecosystems (for example, in waters affected by pollution from agricultural run-offs or urban wastes) will be ineffective in improving fish stocks if efforts are not linked with corresponding measures aimed at reducing negative impacts. If the aim of a MPA is to increase fish production, it won't be effective if established in areas where ecological conditions can't support large fish populations. Similarly, if the main objective of a MPA is the protection of critical habitats from fishing activities, it makes little sense to establish one in an area that traditionally has not been used as a fishing ground.

A diver explores one AR, recently installed, made of concrete with a singular football shape

Ultimately, MPAs will only be an effective tool if accompanied by fisheries management efforts which aim to regulate fishing in areas surrounding MPAs in order to avoid potential negative impacts caused by excessive and destructive fishing pressure outside the area.

Restocking also requires fisheries management

Such ecosystem considerations are equally important for restocking programmes. To enhance or replenish depleted fish stocks through the release of hatchery-produced seeds, a restocking programme has to ensure that the released fish can reproduce before they are harvested. The production of seeds of commercially important fish species in hatcheries and their subsequent mass-release will only enhance stocks if the fish becomes self-sustaining thereafter. This can only be achieved through the introduction of harvesting regulations, or in other words, through the integration of restocking activities into a comprehensive fisheries management programme, which regulates fishing activities in areas where seeds have been released. In this context, the most promising approach would probably be to conduct restocking programmes within a decentralized management framework, which provides harvesting rights for the released fish to clearly defined users .

The promotion of one species over other species within a given area or ecosystem needs to be considered carefully. Local fishers and potential beneficiaries should be involved in selecting the target species of a restocking programme. Species selection should be based both on socio-economic and on biological criteria. While the selected species should be commercially important and



attractive, biological characteristics such as their amenability to being bred and reared in hatcheries, and the potential impact of their mass-release on other species and on the eco-system, need to be carefully considered as well. The availability of food and niches for the selected species in the environment were it to be released should also be considered, while trying to maintain maximum biological diversity to safeguard the ecosystem's stability.

“The most important consideration for restocking programmes is probably the genetic integrity of populations and biodiversity”

Site selection is another critical issue in restocking programmes. Release sites need to be as carefully selected as sites for establishing Marine Protected Areas or installing Artificial Reefs.



Galvanized iron pipes soldered into pyramid shape to be deployed as AR, stored on the beach, at Carmen, Philippines

The most important consideration for restocking programmes is probably the genetic integrity of populations and biodiversity. Often seed are released into areas in which the natural population has different genetic characteristics to those of the released seeds. Hatchery seed is frequently selected by hatchery operators for its capacity to grow and breed in an artificial environment. To avoid any negative impacts on population genetics, restocking programmes should ensure that the breeders used to produce the seeds are either taken from the intended release site or at least have the same genetic characteristics as the local stock.

“coastal resources enhancement project can have detrimental impacts [...] unless it is integrated into a comprehensive coastal fisheries resources management package”

The promotion of restocking programmes in the region should be based on a further clarification of these issues in order to avoid potential negative impacts and to assure their economic and ecological viability and sustainability.

On the need to promote a wider coastal management programme

The discussion on technologies and strategies for SEAFDEC's coastal resources enhancement project demonstrates clear ambiguity. Each can have detrimental impacts rather than the desired fisheries resources enhancement impact unless it is integrated into a comprehensive coastal fisheries resources management package. The fish-attracting properties of an AR require the strict management of fishing activities in their areas; the potential consequences of a fishing ground reduction through

the establishment of protected areas requires the regulation of fishing activities in these areas; restocking programmes need to be accompanied by management interventions to ensure their success.

“No single resource enhancement technology can be successful unless integrated into a wider coastal management programme”

Discussion of resource enhancement methodologies raises questions of user and ownership rights: to whom do the ARs or the released fish belong? Who has a right to fish in the vicinity of an AR or MPA? These questions need to be addressed by corresponding integrated management packages, within a framework of decentralized co-management system, in which user and access-rights are clearly defined. Under the de facto open-access coastal fisheries regimes currently prevalent in the region, any potential benefits from these and other resource enhancement methodologies might



Box 3. Artificial Reefs: the Carmen experience (by Karsten Schröder, DED)

Carmen is a small town of 20,000 people, located on the northeastern coast of Cebu Island in the Philippines. Besides basic agricultural production like corn, coconut, and bamboo, one of the major income-generating activities is fishing. In the local frame, this translates into marginal fishing.

In the Philippines, indiscriminate overexploitation of once bountiful marine resources and the use of destructive fishing methods and inappropriate land-use technologies, including logging, have resulted in a drastic reduction in fish catch, with ever-increasing impoverishment and malnutrition as a consequence.

The near-shore marine areas are characterized by a rocky/sandy beach. Soft bottom patches with intermittent rock formations provide only a limited substrate for establishment of hard corals.

In 1998, two small peoples' organizations in the coastal barangays (villages) of Luyang and Malbago decided to install several artificial reefs in a previously established 16.7 hectare municipal MPA. With the support of a local NGO and technical assistance from the German Development Service (DED), the fisherfolk drew up a plan and identified a suitable location for the AR installation, based on criteria of water depth, light penetration, currents and wave action. Two types of modules were chosen for establishment:

1. A quadrangular shaped arrangement of eight used truck tyres per module; on land, tyres were connected with rubber straps from slashed tyre material and were transferred on a raft to the site, and then sunk by divers. Limestone rocks of a size that could be handled by a person were transferred to the site and dumped into the rubber modules to provide substrate for coralline growth and niches for smaller fish. At the same time this heavy limestone material would prevent the modules drifting away.
2. The other modules were made of galvanized iron pipes; these were soldered into pyramid shapes about 2 metres high. Limestone rocks were placed on top of the structures and in the intersections respectively, thus providing a surface area for microorganisms and invertebrates to settle, and adding weight to anchor the structure.

A total of 110 rubber modules and 270 pyramid-type modules were installed at depths varying from 15 to 22 metres. Being part of, and installed within, a MPA, fishing activities are regulated through a consensus of local fishermen. No fishing is allowed in the core zone of the MPA, and only hook and line, and occasionally gill-net fishing, are allowed within the buffer zone around the MPA. Daily patrols by the fishermen ensure that the no-fishing zone and other fishing regulations around the MPA are respected. Visual inspections of the AR have been conducted several times, and a complete survey was carried out in 2002, while another is planned for the end of 2003. After one year, the first colonies of encrusting corals were observed on the rubber tyres. Pictures taken after years show various genera of hard corals on the metal pyramid type of ARs.

Although no regular fish catch monitoring is conducted, there is circumstantial and anecdotal evidence that fish catch has improved, leading to a 20 % to 40 % increase in the income of local fishers. As the ARs are within the no-take zone of the MPA, this increase has to be attributed to spill-over effects from this area. Whether this increase in productivity within the MPA could have been achieved without the ARs cannot be determined, but the fisherfolk of Carmen believe that the establishment of the artificial reefs within the MPA has contributed greatly to the increase in fish catch. Another, and probably more important, impact of the AR installation is the feeling of ownership that the fisherfolk have developed through their active participation in finding ways to become resource managers.



quickly disappear under unrestricted and unregulated exploitation pressure from the resource users.

No single resource enhancement technology can be successful unless integrated into a wider coastal management programme. As a component of an integrated coastal management and development programme, coastal resource enhancement methodologies have great potential to increase fish production without further depleting fish stocks and other aquatic resources. In implementing such comprehensive approaches, one needs to recognize the relationship between conservation and sustainable fisheries management. These are not mutually exclusive, as traditional representatives of both the conservationist camp and fisheries managers often maintain, but represent the two sides of the same coin. To quote from the FAO definition for sustainable, ecosystem-based fisheries management: “The overarching principles of ecosystem-based management of fisheries ... aim to ensure that ... the capacity of the aquatic ecosystems to produce food, revenues, employment and ... other essential services and livelihood, is maintained indefinitely for the benefit of the present and future generations ... to cater both for human as well as ecosystem well-being. *This implies conservation of ecosystem structures, processes and interactions [...and...] consideration of a range of frequently conflicting objectives* and the needed consensus may not be achievable without equitable distribution of benefits.” (FAO Fisheries Atlas, 2nd edition, Rome, 2003).

Conclusion

In their efforts to make the fisheries sector both more responsible and more sustainable, fisheries managers and policy makers have to acknowledge that any fisheries management intervention, be it conventional or innovative, will have short-term socio-economic impacts, which need to be mitigated. A cost-benefit analysis should be conducted for all new resource enhancement technologies and fisheries management practices. Such an analysis needs to answer the question



Installation of perforated concrete pipes as ARs

of whether the potential economic benefits derived from these measures justify the investment in their implementation, and will help to identify the most effective and efficient management approaches for sustainable fisheries.

To ensure that such efforts in the ASEAN Region contribute to the long-term sustainability of fisheries, regional guidelines for responsible resource enhancement methodologies should be developed. This requires intensive studies and environmental impact assessments

of each of the resource enhancement methodologies introduced, through regional pilot projects. Different management approaches and packages should be included in these pilot studies in order to test them under different ecological and socio-economic conditions.

“regional guidelines for responsible resource enhancement methodologies should be developed”

The results of such research programmes will greatly contribute to the establishment of coastal resource use practices, and will help realize the full potential of coastal ecosystem productivity in a sustainable manner, for greater food security in the ASEAN Region and for the benefit of the people of Southeast Asia.

About the author

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Managing Sea Turtles in Southeast Asia: Hatcheries and Tagging Activities

by *Zulkifli Talib,
Ahmad Ali and
Ku Kassim Ku Yaacob*

Introduction

Sea turtles are one of important migratory, marine animals protected under the CITES agreement in Southeast Asia. Six of the seven sea turtles species recognized in the world are found in Southeast Asia. These are leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), olive ridley (*Lepidochelys olivacea*), loggerhead (*Caretta caretta*) and flatback (*Natator depressus*). All six species are nesting across Southeast Asian waters except for flatback, which is mostly reported in Indonesian waters.

Formerly abundant, most of the species are now facing new threats to their ability to maintain their stocks. An exception appears to be the green turtle, reported to still be widely distributed throughout the

region, though even its numbers are declining. Major threats include:

- Substantial by-catch or accidental capture in many fisheries, including trawl, gill net, and longline fisheries.
- Habitat loss and degradation in areas that serve as nesting, foraging and resting habitats, including beaches, seagrass beds and coral reefs.
- Unsustainable utilization by coastal communities in many parts of the world, for traditional or trade reasons.

Recognizing the importance of a sound comprehensive sea turtles conservation programme, the ASEAN Member Countries engaged themselves to assess and possibly address these issues during the

ASEAN-SEAFDEC Regional Meeting on Fish Trade and Environment, held in Bangkok in October last year.

“most of the species are now facing new threats to their ability to maintain their stocks”

Sea turtles hatcheries and tagging activities in SEAFDEC Member Countries

Realizing the needs to conserve and to protect sea turtle populations from further depletion, coupled with growing awareness and concern among relevant authorities, the public and non-governmental organizations, ASEAN Member Countries are giving increasing attention to the issue of sea turtles conservation. Particular attention is being paid to the critical stages of nesting and the release of hatchlings on the beach. As a result, management programmes are orientated toward the establishment of turtle hatcheries, and hatchery operation as a conservation technique is now far more widely practiced in the region than anywhere elsewhere in the world, with operations found in most ASEAN Member Countries.

Turtle eggs are protected by translocating them to fenced hatcheries built near the nesting beaches. Inside the hatcheries, the eggs are protected against poaching by humans and from predation by wild animals, and also from natural hazards such as erosion and high tide. One problem already identified by the ASEAN-SEAFDEC researchers is the biased sex ratio of hatchlings incubated at a constant hatchery temperature, and appropriate remedial activities have already been initiated to address the problem.

“Particular attention is being paid to the critical stages of nesting and the release of hatchlings on the beach”

Since sea turtles are exceptionally migratory, and are known to move through the waters of the Southeast Asian region, a tagging programme has also been implemented. Comprehensive biological information on parameters such as migration, growth, mortality and reproduction can be derived from tagging experiments, and is crucial for the proper management of ASEAN's sea turtles.

This article aims to highlight the status of sea turtles hatcheries and tagging activities in eight ASEAN-SEAFDEC Member Countries, namely Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Vietnam. The paper attempts to illustrate various regional initiatives to enhance turtle populations and resources, reflecting the long-term commitment of all ASEAN Member Countries.

It should be noted that the data used in this article were collected for the Regional Technical Consultation on Management and Conservation of Sea Turtles in Southeast Asia, held in Kuala Lumpur, Malaysia, in September 2003, and do not reflect all hatchery achievements in the region.

Brunei Darussalam

The hatchery in Meragang is managed by the Department of Fisheries. In 2001, a total of 935 olive



ridley turtle eggs and 97 hawksbill turtle eggs were collected from nesting beaches by the Department of Fisheries staff and turtle eggs collectors. A total of 917 olive ridley hatchlings and 63 hawksbill hatchlings emerged after incubation using styrofoam boxes for a period of 56 to 59 days.

In 2002, a total of 2,678 olive ridley turtle eggs and 159 hawksbill turtle eggs were collected and transferred to the hatchery. A total of 2,097 olive ridley hatchlings and 87 hawksbill hatchlings emerged. The hatchlings were kept in tank conditions for 3 – 4 months before being released.

Tagging of sea turtles started in 2000 on Muara and Sungai Liang beaches, using inconel tags provided by Marine Fishery Resources Development and Management Department (MFRDMD). In 2001-2002, 49 turtles – 27 olive ridley, 17 hawksbill and 5 green turtles – were tagged.

Cambodia

No information on sea turtles hatcheries was collected at the meeting for Cambodia, but it is known that efforts are being made to build at least one operational hatchery. Tagging of captured turtles started in 2002, using inconel tags provided by MFRDMD. However, tagging is not carried out on a regular basis.

Indonesia

Sea turtles hatcheries are located at Pangubahan, Sukamade, Pulau Seribu, Kepala Burung and Irian Jaya, among other locations. The hatcheries are managed by the Ministry of Forestry and the Ministry of Marine Affairs and Fisheries. After 16 years of operation, the hatchery at Sukamade alone has produced 801,669 hatchlings from four species of sea turtle, the large majority being green turtle.

Tagging activities started in the 1980s at Pangubahan, P. Seribu, Sukamade, Segamat-Lampung, Belitung Island and Semut Island. Inconel, titanium and plastic tags were used. More than one thousand sea turtles have so far been tagged in Indonesia.

Malaysia

There have been hatchery operations in Malaysia since 1949 in Sarawak, 1961 in Kelantan and Terengganu, 1966 in Sabah, 1971 in Penang and 1988 in Melaka, Perak and Pulau Pinang. Artificial hatcheries have been established near most of the nesting beaches in the country, with at least 15 hatcheries currently operational.

Since 1949, some 262 million sea turtle hatchlings, mostly green turtles, have been released to the sea. More than 127 million were released between 1949 and 1960, 128,676,865 between 1961 and 1995, and 5,576,706 between 1996 and 2002. The number of hatchlings released has been declining in recent years due to the decreasing number of sea turtles landing.

In Sabah and Sarawak, almost all the sea turtles eggs have been incubated in hatcheries since nesting islands were classified as Marine Protected Areas. In Peninsular Malaysia, the eggs of leatherback, hawksbill and olive ridley turtles are bought from collectors to be incubated



(Courtesy of TD/ Audio-Visual Section)

in the hatcheries. At least 70% of green turtle eggs are either buried in situ or transplanted to artificial hatchery sites.

The earliest tagging programmes in Malaysia were reported in 1953 on the green turtle population of Sarawak. In Sabah, tagging programmes began in 1970. In 1966, a ten-year tagging programme for leatherbacks was initiated in Terengganu. The programme was resumed in 1990 using titanium tags, and extended to other species in 1993. In 2003, the Passive Integrated Transponder Tags (PITs) were being used for green turtles at Redang Island.

“Since sea turtles are exceptionally migratory, and are known to move through the waters of the Southeast Asian region, a tagging programme has also been implemented”

Since tagging programmes started, more than one thousand sea turtles have been tagged. It has been shown by the programme that leatherback turtles may nest from one to eight times per season (3.3 times on average), with an inter-nesting interval of on average 13.4 days. Green turtles may nest up to 10 times per season, although most nest three to six times, with nesting intervals ranging from 9 – 12 days.

Myanmar

At present, there is only one hatchery, at Thamee Hla, which started operation in 1986, and is managed by the Department of Fisheries. For 1991 and from 2000-2003, 143,406 green turtle eggs were incubated, and 126,442 hatchlings were released. In 2002, 201 olive ridley eggs were incubated, and 126 hatchlings were released.

Tagging activities started in 2001 using inconel tags provided by MFRDMD. Tagging is done at Thamee Hla, Khone Gyi, Gadon Galay and Gayet Gyi rookeries. So far, 82 green and 66 olive ridley turtles have been tagged.

Philippines

At present, the Pawikan Conservation Project (PCP) and the Protected Areas and Wildlife Bureau (PAWB), under the Department of Environment and Natural Resources (DENR) assist, monitor or manage twelve hatcheries. These are in the Turtle Islands in the province of Tawi-Tawi, Morong in the province of Bataan, Hinatuan in the province of Surigao del Sur, San Juan in the province of Batangas, and Pamelikan Island and Miniloc Island in the province of Palawan. Five hatcheries are in the Turtle Islands, three in Morong, and one each in Hinatuan, San Juan, Pamelikan Island and Miniloc Island.



All the hatcheries in Turtle Islands are managed by the PCP, while hatcheries in Morong are managed jointly by the Bantay Pawikan (sea turtle guard; a people’s organization) and the local government. The Unlad Chapter of the Philippine Rural Reconstruction Movement (PRRM), a non-governmental organization (NGO), was one of the groups that pursued the establishment of the hatcheries in Morong. In Hinatuan, the local government, in collaboration with the Centre for

Tagging of accidental catch sea turtle before being released in Cambodia (Courtesy of DoF Cambodia)

Empowerment and Resource Development (a NGO) and the DENR regional office are managing the hatchery. Only the local government and the DENR regional office handle the hatchery in San Juan, Batangas. Pamelikan Island is managed by a private institution.

The establishment of hatcheries in the Turtle Islands started in 1984, allowing residents to collect 60% of the total eggs produced in all islands except Baguan Island. Only 30% of the total eggs produced in the collection islands are transferred to hatcheries. From 1986-2002, 1,946,720 eggs were transplanted in the Turtle Islands, and 941,036 hatchlings were released.

Before 1998, all turtle eggs were collected and traded by coastal residents in Morong. With the combined conservation efforts of the PCP-PAWB and PRRM, these coastal residents were trained to become protectors of sea turtles, leading to the formation of the people's organization Bantay Pawikan. Bantay Pawikan's role is to monitor sea turtles, in this case, olive ridleys, and transfer eggs to hatcheries during the nesting season.

The first hatchery constructed in Morong, Bataan was in Sitio Nagbalayong. Later, two additional hatcheries were constructed in Sitios Fuerte and Matico. Proper management and the dedication of the members of the Bantay Pawikan have led to good hatchery results in Sitios Nagbalayong, Fuerte and Matico. In the last nesting season in 2002, 89.65% of eggs in Nagbalayong hatchery, 91.57% in Fuerte hatchery, and 97.29% in Matico hatchery emerged successfully.

Tagging activities are being carried out in all areas of the country. Tagging was first started in Turtle Island, Tawi-Tawi in 1982, using steel tags and inconel tags. At present, monel tags are being used. Some significant tagging activities are summarized below:

- A total of 10,532 green turtle were tagged in Turtle Islands and in Bancauan Island, Mapun Province



PITs tag scanner used in Malaysia (Courtesy of MFRDMD)

of Tawi-Tawi from 1982-2002.

- Sixty sea turtles were tagged in Morong, Bataan from 1999-2002; 95% of the nesters tagged have been olive ridley turtles.

- A total of 1,683 sea turtles, mostly green and hawksbill turtles at different life stages, were tagged in various other regions of the Philippines from 1985-2002.

Thailand

There are a number of sea turtle hatcheries in Thailand. These are managed by different government agencies:

- The Eastern Marine and Coastal Resources Research Centre in the Gulf of Thailand in Rayong Province (Man-nai Centre) is managed by the Department of Marine and Coastal Resources

- The Sea Turtles Conservation Centre on the Gulf of Thailand coast in Chonburi Province is managed by the Royal Thai Navy

- The Andaman Marine and Coastal Resources Research and Development Institute on the Andaman Sea coast (Phuket Marine Biological Centre) is managed by the Department of Marine and Coastal Resources

- The Coastal fisheries Research and Development Centres, located along the coast line of the Gulf of Thailand and Andaman Sea, are managed by the Department of Fisheries



*Sea turtle hatchery in Malaysia
(Courtesy of MFRDMD)*

□ National marine parks are managed by the Ministry of Natural Resources and Environment.

The number of hatchlings produced by hatcheries during the period 1980 – 2000 in Thailand is shown in the table next page.

Tagging activities started in 1994 at Man-nai Island and Similan Island. Plastic tags, clip tags and metal tags have in the past been used. Inconel tags and PITs tags are presently being used. The number of turtles tagged yearly in Thailand is shown below:

- At Khram Island, about 20 turtles are tagged yearly using PITs and inconel tags.
- At Similan Island, 10 turtles are tagged yearly using PITs and inconel tags.
- At Mannai Island, 150 turtles are tagged annually using PITs tags.

Vietnam

Sea turtles hatcheries in Vietnam are located at Nui Chua in Ninh Thuan Province, Con Dao National Park (five hatcheries), Phu Quy Island, Phu Quoc Island and Tho Chu Island. Hatcheries are managed by the Research Institute for Marine Fisheries, the Fisheries Resources Exploitation and Conservation Department under the Ministry of Fisheries, and the Department of Forestry Protection under the Ministry of Agriculture and Rural Development. From 1994-2002, a total of 304,950 hatchlings were released into the sea, the number gradually being increasing annually.

Tagging of sea turtles started at Con Dao National Park in 1998 using inconel tags provided by MFRDMD; from 1998 till now, a total of 1,320 turtles have been tagged.

Conclusion

All SEAFDEC Member Countries regard sea turtles as important species some of which are seriously threatened. All eight Member Countries whose activities are reviewed in this article are serious about strengthening their conservation measures. One of the most important conservation tools is to set up hatcheries so that sea turtles eggs have a better chance of hatching. Tagging programme will provide considerable ecological information, including information on geographical range and migratory path, breeding and inter-nesting frequencies, growth rates and population size.

Table. Hatchlings production from the hatcheries in Thailand

<i>Hatchery</i>	<i>Year</i>	<i>Eggs Incubated</i>	<i>Hatchlings Released</i>
Man-nai Center	1980-1996	116,990	37,125
Khram Island	1983-2000	13,789	8,000
Similan Island	1996	4,043	2,830
Trang Province	1990-1994	1,655	904

Conversely, one has to note that recent population modelling suggests that conservation of eggs and hatchlings without concurrent conservation of older turtles may have limited impact, suggesting the need for appropriate actions to be taken to emphasize in-water conservation and management.

No single approach can promote effective and successful sea turtles conservation. At the regional level, strategies to contribute toward the best conservation approach must be developed for each country's specific situation. Most ASEAN Member Countries have established national or regional conservation programmes to

protect marine turtles and habitats. Some of these programmes, under national jurisdictions, call for a need of greater regional cooperation and coordination for conservation and management activities, and to provide an overall picture of the stock, breeding behaviour and migratory patterns in Southeast Asia.

“the conservation of eggs and hatchlings without concurrent conservation of older turtles may have limited impact, suggesting the need [...] to emphasize in-water conservation and management”

As noted in this article, it is hard to gather all the information from different countries in the region concerning their sea turtles initiatives, such as the release of hatchlings. Proper mechanisms to collect all required information from all ASEAN Member Countries have not yet been developed, and serious efforts to develop comprehensive databases and to network turtle hatcheries and tagging activities will improve effective understanding of all initiatives, and promote collaboration in regional efforts to enhance turtle populations.

Another constraint, noted during the Regional Technical Consultation, has been the lack of coordination between environmental agencies, which

are by and large responsible for endangered species issues, and fisheries related agencies, which are responsible for fisheries management, including incidental catch of turtle. In accordance with the clear recognition of the issue at the regional level, it is to be hoped that cooperation will improve in the near future.



Green turtle nesting in Malaysia (Courtesy of MFRDMD)

The need to broaden regional activities into an integrated management approach is crucial for future marine turtle conservation. Such an approach should incorporate coastal management to ensure that ecosystem functions and habitat quality are maintained, and to integrate different geographical dimensions, from the local

to the regional level. This integrated management must bring together all available conservation tools, including management measures, research and monitoring, public awareness, education and information, capacity building, community participation, and effective communication. Unquestionably, all Member Countries will continue to make great efforts towards working in unison, making sure that the conservation of sea turtles becomes a regional success story.

About the authors

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ASEAN and Fishery Subsidies: Outlining a Regional Vision

by Magnus Torell



Introduction

Questions about subsidies to fisheries in Southeast Asia are important, and also at times highly sensitive. Subsidies are ever more controversial in the global context as well, something apparent from the World Trade Organisation meeting in Cancun earlier this year. Fisheries have a particular importance in terms of trade and national development in ASEAN countries, since a large share of international trade of certain fish commodities originates in Southeast Asia.

Closely connected to concerns about subsidies in terms of international trade and sustainable development, questions about subsidies are also high on the agenda of both ASEAN and SEAFDEC. In the Resolution and Plan of Action adopted during the Millennium Conference, ASEAN Member Countries were requested to assess the impact of government subsidies on fisheries, particularly in terms of the needs of small-scale fisheries in the ASEAN region and sustainable fisheries. Collaboration with international organizations such as the Food and Agriculture Organization of the United Nations (FAO) and the World Trade Organization (WTO) was advised.

The ASEAN position on subsidies

At the 25th session of the Committee on Fisheries (COFI), organized by FAO in February 2003 in Rome, it was concluded that an International Technical Consultation would be held in 2004 to consider the effects of subsidies on fisheries resources. A large number of developing countries called for caution when appraising the role of subsidies in fisheries, as recognized in the special notes of the report. These countries stressed that attention needed to be given to the impacts of subsidies on the economic and social dimensions of sustainable development. In particular, they emphasized that subsidies could be used as an instrument for economic policy aimed at stimulating sustainable growth of national fishery sectors, at reducing and alleviating the poverty of fishing communities and households, and at enhancing food security, among other goals.

“A large number of developing countries called for caution when appraising the role of subsidies in fisheries”



From regional to international technical consultation

As part of its work on fisheries subsidies, the FAO Fisheries Department, in collaboration with various ASEAN countries, will develop case studies through which the environmental, economical and social impact of subsidies can be analysed empirically. This is part of the preparatory work for the proposed 2004 International Technical Consultation, which for the ASEAN region will focus on Indonesia and Thailand.

In response to the process to develop a common ASEAN view on subsidies within fisheries to be presented in the international venues, and more specifically in preparation for the FAO International Technical Consultation, a Regional Consultation on Fisheries Subsidies was organised by ASEAN – SEAFDEC in Bangkok, Thailand, 9 – 10 October 2003.

In preparation for the meeting, all ASEAN Member Countries were requested to complete a questionnaire on available subsidies within their fishery sector. Almost all countries responded. The responses gave a range of examples on subsidies in use, rather than a complete

list of implemented subsidies. Another insight from the questionnaires is that continued work needs to be done on definitions, and specifically on distinctions between types of subsidies that are acceptable and those that are not.

Two documents were essential as a basis for the Regional Consultation: “The Conclusions and Recommendations of the FAO Expert Consultation on Identifying, Assessing and Reporting on Subsidies in the Fishing Industry” (Rome, 3-6 December 2002) and the “WTO Negotiating Group on Rules: Note by the Chairman on Compilations of Issues and Proposals Identified by Participants in the Negotiating Group on Rules” (22 August 2003). The WTO document is interesting in that it presents an idea on how subsidies might be categorised as prohibited (‘red light’), permitted (‘green light’) and possible, given notification and that negative aspects cannot be shown (‘dark amber light’). It should be noted that the FAO and WTO categories are not adopted norms, but merely reflections of ongoing processes with inputs from various parties.



Participants to the ASEAN-SEAFDEC Regional Consultation on Fishery Subsidies

FAO and WTO categories and types of subsidies

The Members of the Working Group on Regional Fisheries Policy compiled information from the questionnaires into a matrix, with categories and types of subsidies listed in the WTO and FAO documents. Results were presented by the Working Group to the Consultation. The matrix turned out to be a good basis for discussion on how the types of subsidies listed for the FAO relate to the WTO's 'traffic light' system. It gave a good background to discussions on the relevance of suggestions presented in the WTO document for the ASEAN Region.

“There seems to be a common understanding that subsidies leading to overcapacity and IUU fisheries should be avoided”

Participants in the Regional Consultation also received two comprehensive presentations about ongoing processes within the FAO and WTO respectively. Even so, matters related to subsidies remain unclear, and in many cases sensitive. There has been no systematic discussion on subsidies within fisheries management authorities, and participants conspicuously

noted that fisheries management authorities from the ASEAN Region were not well represented at the WTO meetings. To clarify an ASEAN vision on fishery subsidies, the major part of the Consultation came to focus on comparing different types and categories (FAO and WTO related) to determine the 'colour' under which they might be classified.

An ASEAN vision of fishery subsidies

Two major concerns were discussed by Member Countries. One related to the environment, with inputs associated to overcapacity and illegal, unreported and unregulated (IUU) fisheries; the other related to trade, with issues related to more or less direct or indirect trade benefits, causing trade distortions in various ways.

There seems to be a common understanding that subsidies leading to overcapacity and IUU fisheries should be avoided. Where fleets are being modernised or renewed, it is understood that the use of subsidies is justified if based on appropriate environmental and management criteria.

Questions related to trade are harder to handle, especially if seen from the perspective of a fisheries

management authority whose major responsibility is to work towards improved management and sustainability of aquatic resources. Two categories listed under the WTO ‘dark amber light’ were seen to be crucial to the development situation of ASEAN Member Countries today. These two ‘dark amber light’ categories are: (1) subsidies of a social nature, the final purpose of which is to resolve problems affecting small-scale fisheries, for the benefit of coastal communities and with a view to improving quality of life; and (2) subsidies relating to fisheries management, including research and administration and other measures, the sole purpose of which is to ensure the sustainability of hydro-biological resources and their environment.

“it is seen as critical to work in conformity and complementarily with the categories and standards being developed by international bodies”

As these categories are in principle central to how government funding should be applied in ASEAN Member Countries, suggestions were made to see these categories of subsidies moved into the ‘green light’ segment. This would give further emphasis in terms of developmental and environmental necessities, while at the same time easing requirements of notification, threats of having to sit with the ‘burden of proof,’ and so on.

The way forward

The consultation did not go into details on requirements for ‘notification’ of subsidies, or on what these notifications should contain, nor was the issue of ‘burden of proof’ with respect to the appropriateness of specific subsidies discussed in detail. Even so, it was plainly noted during the conclusions that these issues will be very important for future meetings. From this perspective, it is seen as critical to work in conformity and complementarily with the categories and standards being developed by international bodies. For example, it would be impractical if a project on coastal development assistance, within the criteria of a ‘good’ project for the Region, would be found to be included within the WTO’s red categories. It is also important that types and categories worked out under the WTO



are consistent with similar types and categories under FAO.

Recommendations were made by various organizations, notably the FAO, OECD, and WTO, to revise and update lists, categories and typologies. The process within ASEAN and SEAFDEC – to which this consultation has contributed – will at the same time continue to facilitate and develop a common ASEAN platform with regards to fisheries subsidies.

About the author

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Fishing Reform and Community Fisheries: Fisheries Resource Management Trials in Cambodia

by Shingo Takahashi



Introduction

As a SEAFDEC Member Country since 2001, Cambodia is now fully involved in the Centre's activities, cooperating with other Member Countries to promote sustainable use of regional fisheries resources. Cambodia was actively involved in the Millennium Conference in Bangkok in November 2001. Acknowledging the Resolution and Plan of Action, one of the major achievements of the Conference, Cambodia is notably dedicated to gradually introducing rights-based fisheries management systems for regulating access to fishery resources.

“Cambodia is notably dedicated to gradually introducing rights-based fisheries management systems for regulating access to fishery resources”

One of the important initiatives undertaken by Cambodia to improve resource management has been the promotion of community fisheries. This initiative is part of a decentralization policy that aims to encourage the appropriate transfer of rights, authorities and responsibilities from central to local levels.

Cambodia, through this trial, is expecting to place a certain measure of responsibility for resource management on local communities.

The Cambodian fisheries reform

In the past, Cambodian people have been able to exploit abundant fisheries resources. However, natural fisheries resources are increasingly threatened, with fisheries production decreasing through over-exploitation, illegal fishing and habitat destruction (see Box 1). The conversion of inundated forests, which used to be seasonal fishing grounds during the flooding season, into agricultural land is aggravating the problem further. Moreover, conflicts over resource use among stakeholders are occurring ever more frequently. This situation has created a vicious circle, accelerating the further deterioration of natural resources and the frequency of conflicts.

Sustainable use of fisheries resources means ensuring their availability for future generations. To achieve this, it is essential to introduce effective resource management systems, appropriate legal and institutional

structures, and effective law enforcement and monitoring. These will be promoted through capacity building of both governmental agencies and the private sector.

“In recognition of the increasing severity of conflicts between fishing lot concessionaires and local fishers, a fisheries reform was initiated in late 2000”

The government has also recognized that without the direct involvement and participation of local populations in the management system, conflicts among resource users will be further exacerbated while resource degradation cannot be contained.

In recognition of the increasing severity of conflicts between fishing lot concessionaires and local fishers, a fisheries reform was initiated in late 2000. Although progress has been difficult and slow, limited both in terms of financial, human and technological resources and by Cambodia’s undeveloped basic infrastructures, the reform has led to several important measures being taken by the Department of Fisheries (MAFF 2001):

- Allocation of fishing lots (see Box 2), with about 56 % of all inland concession areas now released for use by local fishing communities
- Establishment of community fisheries. Although a supporting law has been drafted (a sub-decree for community fisheries), as of October 2003 it had not yet been finalized.
- Revision of the existing Fisheries Law, with the new law already having already successfully passed several consultations with stakeholders, and, as of November 2003, awaiting the approval of the Council of Ministers.
- Clear demarcation of resource conservation area and fish sanctuaries.
- Preparation of a Fisheries Master Plan and institutional strengthening. The Master Plan, which is to cover fisheries until 2020, is already drafted and waiting for the consultation process.
- Clarification of land use in the fisheries domain.
- Enforcement of the Fisheries Law, especially concerning illegal fishing.

Cutback of fishing lots

The establishment in French colonial times of the fishing lot system was intended to ensure a stable source of tax revenues. The lot system was not established for the purpose of resource management and conservation, although lot fish production has shown to be stable, and since there is less fishing pressure, fish habitats were usually better conserved than outside the lot areas.

A priority in the ongoing fisheries reform is to improve the governance of the fishing lots system. The roots of this problem are many, and include the destruction of the social system during the civil war in the 1970s, the low educational level of government officials, a fragile law enforcement and monitoring system, and low wages, with many governmental workers earning only about USD 10-15 / month.

Conflicts over resource use have been spreading through the country, especially between subsistence fishers, who have been demanding more fishing areas, and concessionaires, who strictly exclude outside-access to secure maximum benefits from their assigned lot area. The reasons for the spread of these conflicts is complex. During the civil war, some fishing lots were given to the Khmer Rouges, who later sold the rights for their use to local fishers. When Cambodia achieved greater social stability in the late 1990s, lot concessionaires started restoring their right to lot areas, causing much frustration to local fishers, who had been using the lot areas for the past two decades.

“Conflicts over resource use have been spreading through the country, especially between subsistence fishers, who have been demanding more fishing areas, and concessionaires”

The increasing occurrence of conflicts can also be attributed to the rapid increase in the population dependent on fisheries, including new entries from upland areas, as fishing is the easiest way for poor people to get daily food with little or no investment. Crop cultivation, by contrast, takes time and a level of investment before harvesting. Moreover, social stability has increased in Cambodia since a large number of

Box 1. Degradation of inland fisheries in Cambodia – What is happening?



Cambodia's , freshwater fisheries are among the most productive in the world. Inland waters play an important role in the national economy and in people's livelihoods, providing abundant fish and fisheries products. Fish constitutes one of the most important elements in the diets of the rural people. Current consumption is about 30-40 kg per capita per year and more than 75 % of all animal protein is obtained from fish and fishery products. Inland waters are also the main source of drinking water, irrigation, waterway transportation and so on. The tremendous variety of rivers, lakes and wetlands in Cambodia supports a rich diversity of aquatic life, including more than 500 freshwater fish species. In recent years, the heavy fishing pressure (through over-exploitation, illegal fishing, habitat destruction, and conversion of inundated forest into agricultural fields) is threatening fisheries resources. Conflicts over resource use among stakeholders are occurring more and more frequently.

Reasons for the degradation of fisheries resources

1. Destruction of flooded forests

Destruction of flooded forest is an illegal activity. However, many people still cut and invade flooded forests to collect firewood and to create rice and bean farms. These activities lead to the destruction of fish habitats.



2. Fishing by pumping water out of the pool

Fishing by pumping water out of water pools is illegal. But some people still carry on this fishing practice without regard for the irreparable damage caused to natural resources. The activity catches larger fish but also destroys fingerlings, larvae and other aquatic organisms.



3. Fishing using poison

Fishing by using poison is prohibited by the Fishery Law. Fishers may catch more fish in a certain period using this method, but in the process they destroy fish habitats and other aquatic organisms. The toxins left in the fish body are also likely to be dangerous to the health of the consumer.



4. Fishing by use of explosives

The use of explosives for fishing is prohibited under the Fishery Law. Explosives not only destroy all natural resources and the environment, including fish habitats, but are also dangerous to the fishers themselves and to others people.

5. Fishing using electric fishing gear and fine mesh nets

Using electric fishing gear and fine mesh nets are prohibited under the Fishery Law. However, such practices are still commonly carried out with no regard for their impact on natural resources and the environment. The practice kills all living organisms in the area, including fish fingerlings, larva, and other aquatic animals organisms. Fine mesh catches all juvenile fish, thus threatening the sustainability of a fishery resource. Some brood stock shocked by electricity, yet not captured, are rendered infertile by the use of electricity, and are no longer able to spawn.

6. The destruction of fish habitats and illegal fishing

Habitat destruction and illegal fishing are leading to the degradation of natural fisheries resources and the destruction of the environment. The repercussions will have severe long-term impacts on people's livelihoods and the national economy.

fishing lots have been released to the public in an open access regime.

As mentioned earlier, the fishing lot owners can monopolize resources in the lot area. However, in earlier times, the relationship between local fishers and lot concessionaires was relatively good, with small-scale fishers often being given limited rights to enter the concession area for subsistence fishing. However, under increasingly heavy pressure from local fishers, fishing lot owners have become more vigilant in protecting their lots, sometimes even using hired armed guards. Indeed, several incidents have been reported in recent years of local fishers being shot dead or injured by lot guards while trespassing on closed lot areas.

“a direct plea to the Prime Minister [...from fishermen...] prompted the Prime Minister to establish the Fishing Lot Reform, as a consequence of which the total fishing lot area was reduced by 56 %, or about 5,300 km², to be utilized and managed by local communities”

In mid 2000, groups of local fishers from the northern provinces came to the Phnom Penh, and made a direct plea to the Prime Minister for establish free fishing areas to ensure their livelihood. These actions prompted the Prime Minister to establish the Fishing Lot Reform, as a consequence of which the total fishing lot area was reduced by 56 %, or about 5,300 km², to be utilized and managed by local communities. This sudden change in the management system has created a great deal of confusion for both government administration and local fishing communities during the 2001 season.

Development of community fisheries

It is only half a decade since the concepts of ‘community fisheries’ or ‘community-based fisheries management’ were introduced to Cambodia. At the early stage, there were many trials to establish fisheries communities in the Tonle Sap region. However, without appropriate support from fisheries authority, most of these trials ended in failure.

The Fisheries Reform was initiated in late 2000, with

the Community Fisheries Development Office (CFDO) established by the Department of Fisheries in February 2001. CFDO has a mandate to oversee the establishment, development and management of community fisheries throughout Cambodia by means of local participatory processes. The expectation is that with the establishment of community fisheries organizations, fisheries resources will be managed efficiently, sustainably and equitably.

“Yet the institutionalization of co-management schemes for fisheries faces various problems”

As of 2002, some 265 community fisheries had been established in Cambodia in cooperation with provincial fishery offices, local authority, concerned community residents, and government and non-government organizations (NGOs). Yet the institutionalization of co-management schemes for fisheries faces various problems. These include the limited experience, resources, skills and capacity of staff in the Department of Fisheries. Nonetheless, the government plans to double the number of communities in the near future.

Prospects for community fisheries

Most community fisheries stakeholders suffer from a lack of knowledge, understanding and skills to apprehend and undertake community fisheries management planning and implementation. But there is also low public awareness and understanding of the damage caused by the use of illegal fishing gear, such as electro fishing and fine mesh nets. There are several other obstacles to the establishment of community fisheries committees. These include:

- The very low educational level of the majority of local populations.
- The conservative nature of most fisheries communities, which tend towards tradition rather than adoption of new concepts.
- The practical difficulty of identifying members of communities based around flooding areas, because such communities move frequently with seasonal hydrologic fluctuations.
- The negative response by Khmer people to the concept of “community” because of the bad experience

of socialist cooperatives during the Khmer Rouge period.

Community fisheries have been established in many developing countries during the past 20 years. Expectations have been immense, with community fisheries considered a potentially ideal system for resource management. However, in many cases, trials have not been successful. Failures have been attributed to a lack of understanding of the system, both on the part of those responsible for its introduction and on the part of those responsible for its implementation. In many cases, community projects have focused on resource protection and conservation, but pay inadequate attention to other aspects, such as responding to the actual needs of livelihoods in local communities.

Furthermore, motivation of people in communities has been poor; frequently, people do not understand why they have to be involved in community fisheries management. In the long run, communities will get benefits if a sound management system is introduced, but for those suffering from poverty and struggling to guarantee their daily food, there is a need for immediate benefits from the system. Unless these basic needs are met, it is understandable that they do not become involved in the co-management process. Another obstacle is that during the process of community establishment, local people behave as if they led by the government, rather than being themselves responsible.

In order to maintain functional communities, strong incentives to motivate community



Cambodia, an abundance of fishery resources

members are essential. During the process of organizing communities, more benefits oriented elements in the system need to be put into the system, notably by recognizing the community unit as a small business enterprise working in the fisheries sector. As such, the benefits will become the force driving communities to sustain and nurture the system.

“Community fisheries have been established in many developing countries during the past 20 years. Expectations have been immense, [...] in many cases, trials have not been successful”

It is therefore necessary, at an early stage of community establishment, to obtain legal, administrative, technical and financial support from government authorities and donors. These must include effective implementation of programs to generate benefits, such as small-scale aquaculture, livestock, cash crop, and so on. These community livelihood ventures need to be well supported for a certain period of time by government and donors. They will also require:

- A soft loan system, established by international credit institutions, to support community enterprises
- Special laws, including a law on tax exemption for community enterprises
- Enhanced accountability and transparency of community management systems.



Community Fisheries at work

[Events Calendar]

Date/Venue	Events	Organizer
2003		
15-19 September Singapore	Second Regional Workshop on Good Laboratory Quality Management and Practices and methods Validation in Southeast Asia	SEAFDEC/MFRD
15 Sep - 13 Nov Philippines	Third-Country Training Program on Responsible Aquaculture Development	SEAFDEC/AQD
30 Sep - 3 Oct Thailand	Workshop on Artificial Reefs and Stationary Fishing Gear (Set net) Design and Construction and Marine Protected Areas	SEAFDEC/TD
9-10 October Thailand	Regional Technical Consultation on Fisheries Subsidies	SEAFDEC/Secretariat
13-14 October Vietnam	Technical Training in Data Handling and Analysis: Information Collection for Sustainable Pelagic Fisheries in the South China Sea	SEAFDEC/MFRDMD
15-17 October Vietnam	Second Technical Consultation Meeting on Information Collection for Sustainable Pelagic Fisheries in the South China Sea	SEAFDEC/MFRDMD
5-21 November Philippines	Training on Diagnosis for Important Viral Diseases of Shrimp and Marine Fish	SEAFDEC/AQD
10-20 November Thailand	Training Course in Ecosystem Effects of Fishing in Southeast Asia	SEAFDEC/TD
17-19 December Thailand	Workshop on Safety at Sea for Small Fishing Boats	SEAFDEC/TD
2004		
20-23 February Malaysia	ASEAN-SEAFDEC Regional Workshop on Human Resource Development on Fisheries	SEAFDEC/Secretariat
9-11 March Malaysia	The Second Regional Meeting on the Use of Indicators for the Sustainable Development and Management of Capture Fisheries	SEAFDEC/MFRDMD
16-18 March Thailand	Regional Meeting on Issues related to Fish Trade and Environment	SEAFDEC/Secretariat
March (tentative) Thailand	Special Training Course for New Regulation on the Use of Turtle Excluder Devices	SEAFDEC/TD
March (tentative) Singapore	Workshop on Regionalization of the Code of Conduct for Responsible Fisheries in Post-Harvest Practices and Trade	SEAFDEC/MFRD
28 April - 27 May Philippines	Training Course on Crab Seed Production	SEAFDEC/AQD
7 May - 5 June Philippines	Training Course on Management of Sustainable Aquafarming Systems	SEAFDEC/AQD
May (tentative) Venue to be defined	Expert Meeting on Fishery Statistics	SEAFDEC/Secretariat
May (tentative) Venue to be defined	Regional Technical Consultation on Human Resource Development	Sida-SEAFDEC
May (tentative) Singapore	Second Regional Technical Consultation on Establishment of Sustainable Regional Fisheries System in Southeast Asia	SEAFDEC/MFRD
2 June - 16 July Philippines	Training Course on Marine Fish Hatchery	SEAFDEC/AQD
2 June - 12 Sep On-line	E-Learning on Principles of Health Management in Aquaculture	SEAFDEC/AQD
June (tentative) Venue to be defined	Second Regional Technical Consultation on Fishery Statistics	SEAFDEC/Secretariat
June (tentative) Singapore	Regional Training Course on Examination of Maximizing Utilization of Pelagic Fish Resources	SEAFDEC/MFRD
June (tentative) Singapore	First Regional Meeting on Seafood Safety Information Network	SEAFDEC/MFRD
June (tentative) Philippines	Training Course on Polymerase Chain Reaction (PCR)	SEAFDEC/AQD

Southeast Asian Fisheries Development Center (SEAFDEC)

What is SEAFDEC?

SEAFDEC is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote fisheries development in Southeast Asia.

Objectives

SEAFDEC aims specifically to develop fishery potentials in the region through training, research and information services in order to improve food supply through rational utilization of fisheries resources in the region.

Functions

To achieve its objectives the Center has the following functions:

1. To offer training courses, and to organize workshops and seminars, in fishing technology, marine engineering, extension methodology, post-harvest technology, and aquaculture;
2. To conduct research and development in fishing gear technology, fishing ground surveys, post-harvest technology and aquaculture, to examine problems related to the handling of fish at sea and quality control, and to undertake studies on the fisheries resources in the region; and
3. To arrange for the transfer of technology to the countries in the region and to make available the printed and non-printed media, which include the publication of statistical bulletins for the exchange and dissemination related to fisheries and aquaculture development.

Membership

SEAFDEC members are the ASEAN Member Countries (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam) and Japan.



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