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Tanzania Mariculture Guidelines Source Book

Tanzania Coastal
Management Partnership

TANZANIA MARICULTURE GUIDELINES SOURCE BOOK

Prepared by
Tanzania Coastal Management Partnership Support Unit
and the
Mariculture Working Group

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Preface

The Tanzania Coastal Management Partnership (TCMP) through its Mariculture Working Group (MWG) has prepared Mariculture Guidelines. These Guidelines will serve as guiding principles to promote development and good management of sustainable forms of mariculture on the Tanzania Mainland. The Guidelines also serve a larger purpose by providing a model of the consultative process in developing policy for coastal management.

It is anticipated that a wide range of stakeholders will find these guidelines a useful tool for profitable and sustainable mariculture development. The audience for the Guidelines includes all individuals and groups that have an interest in mariculture development, whether in the public or private sectors. These include government officials at the national, district and village level, environmental managers, and prospective investors. The Guidelines will assist the investor and regulator alike in understanding and navigating the permitting procedure in order to streamline the process and reduce costs, thereby encouraging the establishment of mariculture businesses.

The guidelines represent the first step in setting the stage for mariculture development that will benefit the nation while maintaining environmental quality. This is a reiterative process that must be revisited in the future as progress is made and experience gained. Mariculture development is a complex, multidisciplinary field that has environmental, biological, legal and engineering aspects, among others. This wide range of mariculture-relevant topics are addressed at different levels of specificity depending on the current need for guidance and state of knowledge on the particular topic. Some topics such as site selection and choice of culture species are covered in some detail, based on extensive international and national experience. This will assist mariculture investors in designing technically feasible projects. The current permitting procedures are clearly explained.

The current permitting process was found to be inadequate in certain aspects. The investors' need for streamlined procedures to obtain all permissions and the need of the government to promote sustainable development were not fully accommodated by the legal framework. The ability to maintain environmental quality and receive public input also required strengthening. Modifications and recommendations were therefore made where necessary, to strengthen and harmonize the process. Relatively new topics such as Environmental Impact Assessment (EIA), monitoring, and project management programs are also explained in detail, and recommendations made for use of these management tools.

For all topics, emphasis is placed on governance, institutional arrangements and procedural approaches in order to strengthen the capacity to manage this new area of economic development.

The guidelines are dynamic and liable to amendments and changes to suit the requirements for sustainable mariculture development in the country.

Preamble

Mariculture presents management challenges typical of other economic development activities that increasingly exert pressure upon coastal habitats and residents.

Mariculture also has unique attributes, since it most commonly takes place at the interface of land and water. This interface area presents special problems for management and sustainable development because institutional jurisdictions, responsibilities and roles are often weakly defined for these areas. However, success in developing mechanisms to promote and regulate mariculture offers the promise of providing an example of how to deal with other coastal development issues.

Mariculture development in Tanzania has been largely limited to seaweed culture, although this has been highly successful as a means of economic development for villagers. Other forms of mariculture also hold potential for both large- and small-scale development. Despite its latent potential, development lags behind other forms of economic development due to lack of institutional attention and its low priority in national economic planning. Thus, when the prospect of industrial-scale shrimp culture burst on the national scene in 1996-1997, institutional capacity to guide and manage large-scale mariculture operations was limited. Environmental assessment, permitting procedures, procedures for acquisition of land and water use, environmental standards and monitoring had not been fully adapted to mariculture development. Additionally, responsibility for these areas is fragmented among various institutions and levels of government. Intergovernmental coordination is not sufficient to completely and efficiently guide mariculture projects to full legal compliance.

OPPORTUNITIES AND CHALLENGES

The challenge lies in developing the ability to take full advantage of the opportunities offered by mariculture development while avoiding mistakes made in other parts of the world. Coastal habitats are the foundation of biodiversity and support nearly all coastal

economic activities such as fisheries, agriculture, tourism and forestry. Inappropriate culture methods can cause environmental impacts which in turn may produce social and economic impacts. Therefore sustainable mariculture development requires careful application of good farming methods and integration of activities in selected sites to avoid damaging ecologically sensitive areas and disturbing other economic activities.

To address the above challenges, comprehensive mariculture development guidelines that are backed by coastal management policy and other public management tools are identified in this document. The capacity of government to manage mariculture development at the district level must also be strengthened to allow development to proceed in a sustainable fashion. It is not only a question of preventing potential negative impacts of mariculture through regulations and restrictions, but also encouraging more rapid growth of sustainable forms of mariculture.

HISTORY OF MARICULTURE GUIDELINE DEVELOPMENT

To date, no large-scale mariculture projects have been able to obtain all permits required to establish a legal operation. The realization that the nation was not fully prepared to deal with regulation of mariculture coincided with the planning period of the Tanzania Coastal Management Project (TCMP). The TCMP sought a multisectoral coastal development issue to serve as a model and learning experience for formulation of policy to address issues of integrated coastal zone management. Mariculture was chosen as this model because of the urgent need to address challenges presented by the introduction of large-scale project proposals, because rapid progress is possible, and because mariculture is typical of the challenges that the nation will face in managing other coastal development activities.

OBJECTIVES AND ACTIVITIES OF THE MARICULTURE WORKING GROUP 1998-2000

The TCMP Mariculture Working Group (MWG) was formed in March 1998 as a multisectoral advisory team to the TCMP during the Integrated Coastal Management (ICM) policy development phase. The team had two broad tasks:

1. Identify issues of concern for mariculture as an intersectoral coastal development issue.

The issues identified by the MWG were divided into two broad categories:

- Issues related to governance and management of mariculture
- Issues related to the development and promotion of large- and small-scale mariculture

2. Formulate the means necessary to address critical issues for mariculture focusing on policy and institutional arrangements. This would also serve as a model for the Integrated Coastal Zone Management (ICZM) policy development process.

The Tanzania Mariculture Issue Profile (TCMP, 1999) summarizes the finding of the issue-identification phase. The major mariculture challenges and opportunities are described in this document along with preliminary recommendations to address these. This document formed the basis for the Mariculture Guidelines which presents final, detailed recommendations.

METHODOLOGY

The support unit of the TCMP convened an MWG that is multidisciplinary and intersectoral. Members were drawn from various public and private sectors including individuals having a stake in coastal and marine development in the United Republic of Tanzania. The MWG members have experience in areas related to mariculture development such fisheries, forestry, environmental management, water resources and land management. The group prepared the Mariculture Issue Profile in 1999 and the Mariculture Guidelines in 2000 in collaboration with the support unit of the TCMP. The working group researched, compiled and reviewed primary and secondary information relevant to the development of mariculture in Tanzania and other nations, where relevant. The working group also consulted lessons learned from various case

studies from mariculture development in Bagamoyo and Tanga. Additional input was extracted from regional experience through a Mariculture Environmental Assessment Course conducted in Dar es Salaam. Consultations with institutional and individual stakeholders were also held. The routine working group meetings enabled members to exchange experience and improve the guidelines.

As work progressed, the guidelines were reviewed at several critical junctures by directors of government institutions and their feedback used to improve the work. After the final directors' review and approval in June 2000, final revisions were made. One recommendation of the directors led to the production of a condensed version of the Guidelines focusing on the planning and permitting aspects. This document was published as the, "Guide to Mariculture Permitting and Development in Tanzania." The full work, represented by this document, "Tanzania Mariculture Guidelines Source Book," contains all background research and the full findings of the MWG. Some of the options and recommendations contained here were not adopted by the directors, but are included here for future reference and possible use should the current legal and economic circumstances changes in such a way that they become feasible.

RELEVANCE OF THE MARICULTURE GUIDELINES FOR IMPROVED GOVERNANCE AND POLICY

The Mariculture Guidelines are seen as a vehicle to address issues related to both development and management of mariculture. The Guidelines attempt to find positive means to improve institutional capacity by making recommendations and devising institutional arrangements to resolve critical challenges in mariculture management. This work will also serve as an input and model for integrated coastal zone management policy development.

Chapter One

MARICULTURE PROJECTS REVIEW AND APPROVAL PROCEDURES

1

This chapter is a guide to the procedures required for obtaining the legal approvals needed to start a mariculture business. The existing review and permitting procedures for mariculture projects are not well defined. They evolved as an ad hoc amalgamation of previously existing procedures in an attempt to accommodate a new activity. Lack of a clear permitting pathway backed by comprehensive policy has meant that obtaining permission to begin a mariculture project is confusing, time-consuming and complicated. A number of institutions are involved, or could be potentially involved in the process, but their roles and responsibilities are not clearly defined by policy or regulations. Overlaps and gaps in jurisdiction over resources related to mariculture such as land and water exist.

This situation causes difficulties for both the public and private sector. Without clear institutional procedures and arrangements, decisionmaking is impeded by lack of guidance and criteria. The sectors may work in isolation when reviewing and issuing approvals so that the investor faces redundant approaches. The work of government personnel may be unnecessarily cumbersome and coordination with other institutions is difficult. The private sector incurs costly delays and uncertainties that may prevent economic development. Environmental quality is threatened by lack of protective regulations and methods. Lack of clarity regarding the role of public input in the decisionmaking process prevents members of the public from being heard on issues of national concern.

The Guidelines are intended to clarify the current established procedures and to highlight areas which need modification or strengthening. Where gaps or conflicts in the process exist, recommendations are made to address these deficiencies. The principal audiences are the mariculture investor, public sector personnel and the concerned public.

Where possible, an attempt is made to rely upon existing policy, regulations and institutional arrangements to avoid the lengthy process of approving new policy and regulation or creating new institutions. Most of the procedures described or recommended in this document can be put in place immediately.

1.1 THE OBJECTIVES OF THIS CHAPTER ARE:

- To develop review and approval procedures based on intersectoral coordination that resolve the existing gaps, fragmentation and confusion of the current ad hoc process
- To ensure that intersectoral coordination and communication is enhanced through clarification and modification of the roles of various institutions involved in the approval process
- To ensure that the participation of all stakeholders is enhanced in the approval process to protect other opportunities for resource use and to minimize conflicts between resource users
- To enhance the availability of technical assistance and guidance provided to the investor to increase the probability that mariculture projects will be financially successful while maintaining environmental quality
- To ensure that the approval process is clarified and made known to the public, government institutions and prospective investors so that development of sustainable mariculture is facilitated

1.1.1 STRATEGIES IN DEVELOPING APPROVAL PROCESS GUIDELINES

Mariculture has only recently become a subject of interest from the legal perspective. Traditionally it has consisted only of very small-scale, family-owned seaweed farms so that there was little need for regulation. In the last few years, several proposals for large-scale prawn culture have been submitted for approval. It became clear that, unlike some more traditional industries, large-scale mariculture projects touched on the jurisdictions of a number of institutions, and presented potential environmental, social and economic issues that needed careful consideration before permission to proceed could be granted.

Mariculture is also typical of many economic activities now occurring in coastal areas, and thus merits special attention as a model. Careful research and policy analysis by the TCMP Mariculture Working Group during the process of writing the Tanzania Mariculture Issue Profile (TCMP, 1999) revealed that many of the legal mechanisms needed for analysis and approval of these projects did not exist. Additionally, the mechanisms that did exist were distributed between a number of institutions that had few means of coordination and communication.

These guidelines aim to address these gaps and weaknesses by proposing mechanisms that link existing institutions and procedures into a comprehensive system of project assessment and approval. Care is taken to strengthen the existing institutional arrangements and procedures rather than create new ones, where possible. An emphasis is also placed on establishment of science-based criteria for evaluation, and a transparent, participatory process that addresses the needs and concerns of the public and the investor. If implemented, these guidelines will aid in promoting effective economic development that minimally impacts the environment and coastal communities.

1.2 INSTITUTIONS INVOLVED

Mariculture, because of its intersectoral nature, touches many sectors at several levels of government. Each has a different role to play and each enters and exits the process at different times. However, each sector, regardless of their sectoral mandate, seeks to:

Promote integrated and sustainable approaches to the development of major economic uses of the coast to optimize benefits and minimize negative impacts

The following lists the major sectors that are involved in the mariculture review and approval process. Other sectors may be involved occasionally and where required, National Environment Management Council (NEMC) will identify and contact them for involvement in the approval process. For each, we have defined their role and their legislative mandate as it relates to mariculture. They enter and exit the process is

detailed as the process is described in the following pages. This document also provides key contacts for each sector.

MINISTRY OF NATURAL RESOURCES AND TOURISM (MNRT)

Primary Responsibility: Acts as the ultimate authority and provides oversight for approving mariculture projects once individual institutions have completed their reviews and issued their approvals. The MNRT also archives the approval process documents to create a public record of the process.

Type of Review: An administrative review of the package of collected documents acquired during the approval process submitted by the Fisheries Division to ensure that all needed documents are present and that overall compliance with the permitting process was achieved.

Legal Mandate: Presidential Instrument of 1995, revised 1997.

Contact: Permanent Secretary of the Ministry

FISHERIES DIVISION

Primary Responsibility: Contribute to Environmental Permit for **MAJOR** permit process through the feasibility study. Provides guidance and technical assistance to the investor. Submits final approval package to the MNRT for final approval

Type of Review: Feasibility study to determine suitability of the project from the viewpoint of technical and economic feasibility. Elements of environmental and social impacts may also be included as they relate to the technical aspects of the proposal.

Legal Mandate: Fisheries Act (1970).

Contact: Director of Fisheries

FORESTRY AND BEEKEEPING DIVISION

Primary Responsibility: Determines if a proposed project presents potential impacts to forestry resources such as mangroves and other coastal forests.

Type of Review: Determination of project location relevant to forestry reserves and adherence to mangrove zoning scheme; possibility of negative impacts on other forestry areas.

Legal Mandate: Forestry Act (1957).

Contact: Director of Forestry.

WILDLIFE DIVISION

Primary Responsibility: To protect wildlife habitats by ascertaining lack of impacts on wildlife resources and habitats by the proposed project.

Type of Review: Reviews the project proposal to assess whether wildlife or critical wildlife habitats may be affected.

Legal Mandate: Wildlife Act (1998)

Contact: Director of Wildlife.

DIVISION OF ANTIQUITIES

Primary Responsibility: To protect areas with cultural and archeological significance or other natural interest.

Type of Review: Reviews the project to assure that cultural and archeological sites are not impacted by the project.

Legal Mandate: Antiquities Act (1964).

Contact: Director of Antiquities Unit.

MARINE PARKS AND RESERVES UNIT

Primary Responsibility: Establishment and management of marine parks and monitoring of marine habitats and resources.

Type of Review: Reviews projects sited in marine protected areas or which may affect sensitive marine resources.

Legal Mandate: Marine Parks and Reserves Act (1994).

Contact: Marine Parks and Reserves Unit Manager.

NATIONAL ENVIRONMENTAL MANAGEMENT COUNCIL (NEMC)

Primary Responsibility: Coordinates the **MAJOR** permit review process that issues the *Environmental Permit*. Contributes guidance to the District Technical Team for the **MINOR** permit review where needed.

Type of Review: Environmental Impact Assessment (EIA)

Legal Mandate: NEMC Act of 1983.

Contact: Director General of NEMC.

TANZANIA INVESTMENT CENTRE (TIC)

Primary Responsibility: To act as a one-stop permitting center for the investor through liaising with other institutions that review and approve a project. Provides the investor with information on establishing and conducting business in Tanzania. Grants Certificate of Business Incentives which provides a package of incentives.

Type of Review: Reviews for adequacy for business registration and whether criteria for granting of the Certificate of Business Incentives are met.

Legal Mandate: TIC Act, No. 26 (1998).

Contact: Director General.

TANZANIA HARBORS AUTHORITY

Primary Responsibility: Management and protection of harbor and peri-harbor areas.

Type of Review: Reviews project to determine lack of conflict with navigation and other harbor uses.

Legal Mandate: Tanzania Harbors Authority Act (1985)

Contact: Director General

VILLAGE, WARD AND DISTRICT GOVERNMENTS

Primary Responsibility: Evaluate feasibility and effects in local context; consult with the public.

Type of Review: Local-level government and committees are responsible for three types of reviews: 1) The district will participate in the review of large-scale projects as part of the **MAJOR** permit process to evaluate feasibility and acceptability from a local perspective; 2) Committees at the village, ward, and district levels will review the proposal for technical feasibility, environmental impacts and social acceptability for small scale projects in the **MINOR** permit process; and 3) the District Technical Team makes the determination of whether a project falling below the TIC investment threshold has sufficient potential for causing impacts that it should be evaluated using the **MAJOR** permit process.

Legal Mandate: Local Government Act (1997); District By-laws.

Contact: District Executive Director.

LANDS DEPARTMENT

Primary Responsibility: Responsible for granting right of occupancy for land.

Type of Review: The application is reviewed to determine availability of the land and whether it will be allowed according to the type of ownership of the land.

Legal Mandate: Lands Act (1998); Local Government Acts.

Contact: Permanent Secretary.

WATER DEPARTMENT

Primary Responsibility: Responsible for granting water use rights and ensuring water quality.

Type of Review: Determination as to whether the volume of water needed is available and can be abstracted without conflict or environmental damage.

Legal Mandate: Water Act, No. 2, 1974

Contact: Principal Water Officer (for national water sources); Basin Water Officer (for regional water sources)

1.3 MARICULTURE BUSINESS CATEGORIES: "LARGE-SCALE" VERSUS "SMALL-SCALE"

Because mariculture, particularly on an industrial scale, is a relatively new activity in Tanzania, the existing approval process came into existence as an ad hoc amalgamation of existing policies, procedures and regulations. From a legal perspective, there is only one criterion that currently determines the course of the project approval process, and this is based on the scale of investment backing the project. Depending on the level of investment, there is a bifurcated approval process. This is stipulated as part of the mandate of TIC to act as a one-stop permitting institution for investors. Under the definition used by TIC, a minimum investment of \$300,000 for foreign investors and \$100,000 for Tanzanian investors qualifies the investor for facilitation for obtaining business incentives and permitting assistance from TIC. It is the legal mandate of TIC to consult with other institutions before registering a company and granting the Certificate of Business Incentives that shapes the current approval process. Investors who do not meet these established levels of investment, may receive assistance from TIC, but are not entitled to the full spectrum of tax and business incentives.

DISCREPANCY BETWEEN LEGAL AND BIOLOGICAL DEFINITIONS OF PROJECT SCALE

The level of investment does not strictly correspond to the physical scale of a project. For example, a project backed by local investment costing \$90,000 is still of considerable size and may present significant impacts, yet will follow a different route to approval than a project backed by \$100,000 since TIC will not act as an interlocutor between the investor and the permitting institutions. An additional complication is presented by the different minimum levels of investment required from national and foreign investors in order to receive the facilitating services of TIC. Thus, foreign-owned and nationally-owned projects will be subjected to different approval proceedings even though the potential impacts presented by these projects may be equivalent. From the perspective of the regulator, the sole use of TIC investment thresholds to determine the route the review process will follow is insufficient to determining which projects are environmentally and socially friendly.

Once TIC accepts the role of facilitator of the approval process, it has a large influence on the approval process and determines the thoroughness with which the project is considered by the various institutions. A major objective of the approval process is to assure social and environmental sustainability. These considerations should not be swayed solely by the amount of investment or the source of the investment, but also the potential impacts presented by the project.

Recommendations

Given that mariculture is still a new industry in Tanzania, the bifurcated approval process may be the best means of assuring adequate review of projects while avoiding unnecessary bureaucracy and costs for small-scale investors. Therefore, the current investment benchmarks established by TIC can continue to serve as the first level of filtering criteria for the approval process. However, any project, regardless of size, that may be judged to be either risky, contentious, or have national interest, may be required to follow the stricter approval procedures required for large-scale investments.

An additional filtering mechanism to prevent impacts

Large-scale projects, as defined by the TIC investment threshold will undergo Environmental Assessment, where potential impacts can be detected and mitigated. Projects not meeting the TIC investment level are reviewed at the district level. In order to continue review at this level, an initial assessment for the presence of factors that may cause impacts should be required. These factors are size, cultivation of exotic species, number of projects existing in the chosen site, public objections, environmental impacts, or if associated activities may cause impacts. If the District Technical Team (DTT) determines that these factors are present, then the project would be referred to NEMC for review beginning with a Preliminary Environmental Assessment to determine if a full EIA is required. A checklist of factors that may indicate potential impacts is presented in 1.5.2.

1.3.1 LARGE-SCALE INVESTMENT

If a project is backed by the minimum level of investment stipulated by TIC, then TIC will liaise with all other institutions in order to facilitate obtaining permits, licenses and other legal requirements. This was instituted as a means to promote economic development in the nation and help attract foreign capital. Such large-scale investment projects will certainly have intersectoral concerns. In this regard, all steps of the project should require consultation and mutual consideration with all the listed institutions, but there are limited legal requirements to do so. The process by which TIC liaises with other institutions is described later in this chapter. There are several difficulties associated with this procedure.

GAPS

- TIC is required to inform the other institutions of the submission of the project proposal and to request a response within 14 days. Difficulties arise due to the limited amount of time given for a response. Even if a response is provided by an institution within this time limit, evaluation according to the criteria of each institution is not usually possible. The 14 day limit also assumes that the proposal submitted by the investor contains sufficiently detailed and complete information so that the project can be reasonably reviewed. For example, the Fisheries Feasibility Study and EIA may require several months for large or complicated projects.
- Of particular concern is the lack of legal requirements for conducting an EIA. TIC may issue business incentives licenses to projects that have not been vetted by the EIA process, thereby incurring the risk of environmental impacts. This is exacerbated by the lack of mariculture-specific EIA guidelines, as the general EIA guidelines do not fully cover all considerations relevant to mariculture.
- The role of TIC in facilitating project review is triggered mainly by the desire of the investor to obtain the Certificate of Business Incentives. This is not a legal requirement. Therefore, a project, regardless of scale, could escape much of the review process if the decision were made to forego the business incentives in the interest of escaping attention from regulatory institutions.
- Other than the requirement to obtain a response from the responsible institutions within 14 days, the mechanisms that institutions now use to guide intersectoral coordination or communication have tenuous legal backing. Because working in an intersectoral manner may be perceived as difficult or unnecessary and is not always legally backed, institutions may act in isolation.

Recommendations

Establishing a coordinated review process centered around an intersectoral review forum, where the responsible sectors sit together with the investor and present their views, will increase the ability of the government to rationally approve and regulate projects. Convening this type of intersectoral forum can be accommodated within the framework of the EIA, which calls for specialists from various sectors to advise and review the EIA. This forum will provide the means for institutions to communicate directly with each other and the investor. Major difficulties can be rapidly identified and dealt with early on in the process. This will help eliminate duplication of effort, reduce the effort required from the investor and provide technical assistance to the other institutions and the investor. The investor is also thus given immediate access to representatives from the institutions.

1.3.2 SMALL-SCALE INVESTMENT PROJECTS

Small-scale projects are generally thought of as the less labor- and capital-intensive projects carried out by villages, individuals, families, groups or communities.

The purpose of these projects is usually either to produce food for family consumption, or a small amount of product for commercial purposes. However, the technical definition of small- and large-scale is not defined in any policy or law within Tanzania. All mariculture projects, regardless of scale are entitled to the one-stop permitting assistance offered by TIC, but many may not seek assistance. Most smaller project proposers will only seek approval at the local level from a few institutions. There are several difficulties with the current manner of reviewing small-scale projects.

GAPS

- The investment threshold established by TIC is high, and some projects that fail to meet this requirement may still be large enough to incur environmental and social impacts, yet these projects may largely escape attention of the national-level institutions.

- Equally as important, projects falling below the minimum investment guidelines established by TIC still provide important social and economic benefits, and thus merit facilitation to gain approval. Although TIC is required under law (TIC Act 1997, Part 2, paragraph 6d) to provide facilitation to all investors, in reality, the limited resources are allocated to larger projects or projects in other sectors. Even with assistance from the Fisheries Division, the small-scale investor is too often left to their own devices to obtain the necessary approvals through a permitting pathway that is not clearly defined. This impedes economic development since many investors are not capable moving through this process independently.
- The lack of clarity of the small-scale permitting pathway and the lack of legal requirement for an EIA may lead to small-scale projects escaping a review that would prevent environmental damage. Additionally, since rights to land and water use are obtained at the regional level or below, these “small “ projects may not even come to the attention of the national level where they might at least be subjected to a Technical Feasibility Study.
- There is no written set of comprehensive criteria for review of small-scale projects at the national or local scale. Most small-scale investors will seek approval mainly at the local levels since once land and water rights are acquired, there few barriers to the small-scale investor proceeding without further scrutiny. On the other hand, districts and local institutions may establish their own criteria, or in some cases, the professional opinion of the responsible official may be the only standard used. Therefore, projects with merit may be denied, while others with potential impacts could be approved.
- One consequence of this lack of a well-defined process with established criteria is that mushrooming of such small- and intermediate-scale projects may unwittingly cause great damage to the environment through cumulative effects. There is no mechanism to consider the impacts of multiple projects.

Recommendations

All mariculture projects, whether meeting the TIC minimum threshold or not, must undergo an approval process that assures technical and environmental suitability. The options for such processes are elaborated in Section 1.5.3.

All such projects will undergo some determination of whether potential impacts are present. For small-scale projects, this screening can be conducted through the use of a simple check list (see 1.5.2). Small-scale projects possessing one or more factors indicating potential impacts will then be subjected to a Preliminary Environmental Assessment (PEA), as will all large-scale projects. In cases where the PEA indicates that reasons for concern exist, the project will then undergo a full EIA. While PEA and EIA will currently be overseen by NEMC, in the future, capacity should be developed for this to occur at the district level.

All such projects must be examined for Technical Feasibility either by the Division of Fisheries, or the District Technical Team/District Environmental Committee to promote successful projects and avoid the impacts associated with failed projects (criteria for the Technical Feasibility Study are in 1.7.1).

All investors, regardless of the scale of their projects, have a right to the same ease in accessing the legal system and receiving technical assistance. The primary institutions which offer these services, TIC and the Fisheries Division, will require more resources to fulfill their mandates as the demand increases.

Written, science-based criteria for review and approval are needed. The Mariculture Guidelines can supplement currently established institutional criteria as described in 1.7.

When a project is denied or approved, the verdict should be provided in written form and the basis for rejection or approval explained in sufficient detail so an investor can revise the project if desired.

1.4 EXISTING APPROVAL PROCESS

The existing approval process is illustrated in Figure 1 (page 78). Nowhere in the policy or regulations of any institution of the government of Tanzania is such a process in its entirety described or mandated. No mariculture project has yet successfully completed the entire process of becoming a legal business entity. The different steps of the approval process are defined in separate institutional policies and acts. Legally-mandated mechanisms of inter-institutional and inter-governmental coordination and communication are few. Much of the current approval process evolved as an informal institutional response to meet recent needs as more mariculture projects have been proposed. This ad hoc process was elucidated by research of the TCMP Mariculture Working Group, and applies mainly to the large-scale investor as defined by the minimum investment threshold set by TIC.

TIC acts as the pivotal institution in the current approval process because of its role as a facilitator of one-stop permitting. Thus, the large-scale investor may most conveniently enter the process via TIC, but concurrently may also need to contact NEMC for an EIA and the Division of Fisheries for a Technical Feasibility Study, possibly the Division of Forestry and Beekeeping, and depending on the circumstances, other institutions such as Wildlife. None of these consultations are strictly specified according to law; the requirements are based on ad hoc informal arrangements. There is very limited oversight due to the fragmentation of the procedures, therefore, proper compliance is not guaranteed. The investor currently has no legal requirement to undergo the EIA process as the EIA guidelines have not been legislatively approved. As a result, relatively little attention has been paid to assuring that a project is technically, socially and environmentally appropriate.

Apart from approaching the national level institutions, the investor must either directly approach the local-level government to obtain land and water usage rights, or utilize the services of TIC as facilitator of the permitting process to do so. The guiding factor in this process is the mandate of TIC to facilitate the process, and the desire to rapidly issue the Certificate of Business Incentives.

While the process required for the large-scale investor is not completely clear, the process for any project that falls below the TIC minimum investment threshold is even less clear. Without TIC to facilitate the process, the investor is left to himself to discover and navigate the system. TIC is also required to consult with other institutions, but in the consideration of “small-scale” projects, there is little communication and coordination between the various concerned institutions other than what the investor might provide; thus, the institutions may act independently even when dealing with common issues. The investor might even be able to avoid consultation with key institutions until quite late in the process. Given the lack of communication between the levels of government, projects which could have significant impacts can escape national level attention altogether if the local level authorities approve the project. The approval process will vary considerably between districts. It is not clear if all districts possess the specific technical capacity to properly analyze mariculture projects.

It is not even clear at what stage a small-scale investor must bring a proposal to the attention of national authorities. This is particularly true when the location of the project falls outside the jurisdiction of any institution (e.g. intertidal areas). For example, small-scale seaweed farmers do not obtain permits or licenses for their projects. There are few other types of projects to use as models. The only other cases that might apply are those supported by the Tanga Coastal Zone and Development project, which were submitted for consideration at the district level and by the MMP. In some cases, these proposed projects have failed to obtain approval since the legal criteria for this at the local level are few, and the decisionmaking process is often a matter of personal judgment by the official involved.

Recommendations

The Fisheries Division will be responsible for assuring that all proceedings are legally conducted and all criteria met before the final assemblage of permits by the ministry and their granting of approval. This implies that Fisheries must establish a mechanism for monitoring and evaluating the entire approval procedure to be sure all steps were followed and approval documents are officially valid. Fisheries will take an active role in the approval process along with NEMC for both technical expertise and to provide oversight of the multi-stage permitting procedure.

As demand for approvals increases, the Fisheries Division of the Ministry of Natural Resources and Tourism will require more resources in order to maintain accountability in the approval process, as well as improved oversight mechanisms.

1.4.1 MAJOR GAPS IN THE CURRENT APPROVAL PROCESS

1.4.1.1 Gap: No oversight and coordination of the approval process.

The Fisheries Division acts as the technical lead for mariculture. The Ministry of Natural Resources and Tourism receives the collected documents from Fisheries and grants the final approval. There is little oversight to assure that all steps are fulfilled properly or expeditiously other than what TIC may provide. The ministry will investigate any dubious documents, but the cost of doing so is a disincentive. As for coordination, TIC may take the lead in liaising with institutions, but does not particularly concern itself with the economic feasibility, technical or environmental aspects of the projects. Its contacts with other institutions are on the behalf of the investor as a promotional institution for investment. Other institutions issue or deny their approval independently without higher oversight and often without communication with other sectors. There is a need for one institution to assume the role of assuring accountability for the entire process.

1.4.1.2 Gap: Insufficient facilitation or assistance for development of “small-scale” projects

Where the scale of investment falls below the minimum threshold level of TIC, the investor, whether of small or intermediate scale, may lack facilitation or even an entry point into the approval process. Assistance of this sort is critical given the lack of clarity in the existing approval process.

The Fisheries Division assumes responsibility for providing technical assistance for all investors while TIC facilitates permitting, but the scarce resources of both institutions makes it difficult to provide full assistance to all proposed projects. Additionally, the lack of formal coordination between national and district levels in the approval process may impede the flow of information and thus the extent to which Fisheries extension agents at either level can assist the investor.

Recommendation

When TIC is not able to give full assistance to the small-scale investor, the Division of Fisheries through its representatives at the district level, will act as the entry point into the approval process. Most investors will naturally approach Fisheries due to the need for combined assistance with permitting and technical aspects. The Division of Fisheries shall also act as facilitator and liaison for the investor to minimally assure that the investor understands the approval process and that unnecessary bureaucratic blocks do not impede their progress. All investors, regardless of the scale of their investment are entitled to this assistance.

1.4.1.3 Gap: There is no forum at the national level for mutual consideration of specific projects

Each institution acts independently to issue approvals regardless of whether issues are of common concern. The principal mechanism of communication between institutions is the TIC Act (1997) which requires that TIC liaise in writing with the respective

institutions within 14 days of receiving the proposal in order to determine whether objections to the project exist. In the absence of other mechanisms of coordination, this tends to lead to approvals being issued in isolation by the sectors, or in some cases, with no examination at all due to the short time frame specified by TIC. The lack of a common forum also requires the investor to deal with each institution sequentially or separately, when a common dialogue would be more efficient and expedite matters.

Recommendation

The Modified Approval Procedure for Large-Scale Projects proposes an intersectoral approval forum that is based on the current TIC and NEMC practices of consulting with relevant institutions. The proposed forum will be convened by NEMC and be comprised of members from relevant institutions who meet to mutually consider project proposals after preliminary reviews before proceeding with full individual institutional reviews.

The proposed modifications are intended to strengthen coordination and communication while improving mechanisms that assure an adequate review.

The TCMP Mariculture Working Group can play the role of a national level technical advisory committee with representation from the institutions and private sector that have interests in mariculture. This Working Group can work under the auspices of the National Coastal Management Office and report simultaneously to NEMC and the Fisheries Division.

1.4.1.4 Gap: There is little guidance for the investor in preparing the feasibility study that is submitted to the institutions for individual review. Generally these reviews do not have stated criteria as a basis for evaluation

The investor is required to submit a feasibility study (project proposal) to TIC, Division of Fisheries, NEMC, and other relevant institutions, each of which conducts a review according to their institutional interest. There is no stated format for the feasibility

study that specifies the information that the feasibility study must contain. The individual institutions also lack detailed criteria to use as a basis for denial or approval of projects. Approval is often based on the professional judgement of the person in charge of the review. This situation leads to unnecessarily prolonged reviews and lack of transparency regarding the reasons for the decision. Without transparency in the process, the investor may not have recourse if the project is denied. Equally, disgruntled stakeholders may have no recourse if a project is approved over their objections. At the moment, only NEMC has general guidelines, although these are not specific to mariculture (Chapter 3).

Recommendations

Adoption of these guidelines provides a preliminary set of criteria for evaluation of projects. These criteria, in addition to basic descriptive information on the project, can form the basis for a checklist of information required in the feasibility study submitted by the investor, and for a set of criteria to be used by NEMC, Fisheries, and other institutions in their evaluation. The list of information needs and evaluation criteria should be harmonized between the institutions and provided to the public. NEMC, Fisheries and other technical institutions should work together to develop more specific and locally appropriate sets of species-specific guidelines, beginning with seaweed and tilapia culture. These institutions can be assisted by the Mariculture Working Group under Fisheries Division, or the Tanzania Integrated Coastal Management Office (TICMO) if approved by the authorities.

1.4.1.5 Gap: no legal requirement for stakeholder consultation at the national level.

At the national level, there is no requirement for stakeholder consultation. The project could therefore be approved without proper consideration of socioeconomic or environmental impacts. At the local level, consultation is required to obtain land use rights, but this information is not conveyed to the national level.

Recommendations

In addition to conducting an EIA as described in the approval procedures below, where there will be a forum for public consultation, public input should also be required both as part of the feasibility study conducted by the Fisheries Division and the EIA conducted under the auspices of NEMC. The EIA Guidelines set forth a framework for how public consultation shall be conducted and how this information is to be used in the EIA process. Depending on the scale of the project, the DTT, NEMC or Fisheries Division can facilitate the process of bringing the stakeholders together. The investor will finance the process where needed.

1.4.1.6 Gap: need for increased communication and coordination between district- and national-level processes.

Under the existing approval procedure, the investor approaches the national level approval process separately from the local level process to obtain land and water rights. This requires more work from the investor and the separation of the processes may cause the institutions to waste their time and resources since the project could be approved at one level while being rejected at the other. This is exacerbated by the lack of structured communication and coordination mechanisms between the various levels of government and institutions in the current process.

For example, obtaining land and water rights requires consultation at the local level. However input from the review conducted at the national level may not be accessible to the local authorities and local opinion may not always filter up to decisionmakers at the national level. This brings the risk of granting land and water rights to projects that may not be feasible from a technical standpoint to projects excluded for other legal reasons or to projects that may present potential impacts.

Recommendation

If local-level representation were added to the national forum, the flow of information and opinions between the two levels would be facilitated. This will save time and resources for both the investor and the institutions. Involving representatives from the Lands Department, Water Department and local government is key to making granting these rights provisional upon successful completion of other parts of the review process.

Additionally, the TCMP Mariculture Working Group, if continued as a technical advisory group, may add representation from the local levels of government.

1.5 ADDRESSING THE GAPS IN THE CURRENT APPROVAL PROCESS: HARMONIZING AND STRENGTHENING THE MARICULTURE APPROVAL PROCESS

The following sections suggest means by which the current approval process can be harmonized to develop a coordinated review and approval process for large- and small-scale projects. The goal is to make the system more efficient to the advantage of the public and private sectors, while protecting the environmental and social well being of the coast. In the case of large-scale projects, the recommended permitting process is designed to be streamlined and easy to comply with, while assuring that ample scrutiny of the proposal leads to environmentally and socially sound business development. Built-in mechanisms also provide for technical assistance to the investor from the public sector. For small-scale projects, the recommended procedure is intended to prevent impacts and at the same time, not hamper development by investors with limited resources. This process also provides for technical assistance to the small-scale investor.

An effort has been made to use the current approval process, existing policy and acts, and existing institutional roles as the framework for the modified approval procedures, rather than creating entirely new procedures or institutional roles. The recommended procedure centers around the EIA process as outlined by the National EIA Guidelines

with accommodations for interactions with other institutions as guided by their legal mandates in the permitting of mariculture projects.

1.5.1 RECOMMENDED MODIFICATIONS FOR A COORDINATED REVIEW AND APPROVAL PROCEDURE

One of the most perturbing factors in the current permitting procedure is the way in which the TIC investment threshold levels determine the route a proposal will take in obtaining permits. While it is quite clear that any large-scale project meeting the minimum threshold should undergo EIA, it is not clear how the diversified and wide range of “small-scale” projects should be handled. The modified permitting procedure accommodates this by establishing an additional filtering mechanism in the early stages of the procedure that relies upon science-based criteria as well as the TIC investment thresholds to detect the potential for impacts, and thus determine the route the project must follow. Once routed into either branch of the bifurcated permit procedure, recommendations are also made to clarify and harmonize each route so that regardless of the scale of the project, permitting can move in an expeditious, yet careful manner. (See Figure 2, page 79.)

1.5.2 DECIDING WHICH PERMIT PROCESS MUST BE FOLLOWED

To avoid confusion with previously used terms and their associated implications, projects are here classified as **MAJOR** or **MINOR** based on which permitting route the project will follow. A simplified definition is that the **MAJOR** permit route is for projects that may present potential impacts while the **MINOR** route is for projects that clearly do not present potential for impacts. Note that it is the potential for impacts that determines the route, not confirmed impacts.

Two levels of filtering determine the permitting route that a project should follow.

- 1) Amount of investment backing the project
- 2) Potential for impacts.

The recommended procedure to determine whether a project follows the **MAJOR** **MINOR** permitting procedure is as follows.

STEPS:

1) Determine the level of investment

- It is a large project if it is backed by at least \$300,000 (US) for foreign investors or \$100,000 (US) for local investors. Large-scale projects will enter the **MAJOR** approval process. There are no exceptions
- It is a small project if the project does not meet the investment level established by TIC



Large projects proceed to the **MAJOR** permit process described on page 34.



Small projects proceed to the Potential for Impacts step



2) Determining the Potential for Impacts.

In order for a project to continue in the **MINOR** permit process, the developer must demonstrate that significant potential impacts do not exist. Proposals for small scale projects are submitted to the District Technical Team (DTT). The DTT is a subcommittee of the District Management Team and is composed of technical personnel from the responsible sectors (e.g. Fisheries, Forestry and Beekeeping, Wildlife, Lands and Human Settlement Development, Community Development Officer). The DTT reviews the project to determine if potential for impacts exists, where necessary consulting with NEMC. The following checklist is used to determine whether the potential for impacts exists. If the project answers yes to any of the criteria below, then it is referred to the **MAJOR** permit process.

CHECKLIST FOR RAPID DETERMINATION OF POTENTIAL FOR IMPACTS

- **Size**

The physical scale of the project may suggest the degree of potential impacts presented. As a preliminary measure pending further investigation, it is suggested that the following be used to assess the probable lack of significant impacts.

Does the project exceed any of the following limits in size? **YES** **NO**

- Individual earthen ponds measuring less than 400 m²
- Individual floating cages measuring less than 400 m²
- Individual long lines less than 400 m²
- Individual rafts less than 400 m²
- Individual bottom cultures measuring less than 400 m²

- **Use of exotic species**

If exotic or imported organisms are to be used, then the project is assumed to present potential impacts and must be reviewed in the **MAJOR** permit process.

Are exotic or imported organisms to be used? **YES** **NO**

- **Number of projects in the same area.**

Even small-scale projects may produce cumulative impacts when more than one is present in the same area. Thus, as a preliminary measure pending further investigation, it is suggested that if multiple projects exist and exceed the following levels, that the project would be reviewed using the **MAJOR** permit process.

Are there more than 10 individual mariculture projects which together measure over the size limits mentioned above (400 m²) in the same area? **YES** **NO**

Project is defined as an individual pond, floating cage, long line, raft or bottom culture.

- **Objections from the local community or other potential socioeconomic impacts**

Once public notice is posted regarding the intention to establish a mariculture project, if any objection from the community is registered in writing with the authorities, then the objection must be reviewed by the DTT with reference to the criteria listed below to determine whether the project should be referred to the **MAJOR** permit process.

Socioeconomic impacts may include, but are not limited to:

- Displacement of human occupation

- Displacement of other economic or traditional activities
- Possible conflict with other economic activities
- Need to bring in more than 20 workers from outside the local community
- Affects human health or safety
- Is not in accordance to current policy or regulation

Is there a possibility that the project causes any of the above? YES NO

• **Cases where potential impacts related to the following are suspected:**

- Soil, beach or coastal erosion may occur
- Changes in hydrology or hydrodynamics may increase the probability of flooding or affect the water use rights of other users
- Possibility of salinization of ground water
- Obstruction, displacement or hazards to wildlife, migratory birds or aquatic life may occur
- Sensitive habitats such as mangrove, wetlands, intertidal zones or coral reefs are located within the project site, or project activities could affect these
- Use of wild animals or plants such that local populations may be damaged
- Deterioration of water quality

Is there a possibility that the project causes any of the above? YES NO

• **Where associated activities may present potential impacts:**

- Creation of other infrastructure such as processing plants, docks, roads, pumping stations or hatcheries is proposed and is believe to pose potential impacts
- Where degradation or damage may be caused to areas of cultural, historical, archeological or religious importance
- Areas where little or no previous experience exists as a basis of analysis, such as:
 - Use of new species or imported species
 - Use of new culture technologies, particularly in the case of intensive systems
 - Where conditions are judged to exist such that project success is questionable

Is there a possibility that the project causes any of the above? YES NO

A project has the potential for significant impacts, if the project meets any one of the above criteria or if the District Technical Team cannot make a determination. In either case, the DTT refers the project to NEMC for review. NEMC will conduct a Preliminary Environmental Assessment (PEA) to make a determination as to whether full EIA is needed. If the PEA determines that a full EIA is required, then the project follows the **MAJOR** permit process starting with Step 1a (project proposal). If the PEA determines that no significant impacts are presented, then the project may once again return to the **MINOR** permit process.



Small projects proceed to the PEA step of the **MAJOR** permit process described below.

A project does not have the potential for significant impacts, if the project is determined not to possess any of the above-listed impacts.



Small projects proceed to the **MINOR** permit process described on page 56 and proceed to step 1 of the **MINOR** process.

1.5.3 MAJOR PERMIT PATHWAY FOR LARGE-SCALE PROJECTS OR SMALL-SCALE PROJECTS WITH POTENTIAL IMPACTS

Suggested modifications to strengthen the existing approval process for large-scale investment (i.e. minimum \$100,000 (US) local investor/\$300,000 (US) foreign investor) or small-scale projects with potential impacts

Modified Permitting Procedure

The modified permitting procedure (**MAJOR**) that leads to mariculture business approval for large-scale projects or small-scale projects with potential impacts is shown in Figure 3, page 80. In this model, TIC is the one-stop permitting center and remains as the entry point and facilitator for all large-scale investment projects including

mariculture. The “Investors Guide to Tanzania” (1998) provides guidance to business investment procedures in Tanzania. The roles of the other institutions are similar to those in the existing process, although mechanisms for coordination and communication are introduced. The modified permitting process integrates what are now rather separate processes carried out by TIC, Fisheries, NEMC and the district-level government using the EIA process to harmonize and streamline the various procedures.

There are several simple modifications whereby the existing approval process can be strengthened by enhancing the role of each institution and increasing the degree of communication and coordination between institutions and levels of government.

The major modifications are:

- The nature and informational content of the project proposal is specified and one proposal can be drafted by the investor that answers the needs of all institutions for information thereby streamlining the process
- The steps required for the informal consultation are specified, and a feed-back loop is provided to assure that these are properly conducted, with all major stakeholders contacted. This improves the efficiency of the process by avoiding difficulties such as public objections late in the process after much time and energy has been invested
- District-level representation is included at the national level to strengthen communication and coordination between levels of government and to assure that local perspectives are accommodated. This also streamlines the process for the investor, since the second phase of obtaining land and water use rights is simplified
- Representatives from the Ministry of Land and the Water Department are included in the Screening Forum to increase awareness between institutions and to further enhance the linkages between national- and local-level processes
- An additional strengthening of linkage between national and district levels is also provided for by inclusion of a district representative in the approval process

- The major decisionmaking step requiring the agreement of the four major institutions and all concerned institutions is formalized, with improved consultation and communication for the benefit of the public and the investor
- The modified procedure requires close collaboration between Fisheries, NEMC and TIC to provided oversight and facilitation of the three key aspects of mariculture development: technical, environmental and economic. Investors get the added benefit of increased technical assistance rendered throughout the process.
- The institutional and technical capacity of NEMC must be strengthened so that it may continue in its key role in the approval process. This can be achieved by appointing personnel from other institutions, Fisheries in particular, to work closely with the NEMC staff during the approval process.

MAJOR permit procedure

Modified review and permitting pathway for large-scale projects or projects presenting potential impacts

All projects meeting the TIC investment threshold (\$100,000 US for local investors or \$300,000 US for foreign investors) are defined as large-scale projects and will be subject to the **MAJOR** process described below. Additionally, certain projects which do not meet the investment threshold, but are judged to have the potential for significant impact, would be reviewed and permitted under the modified procedure described below. Determination of whether the potential for impacts exists is first detected using a simple checklist (1.5.2) and then confirmed by Preliminary Environmental Assessment as described in Chapter 3.

This process is based to the fullest extent possible on existing institutions and their current legal mandates. Many of the recommended modifications involve mechanisms for increased coordination, communication and intersectoral consideration to help

streamline the process where possible rather than creating new legal procedures. Where necessary, the need for changes in policy or regulation is noted, but generally there is minimal need for this.

Getting Help:

The investor is referred to the "Investor's Guide to Tanzania" (1998) for full details on the procedures for establishing a business in Tanzania.

The three systems used by the MAJOR permit process are:

- **Technical Feasibility Study** - The Fisheries Division is the lead institution for mariculture offering technical assistance as well as legal guidance. The Technical Feasibility Study is reviewed by the Fisheries Division and is used to ascertain that the project proposal is feasible, viable and socially acceptable. Consideration of the social acceptability, economic effects, and environmental impacts is important since these play a role in determining the long-term success of a mariculture business and because large-scale projects generally need support from the public sector, thus justifying review from the perspective of determining feasibility. Apart from determining whether the project should be granted approval to proceed, the Technical Feasibility Study serves as a vehicle by which the project is analyzed by an array of experts from different fields who may provide technical assistance to the investor in areas where room for improvement exists
- **Certificate of Business Incentives** - The Tanzania Investment Center (TIC) acts as a one-stop permitting center and provides facilitation of all investment requirements for the investor. TIC grants the investor the Certificate of Business Incentives. To large-scale investors who meet the requirements, the Certificate of Business Incentives offers advantages related to income, sales, and custom taxes as well as other financial incentives. TIC can facilitate obtaining non-financial incentives such as favorable immigration quotas and visas.
- **Environmental Impact Assessment** - The National Environmental Management Council (NEMC) is the lead agency for reviewing Environmental Impact Assessments (EIA). Successful completion of an EIA is required to legally operate a mariculture business.

The EIA is a process that identifies or predicts, and evaluates or analyzes the potential implications of mariculture development. It also recommends measures to eliminate or mitigate potential impacts. The mariculture EIA is a process that can be used to improve decisionmaking and ensure that the development options under consideration are ecologically, socially and economically sustainable. EIA therefore includes elements of social and economic analysis. The EIA should not be viewed as a tool for regulation only; the investor can benefit from this form of analysis since environmental impacts can cause loss of production and economic losses.

The thread weaving these important systems together is the EIA process. Mariculture touches on a number of environmental, social and economic fields, and therefore requires intersectoral review. A number of key and relevant institutions or government bodies (TIC and Fisheries) must review and approve the project proposal before the project can legally be initiated. The EIA provides a streamlined and integrated process for incorporating the comments of those institutions in the project review. Therefore, the steps of the **MAJOR** permit process mirror the steps of the recognized EIA process. Modifications have been made to accommodate the needs of other key institutions, to ensure that this single process is adequately serving their needs.

Steps in the MAJOR permitting process

Getting Started. Preparing the project proposal.

STEP 1: PROJECT PLANNING AND DEVELOPING THE PROJECT PROPOSAL

Step 1a: Developing the project proposal

An investor wishing to begin a mariculture business must start by designing the project and planning the specifics of how to implement the project. Options for all specifics of the project that influence the biological, social, and financial success of the project should be evaluated, the best option chosen, and all details specified in the plan.

The investor is responsible for developing the original project concept with his or her technical personnel. If the investor is not technically qualified to do this, then it is recommended that he or she hire the services of a technical consultant, as well as

seeking the advice of local- and national-level technical authorities. These authorities should be consulted throughout the process even where qualified consultants are hired to facilitate the process to open lines of communication and to avoid difficulties later in the review process. Government technical personnel have a responsibility to assist investors with the goal of furthering economic development for the nation, but their time and resources are limited, thus the investor is primarily responsible for designing the project. Both the knowledge of these trained professionals, as well as the residents of the planned project site can provide valuable knowledge that will aid the investor and help prevent costly errors in planning. The project concept should minimally contain a basic description of the project and a basic business plan. These should be viewed as drafts of the eventual project proposal.

This information will be used by all reviewing institutions to evaluate the project. During preparation of the project proposal, the investor should be in contact with TIC, who will assist with liaising with local authorities and other institutions. Additional technical assistance is available from the University of Dar es Salaam and the various fisheries institutes (e.g. TAFIRI).

Information required for project proposals in the MAJOR permit procedure

1. Species to be cultured and the biological requirements for successful culture of the species
2. Product to be produced and eventual use of the product (e.g. consumption, sale)
3. Expected production per crop or per annum
4. Level of technology to be used (e.g. extensive, intensive, semi-intensive)
5. Level of investment backing the project
6. Methods of cultivation
7. Proposed location (include map) and site plan
8. Topography and soil type
9. Size of project (number of ponds, farm structures, pounds of product to be produced, etc.)

Information required, continued

10. Existing land use pattern
11. Surrounding features (physical and biological)
12. Types and amounts of raw materials required
13. Source of stock for farm
14. If hatchery is needed or if stock is to be imported, describe these arrangements
15. Natural resources needed for project (e.g. source and volume of water, land requirements, including needs for future expansion, reliance upon wild stock)
16. Infrastructure needs (both those developed as part of the project and those provided from the public sector)
17. Number of employees and where personnel will be obtained
18. Specify technical qualifications of project personnel
19. Whether technical assistance from the public sector is required, and if so, what in what manner
20. Estimate costs, cash flow and profit margin (i.e. provide a basic business plan)
21. Source of funding and assurance of funding continuity
22. Expected benefits of the project
23. Expected potential impacts or difficulties (if impacts or difficulties are possible, please describe how these will be eliminated, addressed or resolved)
24. Means of soliciting public input on the project and use for decisionmaking

Step 1b: Initial contact. Conduct initial consultations with local government to finalize the proposal and begin to secure land and water rights.

Although the large-scale investment mariculture projects are approved at the national level, operations and potential impacts occur at the local level. Thus, this step should be considered as an initial assessment as to whether appropriate conditions exist at the proposed site. Armed with the draft project proposal, the investor should begin by approaching the various local authorities through the facilitation of TIC. After registration, TIC will introduce the investor to the village authorities.

The purpose of local-level consultations are:

- Obtain local-level approval

In order to succeed, a project must meet with the approval of local authorities who will evaluate it from social, economic and biological perspectives. Assuring local acceptability at the early stages is important to avoiding difficulties later in the process. Additionally, most investors will need input from individuals with social and technical expertise at the local level to assure feasibility in the specific local context.

- Identification and evaluation of the tentative project site

The site is identified and should be evaluated as to its availability, suitability, issues of compensation, potential conflicts, and details of occupancy should be explored. Using the collected information, the proposal can be refined and finalized.

- Access to land and water

Identification of a specific site and source of water allows an investor to proceed with the EIA, and allows Fisheries to verify feasibility and take other site-specific permitting steps early on in the planning process. Once an investor has identified a preferred site, informal consultations with local communities and various levels of relevant authorities should be held to determine if this site is available and appropriate. If so, the district authorities will introduce the investor to village authorities in order to obtain a permit to conduct studies on the identified site. The local authority will produce public notices that studies are being conducted.

Steps:

1. Contact TIC. TIC will introduce the investor to the local authorities and facilitate identification of the site.
2. Local authorities will review the proposal and make a determination as to whether the proposed site is acceptable and available. They will then issue a letter stating their approval and their agreement that land use rights may be pursued.
3. Local authorities will produce public notice that the studies are being conducted at the proposed site to inform the public.
4. Identify the precise project site and source of water.

5. The investor then proceeds with thorough investigation of the site and availability of all resources needed to support the project such as labor, water sources, access to market, etc.

Criteria for review of project proposal by local institutions

Local authorities (village, ward and district) review the proposal from the standpoint of acceptability at the local level and to provide important information needed by the investor to assure that the proposed project is feasible. Local authorities also weigh in on the question of whether land is available and whether use of the land is allowable. This allows the investor to then proceed with the process of obtaining land and water use rights. Specific criteria for this review is in Section 1.7.

When to move to the next phase?

It is time to go to the next phase if:

- The village, ward and district have issued letters agreeing to the project, and depending on the size of the land required, issued authorization to pursue land use rights
- The public has been advised that the site is under consideration
- The investor receives advice and local knowledge that may be used to revise the project proposal
- The investor has collected sufficient information that the project proposal can be finalized

<p style="text-align: center;">Getting Help:</p> <p>TIC will assist the investor in approaching the local-level authorities during the processes of gaining land and water use rights.</p>

Step 2 Submission of proposal.

The project proposal is submitted to key institutions.

Once the project proposal has been finalized using information gathered during the initial local consultations, the investor should submit the proposal to Fisheries, TIC and NEMC. According to law, TIC then submits the proposal to the other institutions. However, the investor is advised that submitting the proposal to the other institutions helps facilitate communication and speeds up institutional response to the advantage of the investors. Application forms for the EIA are available at NEMC offices. These should be completed and submitted to NEMC.

Step 3 Screening.

Responsible institutions review the project proposal for adequacy to continue with the permit process. It is at this point that the modified **MAJOR** permit process falls into step with the general EIA process, which is already a requirement for large-scale projects. The general EIA process is described in Chapter 3. By consulting the flow chart in Chapter 3 (Figure 7), the reader may observe that modified procedures adhere closely to the EIA process. By integrating the various institutional reviews into the intersectoral review mandated by the EIA National Guidelines, the entire process is streamlined and inter-institutional communication and cooperation is guaranteed. The process offers an additional advantage to the investor in that the intersectoral nature of the screening forum provides an opportunity for the investor to communicate with all institutional representatives at one time, rather than facing the daunting task of dealing individually with each under different conditions.

In essence, the modifications recommended here constitute a sector-specific EIA for mariculture projects. This process can be easily adapted to other forms of coastal development.

A key feature of the **MAJOR** permitting process is the Screening Forum, which is both a process and an intersectoral body (termed the Technical Review Committee-TRC). NEMC is mandated by the National EIA Guidelines to form and utilize an intersectoral advisory group to provide guidance and technical expertise for review of projects. It is recommended that this mechanism be utilized in the **MAJOR** permitting procedure to provide a means of intersectoral review and also to give the investor ready access to all major institutions.

The Screening Forum

The Screening Forum is an intersectoral forum that meets to jointly review the investor's proposal. NEMC is mandated to coordinate cross-sectoral technical teams (a Technical Review Committee (TRC)) when screening all development projects including mariculture (General EIA Guidelines and Procedures, 1997 (proposed)). The forum held with the TRC shall be comprised of representatives from institutions with a stake in mariculture development.

This includes, but is not limited to NEMC, Fisheries Division, Forestry and Beekeeping Division, TIC, district representatives and local community representatives from the affected area, the Lands Department, and the Water Department. Others may include Marine Parks and Reserves, Tanzania Harbors Authority, Wildlife Division, and the Division of Antiquities depending on the geographic location of the proposed project. Attendees are representatives of their institutions and may rotate depending on the needs of the institution. Attendees should be endowed with the power to convey the official opinion of their institution and have decisionmaking power within the Screening Forum.

Conducting Preliminary Environmental Assessment (PEA) and other institutional reviews prior to Screening Forum

After the project has been registered, NEMC will call a Screening Forum within 30 days of notification by TIC who officially submits the proposal to other institutions. During the 30-day period between receipt of the project proposal and the meeting of the Screening Forum, each institution will prepare for the Screening Forum by conducting an internal review of the proposal to determine if it is adequate to continue in the **MAJOR** permit process. NEMC will also conduct the Preliminary Environmental Assessment (PEA) during this period to begin the EIA process.

Review Criteria applied by institutions can be found in Section 1.7 of this document.

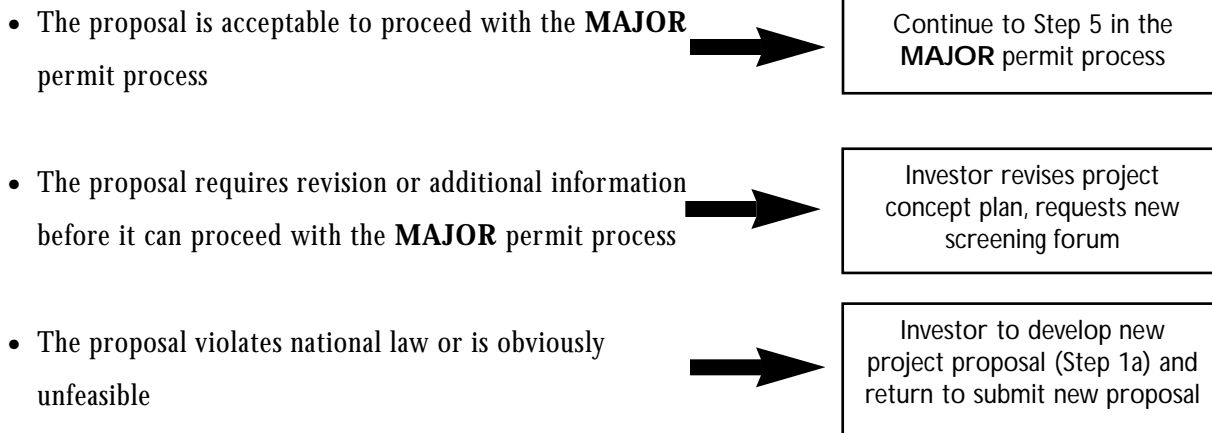
Small-scale projects that may have impacts are reviewed by NEMC and if the PEA determines that a full EIA is needed, then the project begins with Step 1a of the **MAJOR** permit process.

The TRC will sit again to review the EIA and to evaluate individual institution reviews. During the screening step, this group should decide if any institutions may be excused from the following steps on the grounds that the proposed project does not touch on the jurisdiction of the institution. Also, they may decide whether additional technical personnel are required to bring needed expertise to the review process and then arrange for them to participate in the next steps.

Using their review criteria, institutions should make a preliminary determination if the proposal:

- Is acceptable to proceed with the **MAJOR** permit process and EIA study
- Requires revision or additional information before it can proceed with the **MAJOR** permit process. In this instance, institutions will render the official opinions in writing. These shall cite the specific areas that need reconsideration and recommendations should be made as to how the investor can address problematic issues. These will be compiled in the minutes of the meeting and officially submitted to TIC by NEMC
- Is unacceptable and requires a substantial amount of revision or a complete re-design for re-submission. In this instance, institutions will render the official opinions in writing. These will be compiled in the minutes of the meeting and officially submitted to TIC by NEMC

One of three choices will be made at the Screening Forum, directing the investor how to proceed:



Concurrent outcomes

The minutes of this meeting, including the written comments by the participants will satisfy the following needs:

- A timely response to TIC's request for possible objection to registration of the company and the issuance of the Certificate of Business Incentives. This request is made by TIC to relevant sectors after the project has been registered. If no objection is expressed by the other institutions, TIC will proceed to issue the Certificate of Business Incentives if the project meets the internal TIC criteria (Section 1.7) once the Environmental Permit is obtained.
- Findings for a PEA as described in the EIA guidelines [General National EIA Guidelines and Procedures, 1997 (proposed)].
- In the case where a small-scale project has been referred to NEMC by the DTT due to the existence of potential impacts, or where a determination cannot be made at the district level, the Screening Forum may determine that the project does not to present potential impacts and it may return to the **MINOR** permit process. If potential impacts are judged to exist, then the project must continue to step 1a and be treated as a **MAJOR** project.

STEP 4: SCOPING.

The Terms of Reference (ToR) and the scope of the EIA are developed.

The scoping step determines the terms of reference (ToR) and boundaries of the EIA study. It provides an opportunity for the investor, consultant, government authorities, and interested and affected parties to exchange and express views about the proposed project prior to the environmental assessment study. It also focuses the study on reasonable alternatives and relevant issues to ensure that the resulting EIA report is useful to decisionmakers and addresses concerns of interested and affected parties.

In order to accommodate the review criteria of all concerned institutions, and at the same time aid the investor in efficiently addressing all issues, the ToR for the EIA will incorporate all institutional review criteria.

To complete the scoping set, the investor should:

1. *Develop a ToR for Completing the EIA.* This defines “what” will get done. Outcomes of the screening should be incorporated in the TOR. This should include, but not be limited to:

- A description of the proposed project and an analysis of the reason for that project.
- The objective of the project
- A review of, and response to criteria (1.7) from sectors that are involved in the mariculture review and approval process as well as any comments provided during the Screening Forum. A plan should be developed for consultation with all concerned institutions and their comments and reviews incorporated in the final EIA report
- Other options for carrying out the project based on institutions' comments from the Screening Forum and their review criteria
- Comparative evaluation of options that considers:
 - A description of the present environment that would be affected directly or indirectly
 - A description of the future environment predicting its condition if the undertaking did not take place
 - The impact that may be caused to the environment by the undertaking

- Proposed measures to mitigate all the predicted adverse impacts and costs
- An evaluation of opportunities and constraints to the environment of the undertaking
- Identification of the environmentally preferred options and the legal and policy basis for these
- A proposal for environmental management and monitoring programs that address the environmental impacts of the preferred option
- A plan to consult with all concerned institutions and incorporate their comments and reviews in the final EIA report

2. *Develop a Plan for Executing the Assessment.* This defines “how” it will get done. This should include, but not be limited to:

- Objective of the EIA study
- Boundaries of the study
- Methodologies to be used
- Operational details of the study including personnel, costs and schedule

3. *Develop a Plan for Ensuring Adequate Public Consultation.* Public consultation should seek to solicit information and opinions from stakeholders and members of the public that may be directly or indirectly affected by the project. This information will be used to determine if the project is acceptable to the public and whether social, environmental or economic impacts exist. Adequate public consultation will include, but not be limited to the following:

- The public should first be advised through notices, radio or newspapers that a project has been proposed and the nature of the project
- The consultants carry out public consultation based on methods described in the ToR such as individual or group interviews, surveys or informal meetings.
- Care is given to seek out those who might not participate in public meetings by using surveys or questionnaires
- Public officials are included in the public forum

- Results of the public consultation should be archived in written form and be available for public review
- Letters from the village and district obtained during the initial consultations should be included

4. *Submit the ToR, Plan for Executing the Assessment and the Plan For Ensuring Adequate Public Consultation to NEMC for Review and Approval.* NEMC will review this material with the TRC and respond to the investor in writing within 45 days. NEMC, individually or on behalf of the TRC may request support for a visit the project site for physical verification of the scoping report. If NEMC does not approve the material, it will provide written comments.

5. *If the Material Is Not Approved, Incorporate the Comments Provided by NEMC into the Material.* Once revised, re-submit the material to NEMC for review and approval. NEMC will review this material with the TRC and respond to the investor in writing within 45 days. NEMC, individually or on behalf of the TRC may request support for a visit to the project site for physical verification of the scoping report. If NEMC does not approve the material, it will provide written comments. Return to (a).

Technical Review Committee (TRC) supporting NEMC

NEMC will create a cross-sectoral review team—the Technical Review Committee (TRC)—to assist during the EIA Process. For mariculture, the TRC will include technical-level members of the following institutions: NEMC, Fisheries Division, Forestry and Beekeeping Division, district representatives and local community representatives from affected area, the Lands Department and the Water Department.

In many cases, this group will be the same group of institutional representatives that are convened for the Screening Forum, although during screening the decision may be made to include other personnel on the basis of needing additional expertise not represented in the original Screening Forum.

When to move to the next step?

It is time to go to the next phase if you have received written approval of the ToR, Plan for Executing the Assessment and the Plan for Ensuring Adequate Public Consultation.

STEP 5: ASSESSMENT. THE EIA IS CONDUCTED.

The investor completes an assessment that follows the approval of the ToR, Plan for Executing the Assessment and the Plan For Ensuring Adequate Public Consultation. Once the assessment is complete, the investor will prepare and submit to NEMC an EIA report. NEMC will provide a written confirmation that the report was received. Before accepting the report, NEMC will ensure that it contains, but is not limited to the following sections:

- The original ToR
- Executive or non-technical summary
- Text addressing the technical areas prescribed in the Assessment's Terms of Reference
- Any deviations or difficulties in achieving compliance with the ToR and means of addressing this
- Definition of technical terms
- Appropriate annexes and related material
- An attachment listing the sectors participating in the study and the signature of a representative of each institution

STEP 6: REVIEW.

Responsible institutions review the EIA and other institutional reviews.

NEMC will conduct a review of the EIA report within 45 days of issuing a written confirmation that the report was received. The review will be done with the TRC

Review Criteria for Mariculture
Review Criteria for each key and relevant sector is described in Section 1.7 of this document

The purpose of the review is to assess the quality of the EIA report measured against pre-determined criteria and its compliance with approved Terms of Reference. NEMC will prepare a review report evaluating the strengths and weaknesses of the EIA report. The review also identifies issues that are not covered, inaccuracies of information, problems with logic, or conflicts apparent in the assessment process. If there are gaps in the information provided in the report, the investor may be required to complete or revise the report. NEMC may pursue independent investigation or confirmation of the information contained therein.

STEP 7: ISSUING THE ENVIRONMENTAL PERMIT.

The NEMC is responsible for decisionmaking and provision of the Environmental Permit. The Environmental Permit encompasses the interests of the key and relevant sectors to mariculture as defined by the review criteria. If the Environmental Permit is granted, it assumes that the project has met these criteria.

The decisionmaking report is comprised of:

- A statement explaining the decision
- An explanation of environmental preference
- The social, economic, and environmental factors considered in making the decision
- An explanation of the mitigation measures adopted
- A summary of the monitoring and enforcement program that has been adopted to ensure that mitigation measures are implemented
- Supporting documents from other institutions obtained during this process.

When to move to the next step?

You are ready to move to the next phase, final approval, when you have:

- Received the Environmental Permit

STEP 8: FINAL APPROVAL STEPS

1. Issuance of the Certificate of Business Incentives from TIC

- The investor will compile and submit the following documents to Fisheries:

- Environmental Permit signed by Director General of NEMC
 - Letter from village authority showing consideration of the project
 - Letter from district authority showing consideration of the project
- Fisheries advises TIC that all reviews have been completed and recommends that the Certificate of Business Incentives be issued by submitting a letter of notification with the documents listed
 - TIC shall proceed with the issuance of the Certificate of Business Incentives if the project meets TIC criteria. This allows the investor to proceed with obtaining final approval from the Ministry of Natural Resources and Tourism
2. Final approval by Minister of Natural Resources and Tourism. This step reviews all approvals and issues the final project approval so that project development can proceed once final documents are obtained from the Departments of Land and Water
- TIC compiles the following for submission to Fisheries:
 - Environmental Permit
 - Certificate of Business Incentives
 - Proof of land rights such as the Letter of Intent from the district or approving level of government (Letter of Offer and Title Deed to be acquired in the next steps)
 - Letter from village authority showing consideration of the project
 - Letter from district authority showing consideration of the project
 - The Director of Fisheries will submit the verified documents with a letter of recommendation to the Permanent Secretary of the Ministry of Natural Resources and Tourism (MNRT)
 - The assembled documents will be reviewed at the ministry level to ensure that all required documents are present and that administrative procedures have been properly executed (e.g. fees paid) and should any deficiencies be detected, these will be investigated and corrected. The Ministry will archive these documents as part of the public record
 - The Ministry shall issue the final letter of approval
 - An archive of the assembled documents is maintained on file at the Ministry
- ***Obtaining Land Use Rights.*** The investor will have previously consulted with the appropriate authorities, and on the basis of their approval, will have obtained a letter

acknowledging the recognition of the authorities that studies on a given parcel of land may be conducted and that the local authorities do not object to the project subject to other institutions agreeing to the same for the parcel of land chosen as the site for the project

In all cases, final land use rights (Letter of Offer or Title Deed) will not be issued until the environmental permit is issued by NEMC. It is understood that land use rights are granted for specified uses and any change in this requires a Deed of Variation. Land use rights can be revoked if the initial conditions are not adhered to. The investor should be ready to present the project proposal, screening report, environmental permit and other documents supporting the investor's proposal in addition to the documents and applications mentioned in Part II. Because the Title Deed may take a long period of time to process, the investor may go ahead and begin project activities once the Letter of Offer is obtained.

- **Obtaining Water Use Rights.** The investor will have previously consulted with the appropriate authorities, and on the basis of their approval, will have obtained a letter stating that there is no objection on the part of local authorities to the use of water and that application for water use rights may proceed for a particular quantity of water taken from a specified source. The investor should be ready to present the project proposal, screening report, Environmental Permit and other documents supporting the investor's proposal in addition to the documents and applications mentioned below. Provisional water use rights are issued according to the criteria employed by the Minister of Water. Construction can now proceed. Following completion of the project, an inspection is conducted. If all is satisfactory, Final Water Use Rights will be issued and use of water can begin.
- **Business License.** A business license is required in order to sell the product. This procedure is described in Section 1.7.

Special Permit

The process for obtaining water use rights is detailed in the Special Permit section of Chapter 2 of this document.

1.5.4 MODIFIED COORDINATED REVIEW AND APPROVAL PROCEDURES FOR SMALL-SCALE INVESTMENT MARICULTURE PROJECTS (MINOR PERMIT PROCEDURE)

As noted previously, the current approval process is driven by the categorization of mariculture business into large-scale investment or small-scale investment according to the minimum investment threshold set by TIC. A need to differentiate between large- and small-scale projects is recognized, however, use of the sole criteria of investment level does not satisfy the technical or environmental needs for an adequate review. Large and small-scale projects differ in a number of ways and require different procedures, yet for common issues, both may be subjected to similar procedures. The options presented below attempt to accommodate the differences and similarities in ways that protect both the environment and the investor.

Three options for alternative approval processes for small-scale investment might be considered.

Option 1: TIC can consider lowering the investment threshold for mariculture projects to more closely fall in line with the technical and environmental definitions of small- and large-scale. This would have the advantage of offering the facilitation and business incentives to a larger number of investors, many of whom might be local investors who would like to invest a significant sum, yet not the current level of \$100,000 (US). This option would provide for analysis of technical and environmental feasibility similar to that of the larger projects.

Option 2: All “small-scale” investment projects, regardless of the actual level of investment would follow an approval procedure similar to that proposed as the **MAJOR** permitting process for large-scale projects. The main difference would be that since TIC would not be involved, that the Division of Fisheries would take on the role of facilitator and liaise with the other institution to assist the investor. This option has the disadvantage of being potentially onerous for investors with few resources or ability to work through a national-level permit procedure.

Option 3: A more local-level process may be developed whereby all “small-scale” investment projects could be approved at the district level without requiring

consideration at the national level, except where capacity does not exist at the district level for completion of certain steps. This process is based on the current institutional arrangements and technical capacity at the local level. Small-scale projects would be those which fall below the investment threshold of TIC and which are judged by the DTT using the checklist in 1.5.2, not to present significant environmental impacts. This option has the advantage that the districts are empowered to regulate the local projects according to local needs. It also provides for a more thorough review for projects that fall below the TIC threshold, yet present potential environmental impacts. These projects could otherwise slip through the cracks and escape national-level attention. A potential disadvantage may be that capacity to evaluate the larger “small-scale” projects may not be present at the local level. Capacity building will be needed. For example, local-level government does not have the capacity to execute or oversee an EIA. An EIA would either have to be shunted up to the national level, or capacity building would need to take place to enable the district level technical personnel to conduct the EIA.

This option was the one chosen by directors of government institutions upon reviewing the draft of this document and is illustrated in Figure 4, page 81. The term used to distinguish this permit process from the previously used term “small-scale” is **MINOR** since this more accurately describes the projects that will enter the process, i.e. as presenting minor impacts rather than as a reference to size alone.

Getting help.

Technical assistance is offered at the national level from TIC, Fisheries and the other technical sectors. It should be noted that although TIC offers the Certificate of Business Incentives only to those investors meeting the investment threshold, they also offer advice and support (non-financial) to small-scale investors. Primarily, technical assistance will be provided by the District Technical Teams to small-scale investors.

MINOR permit process

Small-scale projects are those which fall below the TIC investment threshold (1.5.2). However, even small-scale projects as defined by this criteria may still require review at the national level via the **MAJOR** permit process. The project proposal is submitted to the DTT who will review it to assess whether potential impacts may exist. In this case, the DTT may refer it to NEMC for further evaluation. NEMC conducts the Preliminary Environmental Assessment (PEA) which assesses whether a full EIA is required based on the presence and potential severity of impacts. If the PEA finds that potential for impacts is insignificant, then the small-scale project can be approved at the local level through the small-scale approval process.

STEP 1: GETTING STARTED PREPARING THE PROJECT PROPOSAL

The investor plans the project and develops the project proposal. The project proposal describes all characteristics of the proposed project and will be submitted for review and evaluation leading to legal approval or rejection. It is important that the project proposal be as complete as possible, since this will be the basis for discussion with local government officials during the process of obtaining local permission, and for obtaining provisional land and water use rights.

The small-scale investor is referred to the list of information requirements (1.5.3) used for planning large-scale projects. Where needed, the investor should include similar information. However, many small-scale projects will not require such an extensive project proposal. In these cases, the project proposal need only contain the following as a minimum requirement.

STEP 2: PRELIMINARY REVIEW OF PROJECT PROPOSAL BY DISTRICT TECHNICAL TEAM (DTT)

The DTT is a subcommittee of the District Management Team, comprised of technical specialists and local representatives. Representatives from all sectors with an interest in mariculture should be present to review the proposal for technical soundness and acceptability, and advise the investor where necessary.

- The investor submits the proposal to the DTT which reviews it
- The DTT reviews the project in order to determine if it presents potential impacts

Information required for project proposals in the MINOR permitting process

- Proposed location (include map) and site plan
- Topography and soil type
- Basic description of the physical layout of the project (size, number of ponds, design, etc.)
- Surrounding features (physical and biological)
- Species to be cultured and source of stock for farm
- Cultivation methods
- Natural resources needed for project (e.g. source and volume of water, land requirements, including needs for future expansion, reliance upon wild stock)
- Infrastructure needs (both those developed as part of the project and those provided from the public sector)
- Number of employees and where personnel will be obtained
- Whether technical assistance from the public sector is required, and if so, what in what manner
- Source of funding
- Expected benefits of the project
- Expected potential impacts or difficulties (if impacts or difficulties are possible, please describe how these will be eliminated, addressed or resolved)

(using the checklist in Section 1.5.2), in which case it is referred to NEMC for PEA to determine whether the **MAJOR** permit process should be followed

- If the DTT finds the proposal is acceptable and the lack of significant impacts does not require referral to NEMC, then it will be forwarded to the Village Development Committee
- In cases where the proposal is inadequate or unacceptable, the DTT will assist the investor to revise it so that it can be accepted for further review
- The DTT should provide written comment on the proposal to be compiled with the comments of the village and ward authorities for later forwarding to the District Management Team

Criteria for review by the DTT

These are yet to be developed for application at the District level. However, it is suggested that the general guidelines listed in Section 1.5.3 be adopted.

When to move to the next step?

If the project is acceptable, then it is forwarded to the Village Development Committee for further review.

STEP 3: REVIEW BY LOCAL AUTHORITIES.

The Village Assembly and Ward Development Committee will review the proposal for local acceptability

- The DTT forwards the proposal and written comments to the Village Development Committee
- The Village Development Committee reviews the proposal. If the Village Development Committee is in agreement with the proposal, it is approved by the Village Assembly and submitted to the Ward
- Ward Development Committee reviews the recommendation for preliminary approval given by Village Assembly. If acceptable, Ward Development Committee makes recommendation for final approval by the District
- The comments of these committees are compiled with those of the DTT for forwarding to the District Management Team

Criteria for review by the Village and Ward Committees

These are yet to be developed. However, it is suggested that the general guidelines listed in 1.7 be adopted.

When to move to the next step?

If acceptable, the proposal is forwarded to the District Management Team along with the compiled comments of all the reviewers to this point to begin the final approval process.

Criteria

These are yet to be developed. However, it is suggested that the general guidelines listed in 1.7 be adopted.

STEP 4: FINAL APPROVAL BY FULL COUNCIL.

The District Management Team reviews the proposal as a final step before approval by the Full Council.

- The District Management Team reviews the proposal and the compiled comments and submits them to the Full Council
- If the District Management Team requires revision of the proposal, it is returned to the investor for revision and eventual re-submission. Rejection may also occur at this stage if the proposal is discovered to be in conflict with regulations or policies
- After the Full Council reviews the proposal, the DED writes a letter of approval to the investor and submits a copy of the letter with findings to the national level Fisheries Division and NEMC to communicate the results and to provide for a means of establishing a public record
- The investor can now proceed to obtain land and water use rights

STEP 5: OBTAINING LAND AND WATER USE RIGHTS.

The process of obtaining provisional land and water use rights is the same as described for the large-scale project approval process in Section 1.5.3.

STEP 6: BUSINESS LICENSE.

A business license is required in order to sell the product.

1.5.5 ADDITIONAL CONSIDERATIONS FOR IMPLEMENTATION OF THE MODIFIED REVIEW AND APPROVAL PROCESS

1.5.5.1 Timeliness in fulfilling institutional responsibilities

The TIC Act specifies that once TIC has notified other institutions of the submission of the project proposal and delivered proposal copies a response from the institutions must be received within 14 days. It is also a legal requirement of TIC to consider the responses of other institutions, including giving weight to the findings of the EIA. If no objections are registered by the end of this period, TIC will act to register the company and grant the Certificate of Business Incentives to the investor. In the past, difficulties have been encountered with delivering, receiving, and reviewing the proposals, as well

as responding to TIC within the stated timeframe. If this modification of convening the Screening Forum is to fulfill the purpose of intersectoral consultation and transparent review and feedback to the investor, then all institutions must act in good faith to execute their defined roles within the very narrow timeframe specified by the TIC Act. This may require all institutions involved to alter internal procedures.

On the other hand, the investor must be aware that in the case where a particular institution does not register a response to TIC within the 14 days, or does not send a representative to the Screening Forum, this does not necessarily mean that the institution will issue a legal approval. Registration of the business and obtaining a Certificate of Business Incentives should not therefore be construed as full and complete legal approval to begin a project.

1.5.5.2 Issues of compensation

There are several instances in which one form or another of compensation will be either necessary or recommended. First, in cases of compulsory land acquisition, compensation is legally required (Chapter 2). Secondly, the EIA (Chapter 3) will detect possible resource use conflicts wherein traditional resource users may be affected by the project. In this case, compensation may be required for this loss. Thirdly, it is recognized that good relations between an investor and the community are enhanced in cases where the company voluntarily provides optional forms of social benefits such as schools or health care to the community. The well being of the community is in the self interest of the company since efficient and harmonious operations depend on this.

It is recommended that issues of compensation be considered during the approval process and where mandatory, be stipulated in writing as part of the final approval. The institutions involved in the review may also advise the investor in cases where compensation is not required, yet may be advisable where community opposition or need exists. TIC can act as a facilitator in this process.

1.5.5.3 Oversight and Accountability of the Review and Permitting Process

The modifications made to the review and processing procedures should improve the

efficiency and transparency of the process. In particular, the closer communication and coordination provided by convening a multi-institutional approval forum should both expedite the process and assure that institutions make decisions based on commonly accepted criteria. However, the process is still reliant upon completion of independent reviews and is complicated by the need for the investor to work at both the national and local levels. There is still a need to further improve oversight and accountability of the process so that the rights of the investor are protected, and to assure that the investor complies with all requirements.

Recommendations

The Fisheries Division will be responsible for assuring that all proceedings are legally conducted and all criteria met before the final assemblage of permits by the ministry and their granting of approval. This implies that Fisheries must establish a mechanism for monitoring and evaluating the entire approval process to be sure that all steps were followed and approval documents are officially valid. Additionally, increased involvement of the TIC in facilitating the convening of the Approval Forum will provide the investor with recourse should any part of the process falter.

As demand for approval increases, the Fisheries Division of the Ministry of Natural Resources and Tourism will require more resources in order to maintain accountability in the approval process, as well as improved oversight mechanisms.

1.5.5.4 Local-level approval process for “small-scale” investment (MINOR permitting procedure)

The local-level approval process for “small-scale” investment requires the investor to work directly with the local-level institutions responsible for development and planning. However, this process is not isolated from the national level, since communication between the District Technical Team and the NEMC will be necessary during the process of conducting the EIA. Linkages will also exist between Fisheries officers and the Division of Fisheries, as well as within the Lands Department and the Water Department.

1.6 REQUIREMENTS FOR PUBLIC CONSULTATION IN THE APPROVAL PROCEDURE

Public consultation should play an important part in any of the options for the approval procedure outline above. Mechanisms that increase public consultation are needed (Table 1).

EIA for small-scale projects

Small-scale projects are defined as those that fall below the TIC investment threshold. However, since these small-scale projects may cause impacts, there is a requirement for initial evaluation using the checklist (1.5.2) and possibly PEA. Currently, capacity to oversee PEA exists only at NEMC. Therefore, the PEA must be guided by NEMC until capacity exists at the local level. That means that all proposals, regardless of scale, must be reviewed by NEMC. For those projects determined not to require EIA, the investor then returns to the small-scale approval process. If PEA determines that an EIA is required, then the project is reviewed by the large-scale, national-level process (MAJOR process). In some cases, people wishing to begin very small-scale projects at the village level may not be aware of the requirement to first consult NEMC or may lack the resources to liaise directly with NEMC. In this case, the District Natural Resources Officer will be responsible for assisting the investor to liaise with NEMC to ensure that the PEA is carried out in a manner that facilitates the small-scale investor to begin his or her project without undue costs or steps.

Currently, significant public consultation occurs only during the EIA process (see Chapter 3) and during the local process of land and water acquisition (Chapter 2). The public consultation required for the EIA occurs after the report has been prepared, however, and is more a means of informing the public of the result, rather than actively seeking input and incorporating this into the mitigation recommendations.

Recommendations to strengthen the process of soliciting public input for the EIA are made in Chapter 3 and these mechanisms can also be used during the other permitting steps. The process of acquiring land and water use rights also requires public meetings. These meetings can be used by other institutions to consult with the public.

Table 1 Current and recommended mechanisms for public consultation in the approval process

Type of approval	Is public consultation now required?	If so, who is consulted? How much time allowed? What is the product of consultation?	If not currently required, is public consultation recommended or are new steps recommended?	If public consultation is recommended, who would be consulted? What is the desired result of the consultation?
Informal consultations by investor	No	N/A	Yes	<ul style="list-style-type: none"> • Public notice to be posted locally • Presentation of project concept in public meeting • Result: record entered into Technical Feasibility Study
Technical Feasibility Study conducted by Fisheries	Yes	Local level officials during site visit	Yes	<ul style="list-style-type: none"> • Investor to consult with DTT and local technical experts • Public notice published of intent to conduct Feasibility Study • Public meetings held for comments
Right of occupancy	Yes	Depends on type of land (Chapter 2)	Yes (See Chapter 2)	See Chapter 2
Water rights	Yes	District Development Committee	Yes	See Chapter 2
EIA	Yes	See Chapter 3	Yes	See Chapter 3

Recommendations

More opportunities for structured and specified public consultation are required if the approval process is to be transparent. Specified mechanisms of incorporating the results of public consultation into the process are also required.

Current mechanisms for public consultation are specified in Table 1 with additional recommendations intended to increased public input.

1.7 DECISIONMAKING CRITERIA AND SPECIAL PERMITS

The following is a list of criteria that are recommended for review and approval of mariculture development in Tanzania. Science-based criteria that allow for accurate determination of the potential impacts or benefits of a given project in a specific area are critical for guiding sustainable development. Such criteria partially exist in the management framework in Tanzania, but many gaps exist. An effort has been made here to address these gaps, however, as development proceeds and experienced is gained within the specific context of Tanzania, these criteria must be revisited and refined.

The criteria are sorted by sector except for water and land use rights, which require the investor to follow permit procedures that are separate from the permit procedures described above (Chapter 2).

1.7.1 FISHERIES DIVISION

Feasibility study

The purpose of the feasibility study is to determine whether the project is properly planned so that there is a high probability of success from the economic, biological, environmental and social perspectives. In addition to the considerations listed below for species selection, site selection and culture technology, the feasibility study will consider issues of financial soundness and availability of infrastructure, human resources, public services and other basic necessities. The Fisheries Division will work closely with the

District Fisheries Officer and other technical personnel to evaluate the feasibility of the proposed project. The investor will provide the information listed in 1a as part of the project proposal. This information will be used to evaluate the project according to the criteria listed below.

1. ECONOMIC ASPECTS

Failed projects impose a cost to the public, government and environment, therefore assuring that a proposed project has a reasonable chance of success is an important part of the feasibility study. The probability of success of a project will be evaluated according to the following criteria.

Criteria

- The financial backing to support proposed project activities is sufficient
- The business plan of the company is reasonable and adequate
- The infrastructure and services required for project activities are either available or will be created as part of the project
- Human resources such as labor and qualified technical personnel are either present or obtainable
- There is an accessible market for the product and means to deliver the product

2. SPECIES SELECTION

There is potential to culture a wide range of finfish, aquatic plants, mollusks and crustaceans (e.g. prawns, crabs) in Tanzania. However, certain limitations will be imposed due to legal requirements governing the importation of exotic species, and factors which determine the economic and practical feasibility of certain species. The information presented here is designed to assist the investor in making an informed choice of a species, taking into account biological, economic, technological and social factors. With the exceptions noted elsewhere (i.e. imported or potentially damaging species) species selection is not regulated by law and this information is provided solely for the benefit of the investor, and to assist in establishing a sustainable mariculture industry in Tanzania.

Criteria

- The species selected for culture should be one which is biologically suited to the selected site, can be sold profitably or consumed, and whose culture technology is feasible and appropriate in Tanzania
- The species selected is one that does no damage to other flora, fauna or habitats
- Issues of human health and safety should also be taken into account

Getting Help

The investor is advised to make initial, informal consultations with the Fisheries Division and Research Institutions such as TAFIRI or the University of Dar es Salaam to obtain information on which species are most likely to be viable culture species.

3. IMPORTING AND EXPORTING LIVE AQUATIC ORGANISMS

Some restrictions are imposed on the importation of aquatic species in order to safeguard indigenous fauna and flora, protect habitats, and prevent the introduction of animal, plant and human diseases.

If the investor proposes to use a culture species that is determined to be exotic and not already found in the country, the following procedure should be followed.

- a) The investor will submit a request to import the species to the Fisheries Division.
- b) Currently, the Fisheries Division is responsible for issuing import permits while the country of origin issues the health certificate. The investor is responsible for obtaining the health certificate from the country of origin.
- c) The Quality Control Unit of the Fisheries Division issues health certificates for export of live fish and fisheries products, which may include aquaculture products.
- d) The Fisheries Division will determine whether the species can be imported if none of the criteria listed below is violated, and if a health certificate is obtained.

Criteria

- The FAO Code of Practice and Manual of Procedures for Consideration of Introductions and Transfers of Marine and Freshwater Organisms (FAO, 1988) contains useful guidelines that should be taken into account when permitting exotic species
- Species listed in the Fisheries Regulations as banned from import will not be allowed (e.g. carp) without careful consideration
- As a general statement, native species or species already cultured in the nation are preferred
- The species presents no threat of competition with native flora and fauna and does not hold the potential for damaging habitat
- The species does not present the threat of affecting the gene pool of local species through hybridization or genetic swamping
- Parasites, pathogens, or diseases do not affect public health
- Care must be taken to ensure that any imported animals and plants are free from pathogens and parasites. Facilities providing juveniles or broodstock should have health records available for the past 3 years to support the application to import animals from outside the country
- Importation of dangerous organisms such as predatory fish or invasive vegetation may also be prohibited
- If the request for importation is approved, the Fisheries Division will issue a letter permitting the importation
- Where needed, all precautions will be taken to minimize any potential ill effects of importing species

4. SITE SELECTION

Selection of an appropriate site is crucial to establishing a viable mariculture business that has minimal environmental and social impacts. An appropriate site is one which provides optimal bio-physical conditions for growth of the species, minimizes damage to the environment, avoids conflicts with other resource-use activities, and provides accessibility to a market.

Criteria

- The site must be available (i.e. not otherwise in use) and the project acceptable to local people. Issues of displacement of local peoples, conflicts with ongoing economic uses, threats to wildlife or livestock, potential health or safety hazards, or affects on sensitive sites must be considered
- The site must accommodate the requirements of the species to be cultured
- Site characteristics such as availability, baseline biophysical and chemical conditions and supply and quantity of water will need to be confirmed through a site visit and research
- The value of the land and adjacent areas must not be diminished through soil erosion, salinization of ground waters, detrimental changes in hydrology, etc
- In the case of land held under Customary Right, if projects are to be started, status of the land must be changed to Statutory Right of Occupancy
- If potential for environmental impacts (“Determining the potential for impact” I, page 15) is detected, then granting Land Use Rights is contingent upon satisfactory completion of an EIA and issuance of an Environmental Permit.

5. CULTURE TECHNOLOGY

The intensity of an aquaculture operation will have a bearing on the financial viability and the potential for impacts. The Fisheries policy emphasizes that semi-intensive culture should be encouraged. Intensive and extensive culture are not prohibited. The actual parameters will vary considerably depending on the species cultured. Maximizing outputs (either production or financial) while minimizing practices that may cause environmental impacts such as excessive use of chemotherapeutants or heavy effluent loads is the intent of the fisheries policy.

- Species-specific criteria for culture technology do not exist in Tanzania and will vary widely according to the species. Generally the appropriate level of technology will depend on the level of production expected, the experience of the operator, the amount of capital available, potential impacts presented, and the size and characteristics of the site. These will be reviewed on a case-by-case basis

6. CUMULATIVE IMPACTS FROM MULTIPLE PROJECTS

In cases where multiple projects exist or are proposed, the cumulative impact of project expansion must be considered. Limits to expansion may need to be set on a case-by-case basis relative to the ability of the local area to support mariculture operations while retaining ecological integrity. See “Determining Potential for Impacts”, page 31, for suggested limits.

NATIONAL ENVIRONMENTAL MANAGEMENT COUNCIL (NEMC)

Environmental Impact Assessment. According to the proposed national general guidelines and procedures there are four review areas (National General EIA Guidelines, 1997 [proposed])

NEMC and the Technical Review Committee (TRC) reviews the EIA according to the following criteria:

- Is the EIA report in compliance with the ToR? Deviations must be fully explained and accepted by NEMC and the TRC
- The adequacy of baseline information for the description of the environment of the study area which could be the basis for impact prediction and monitoring
- Consideration of the correct and full application of methodologies used in the analysis of impacts
- The logic used to identify potential impacts for all phases of the project is sound
- Scoping methods are adequately described and justified
- Affected groups by the project clearly identified
- Project options were properly proposed and evaluated
- All significant impacts have been considered for mitigation
- An effective environmental monitoring and management plan is in place
- Commitment to mitigation measures
- Whether there was adequate and genuine consultations with all stakeholders and their concerns are incorporated in the EIA report
- Public comments were properly considered in evaluating project options
- Presentation of the information is appropriate and logical
- The report is balanced, no undue emphasis or prominence of bias

- There are no gaps and conflicting statements
- The non-technical summary of the analysis and main findings are clear and justified

1.7.2 FORESTRY AND BEEKEEPING

The Forestry and Beekeeping Division will review the project proposal to assure that it is in compliance with the Forestry Act (draft Forestry Act 2000) and the Mangrove Management Plan (1991). The Forestry Act emphasizes the need to conduct EIA for projects in forest areas. Mariculture is not allowed in mangrove areas except for those areas designated as Zone 4.

Criteria

- If a project is proposed for a site in an area not classified as Zone IV:
Mangroves are not allowed to be cut for mariculture purposes in non-Zone IV areas. In some special cases, and only after careful study and review, some minor cutting may be allowed. This is decided based on the extent of proposed cutting and the species composition.
- If a project is proposed for a site in an area classified as Zone IV:
In Zone 4 some development activities are allowed including mariculture. Granting a permit for mariculture activities in Zone IV is based on the extent of the proposed area to be cut and anticipated impacts, including:
 - Extensive cutting of mangrove areas is not allowed (Mangrove Management Plan 1991).
 - In any case, adherence to management plans is required (draft forest Act 2000, section 19, subsection 2a)
 - Aside from removal of mangroves, other factors considered are changes in hydrology that affect natural watercourses or rivers, water quality, effects of effluents, or damage caused by associated activity, or infrastructure that potentially affect mangroves are considered (draft Forest Act 2000, section 73, subsection 1b). Affecting mangroves includes leading to or causing deformity or death
 - Non-mangrove coastal forests (gazetted) can only be cut after obtaining a permit from the Division of Forestry and Beekeeping. Granting a permit is based on proposed area to be cut and anticipated impacts

- Non-mangrove coastal forests (non-gazetted) can only be cut after obtaining a permit from local authorities. Granting a permit is based on the proposed area to be cut and anticipated impacts.

1.7.3 TANZANIA INVESTMENT CENTRE (TIC)

The investor is advised to contact TIC. Large-scale investors may avail themselves of a package of investment incentives. TIC also acts as a facilitator for large-scale and small-scale investors during the permitting process.

The investor is referred to the Investors' Guide to Investment in Tanzania (2000) for full details on the procedures for establishing a business in Tanzania.

To large-scale investors who meet certain requirements, the Certificate of Business Incentives offers advantages related to income, sales, and custom taxes as well as other financial incentives. Non-financial incentives such as favorable immigration quotas and visas are also offered.

Criteria:

- The TIC Act calls upon TIC to take the results of the EIA into account in granting the Certificate of Business Incentives.
- A substantial description of the TIC criteria are presented in the Investors' Guide to Investment in Tanzania (2000).

1.7.4 WILDLIFE DIVISION

The Wildlife Division reviews the proposal to assure that a project does not negatively affect wildlife or critical habitat such as wetlands.

Criteria

- Where habitats critical to wildlife, including wetlands, limits and mitigation measures will be assessed on a case-by-case basis. Additionally, a general principal is that no net loss of wetlands in excess of five percent in a given area will be permitted
- Impacts to wildlife to be taken into consideration are:

- Obstruction of migratory routes or disturbance of migrating animals including birds and aquatic life
- Damage to nesting, resting, migrating or feeding grounds or other habitat for wildlife
- Associated activities such as increased human occupation or infrastructure creation does not affect wildlife
- Presence of endangered, threatened or rare wildlife species or plants will require study and assessment
- Introduction of the proposed culture species does not pose a threat to existing species through competition, introduction of disease or genetic effects
- Where current economic uses of wetlands or wildlife areas such as hunting, tourism, fishing, food gathering may be affected by the proposed activity, public consultation and study by technical specialists will be conducted to determine if the proposed activity can be integrated into current use patterns.

1.7.5 DIVISION OF ANTIQUITIES

This review assures that the proposed project does not cause harm to sites of historic or archeological importance.

Criteria

If the proposed project site possesses historical, cultural, religious or archeological value, then study and assessment will be conducted to determine if mitigation or other options exist to allow integration of the mariculture project as part of the EIA.

For example, the following may allow mariculture activities to take place:

- Rescue of the cultural resource
- Agreement with the investor to protect the resource in accordance to rules and regulations

1.7.6 DISTRICT, WARD AND VILLAGE AUTHORITIES

The DTT and the District Management Team play a part in reviewing projects at three levels: 1) review of proposed large-scale projects on behalf of local government to assess local acceptability and evaluate feasibility from a local perspective as part of the

MAJOR permit process; 2) as the principal review body for small-scale projects in the **MINOR** permit process; and 3) to determine whether projects falling below the TIC investment threshold must enter the **MAJOR** permit process based on the present of potential impacts. In all three cases, the DTT will also liaise with local stakeholders to assess local acceptability. In the case of large-scale projects, a representative from the district will participate in the inter-sectoral group (TRC) that acts to review and evaluate the project to convey local evaluation of the project.

Procedures

The DTT is composed of representatives of the various technical and social sectors. This team will review the full project proposal upon transference and will have reviewed the project concept by TIC. The DC or DED, depending upon the district decision will chair the DTT. The opinion of the DTT will be to represent to the technical review committee by the DC, DED or a designated representative. A local representative from the affected area may also attend.

1. REVIEW OF LARGE-SCALE PROJECTS AS PART OF THE MAJOR PERMIT PROCESS

The principal role of the DTT is to review the project from a local perspective to assess technical, social and environmental feasibility. The following criteria will be used:

Criteria

For technical issues:

For review of large-scale projects, the Fisheries Division will work closely with the DTT to evaluate the feasibility study. The DTT will provide information and the local perspective on items listed in 1.5.3

For socioeconomic issues:

Given that it is at the local level that potential socioeconomic impacts may be detected and evaluated, the district-level review will involve careful consideration of these issues. Public consultation and the opinion of local experts and authorities will be used to determine if the following are likely:

- Conflict with other economic uses or traditional activities
- Displacement of human populations against their will is possible

- Labor requirements for the project are such that a large number of non-local personnel may be brought into the area with possible adverse effects
- Activities associated with the project such as infrastructure creation will adversely affect the local population
- Positive affects such as provision of employment, technology transfer or food production should be considered
- Other areas of possible conflict
- Local population expressing objection to the project for whatever reason

For environmental issues:

NEMC will work closely with the DTT during the ToR and the EIA process to ensure that local perspectives and information that can help evaluate environmental impacts are gathered and fully accommodated in the EIA.

2. REVIEW OF SMALL-SCALE PROJECTS AS PART OF THE MINOR PERMIT PROCESS

The DTT acts to evaluate the technical, social and environmental soundness of the proposal using the criteria listed above for the **MAJOR** permit process review.

Additionally, the DTT is the primary source of technical assistance to the investor. Given that **MINOR** projects are only reviewed at the local level, it is important that the DTT conduct a thorough review.

Criteria

1. *Technical and economic feasibility*: criteria used by the Fisheries Division for review of large-scale projects (page 65) where applicable to the small-scale project under consideration
2. *Socioeconomic impacts*: criteria listed above for use by the DTT in evaluating large-scale projects (Section 1.5.2)
3. *Environmental impacts*: criteria used by NEMC for the PEA/EIA ToR listed in Chapter 3

3. DETERMINATION OF WHETHER PROJECTS FALLING BELOW THE TIC INVESTMENT THRESHOLD MUST FOLLOW THE MAJOR OR MINOR PERMIT PROCESS

Projects will be assessed according to the criteria listed in Section 1.5.2, by NEMC with assistance where needed from the DTT.

1.7.7 MARINE PARKS AND RESERVES UNIT

Marine Parks and Reserves Unit is in charge of establishing management plans for marine protected areas and for conservation of marine resources. In cases where projects are proposed for sites in Marine Parks or where activities adjacent to Marine Parks may impact the Marine Park or protected area, Marine Parks will review the proposal.

Criteria

- If the project is sited in a Marine Park, the project should be in accordance with the guidelines of the Marine Parks General Management Plan
- If the project is outside the boundaries of a marine park or protected area, the following criteria will be used:
 - The project poses no threat to sensitive habitats such as coral reefs located in Marine Parks through physical presence, construction, effluents, sedimentation or through associated activities. The presence or possibility of such impacts should be included in the EIA
 - If a monitoring plan is proposed for projects located outside of Marine Parks that may impact areas inside the Marine Park, then the monitoring plan should also extend to cover the affect area within the Marine Park
- Project does not present conflicts with other uses of Marine Park areas. If potential conflicts exist, mitigation measures must be proposed along with an implementation plan for the mitigation that will ameliorate any conflicts
- If the project relies upon capture or harvest of marine organisms, then fisheries management guidelines established for these species should be adhered to. If such guidelines do not exist, then the Marine Parks and Fisheries shall work with the investor to establish such guidelines to protect marine species

1.7.8 TANZANIA HARBORS AUTHORITY

The Harbors Authority has jurisdiction over harbor or peri-harbor areas. The investor should consult with this institution to determine if the project falls within these areas, and thus needs to be reviewed by the Harbors Authority.

Criteria

- If threats are posed to navigation in marked navigation channels, the project must be relocated
- Other possible use conflicts related to use of the harbor area must be considered

1.7.9 LANDS DEPARTMENT

The Lands Department is responsible for land use planning and for allocation of the land use rights. Granting of land use rights is done in accordance with local planning schemes and through determination that the proposed site is both available and appropriate to the proposed use. These determinations are made according to the following criteria.

Criteria

- The surrounding community does not object to the proposed use. This is determined through consultations between the investors and the local authorities and through public consultation
- The proposed site is available for use, i.e. land use rights have not been previously granted to another user
- The type of land tenure under which the land is classified is compatible with the proposed use
- The proposed use does not conflict with other use of nearby lands
- The proposed use does not irreparably degrade or damage the land or imperil future uses

In the case of an owner who already holds land use rights for a non-mariculture use, a Deed of Variance is required in order to change the use of the land for mariculture.

1.7.10 WATER DEPARTMENT

The Water Department oversees the allocation and use of water to ensure equitable access to water, maintain water quality and to guarantee the future availability of water. To determine whether a project may use water, the following criteria are employed and are applied for use or abstraction of water, and occupancy of water bodies:

Criteria

- The proposed use of the water can be accommodated within the availability of water of the Regional and National water sources
- The proposed volume of water to be abstracted does not imperil the use of other users
- Abstraction by means of well or borehole does not require a permit if the well or bore-hole is on the property. Abstraction of up to 22,700 liters per day is allowed without possessing a water right provided that the well or borehole is not within 230 meters of any other well or borehole, or within 90 meters of any body of surface water
- In no case will wells or boreholes be allowed if it adversely affects the use of other users or causes a diminution of water quality through contamination, salinization or subsidence of the surrounding land
- Effluents must meet water quality standards, or in cases where none are established, effluent loading of any type must not exceed that of the receiving waters
- The hydrology or hydrodynamics of surrounding areas may not be so affected that plant or animal habitat is degraded
- Watering rights of domestic herders or watering areas of wildlife must not be adversely affected
- Desalinization of water for industrial or domestic use requires study and assessment

FIGURE 1 CURRENT MARICULTURE APPROVAL PROCEDURE

Source: TCMP, 1999

Note: the lack of directional arrows is indicative of the fact that no set order of steps exists for the current procedures.

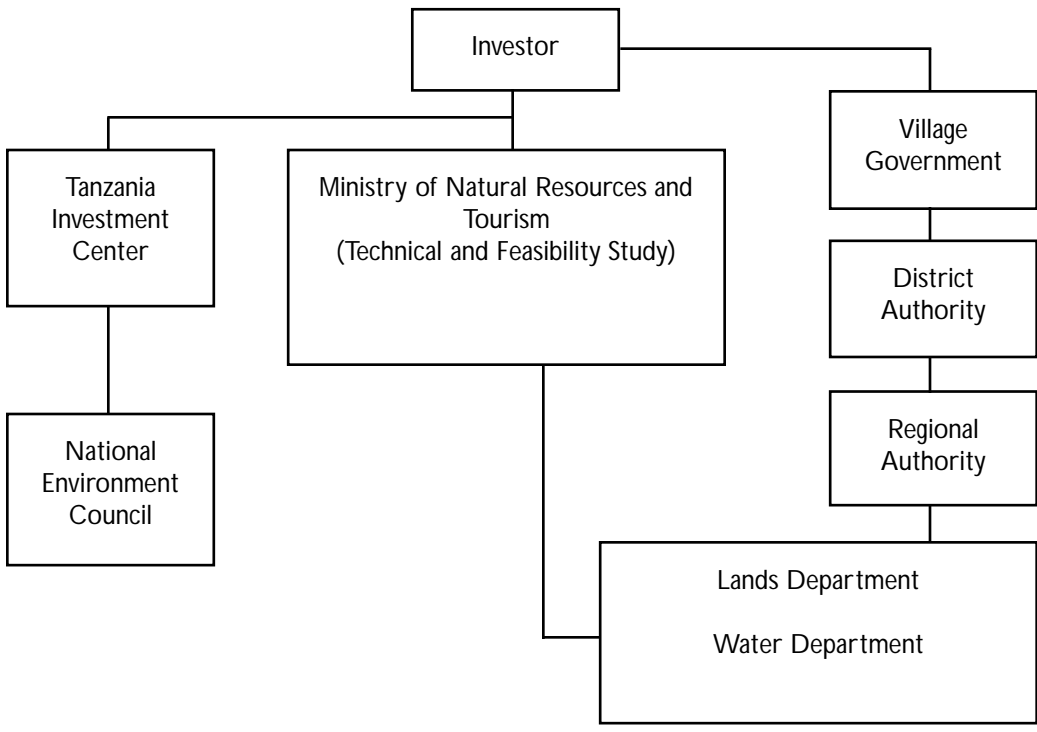


FIGURE 2 DIFFERENTIATION OF APPROVAL PROCEDURE FOR LARGE-SCALE AND SMALL-SCALE PROJECTS

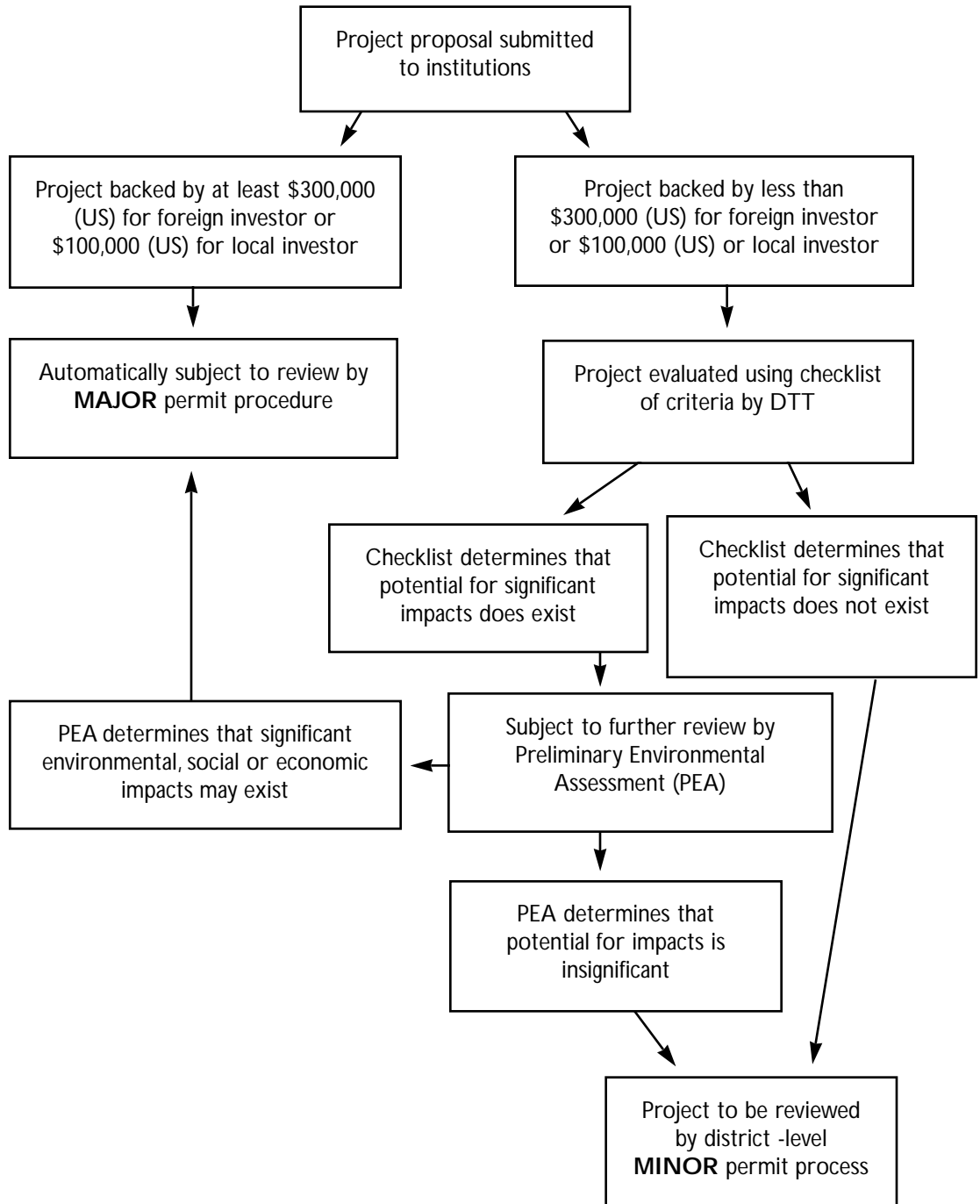
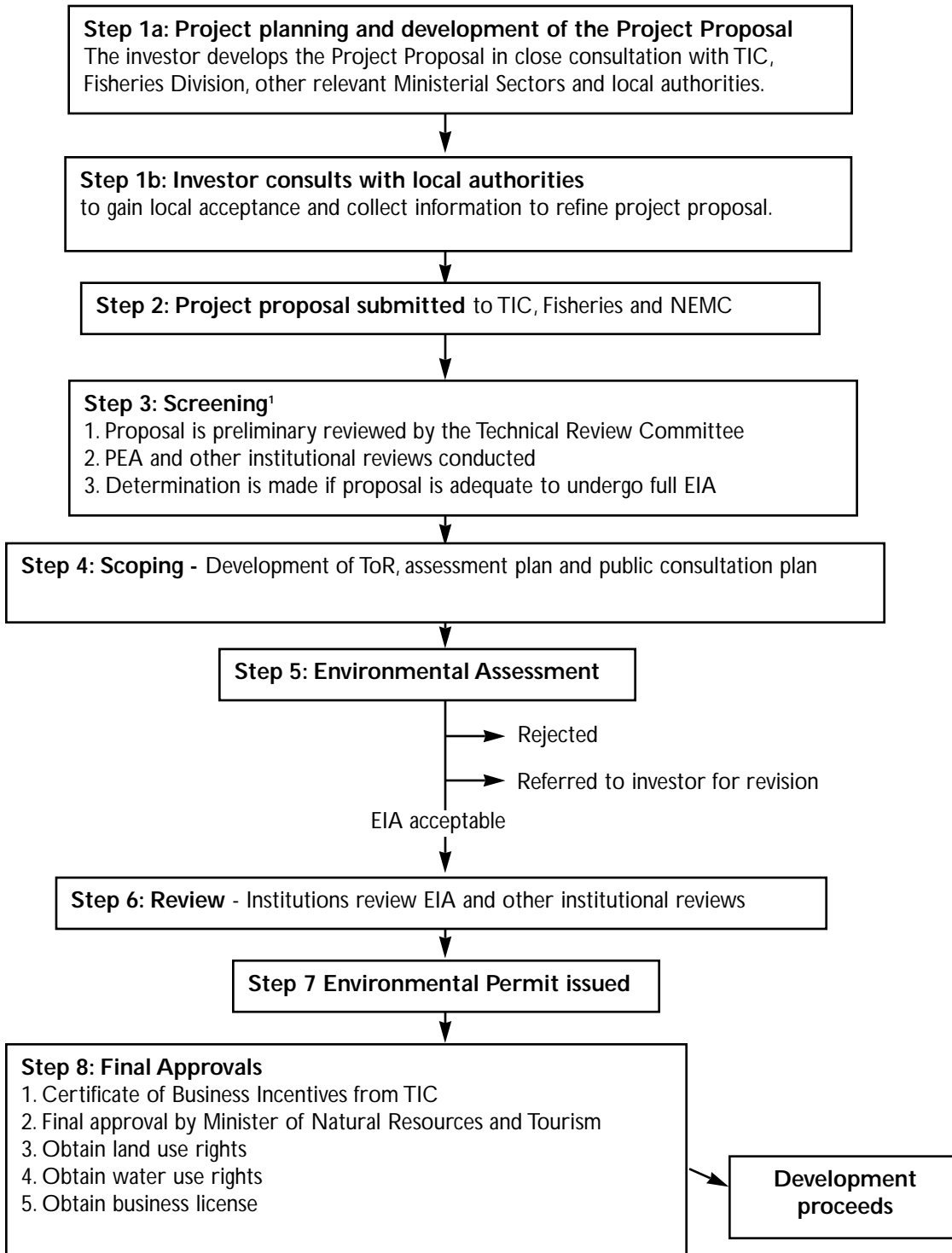
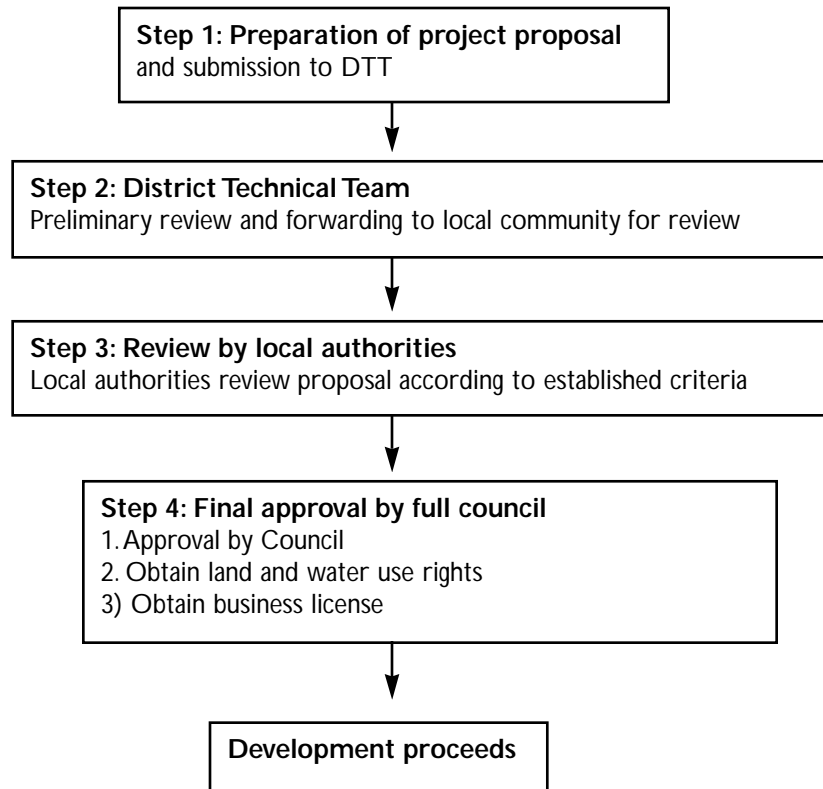


FIGURE 3 MAJOR PERMIT PROCESS MODIFICATION OF EXISTING MARICULTURE PROJECT APPROVAL PROCESS FOR LARGE-SCALE PROJECTS OR THOSE WITH POTENTIAL IMPACTS (Note: refer to text for full explanation of each step)



¹This screening is distinct from that of EIA

FIGURE 4 **MINOR PERMIT PROCESS MODIFICATION OF EXISTING MARICULTURE PROJECT APPROVAL PROCESS FOR SMALL-SCALE PROJECTS WITHOUT POTENTIAL IMPACTS**
(Note: refer to text for full explanation of each step)



Chapter Two

LAND ACQUISITION AND WATER RIGHTS

2

2.0 INTRODUCTION

The land tenure system in Tanzania is unique in certain respects, and it is important that prospective investors understand both the tenure systems and procedures for obtaining the use of land, since these have important implications for establishing mariculture operations. Water rights are also an important part of mariculture, yet in Tanzania there are several key areas of water usage that are not well addressed by the current institutional arrangement and legal framework. Apart from the question of water use through abstraction, issues of tenure for aquatic areas are important.

Mariculture presents additional complexities because it often takes place at the interface of land and water (e.g. intertidal zone, wetlands) over which no institution, or perhaps more than one institution, may have jurisdiction. These gaps need to be addressed in order to strengthen the capacity of the government to regulate water use and the ability of investors to carry out activities in these areas. The following outlines official procedures that describe how land acquisition and water use rights are currently obtained. Recommendations to address gaps related to mariculture issues are also made.

2.1 LAND ACQUISITION

All land in Tanzania is public and is vested in the president as trustee on behalf of all citizens.

This has important implications for mariculture investors. Since there can be no free transfer of land between individuals, all land transactions must be approved by the government. This entails an often-lengthy process involving several levels of government. Hence, establishing a commercial enterprise is necessarily more complicated and slower than in a freehold system. Public opinion as to the acceptability of the proposed project may also have a strong influence over the transfer of land.

Since there is no freehold land system in the country, the right to use land may only be obtained under certain conditions. Violating these conditions means that the use of the land may be revoked. Changing the use of land requires approaching the government for permission. For example, converting a pond from use for salt production to fish farming will require a Deed of Variation¹.

Under some circumstances, obtaining land may require the approval of local communities. This has advantages and disadvantages, from the perspective of mariculture development. On one hand, this requirement provides an opening and official channel for public comment on the appropriateness of the proposed project. On the other hand, it also entails an additional step for the prospective investor.

Although the government holds tight control over the use and transfer of land, it currently does not use this control to the fullest possible advantage to assure that proposed projects are financially, socially and environmentally friendly. In addition, the land acquisition process is not tightly linked to the results of the Environmental Impact Assessment (EIA), the Technical Feasibility Study conducted by the Division of Fisheries, or the granting of the Certificate of Incentive by Tanzania Investment Center (TIC). Making land acquisition contingent on successful completion of these steps, in addition to the standard requirement that the public be consulted at the local level, could provide a means of enhancing the probability that projects will be successful, and help assure valuable land will not be wasted through allocation to poorly planned projects. However, none of the institutional reviews can be conducted until the specific location of the project is designated; thus, obtaining provisional land and water usage rights is an important step in expediting the ability of an investor to move through the permitting process. Provisional land and water use rights refer to letters from local authorities acknowledging that the land and water resources are available and that the project is appropriate from the local perspective.

The process of land acquisition may be complicated and involves multiple steps. A recent World Bank Study found that 80 percent of the population of Tanzania did not know how to obtain land (World Bank, 1996). Foreign investors may also find the process obscure

¹ Deed of Variation allows for change of use of the land.

and complicated. Thus, these guidelines aim to clarify the process, although if mariculture development is to be successful in Tanzania, additional steps must be taken to further streamline the process and make it easily understood by the public.

According to the TIC Act (1992), TIC, in collaboration with the Lands Department, will acquire land and lease it to the investor. These Acts are not yet approved, although TIC may still assist the investor in identification of land available for development. Under these unapproved Acts, the District Councils would identify and set aside packages of land for development activities. TIC, in collaboration with the districts, will locate such land for the same purpose. It is hoped that this will promote investment by identifying land available for development and make the process of acquiring land easier for the investor through the linkage of TIC and the Lands Department.

The process described below is the existing process, and is not that of the two unapproved Acts mentioned above.

Surveyed land with title deed may be used as collateral. However the amount of a loan that can be provided for the piece of land will depend on the valuation of the development made on it.

The government may acquire land where good cause exists and where public interest is at stake. Compulsory acquisition of land that was allocated to TIC or an investor will be done in accordance to the Land Acquisition Act of 1998. Compensation to the affected party will be done fully as described later in this chapter.

Land use rights for land with failed projects may be revoked. Although land occupancy is awarded for specified periods of time, there are no contingency requirements to address questions of contamination or other damage to the land that may affect future use of the land in the case of failed projects. Abandoned mariculture and other industrial projects have posed problems in other nations. It is therefore important that the probability of success of an operation be confirmed through the project proposal and verification by Fisheries Feasibility Study and the environmental soundness be assured by completion of

an EIA. Even so, projects may fail. One possible solution would be the requirement to post a performance bond or other assurance that upon project failure the land would not be left in irreparable condition, or that it required the public to assume mitigation costs.

2.1.1 LAND TENURE

There are two types of land tenure systems in Tanzania: Customary Right of Occupancy and Granted Right of Occupancy (Figure 5).

2.1.1.1 Customary Right of Occupancy (Traditional tenure)

Under this type of tenure, the whole community occupies the land under the supervision of elders and heads of the clan. It exists in the rural areas and is recognized in the current legal framework. This land is not transferable, but it can be leased. Customary land is controlled by a village or a clan and is not available to investors outside these groups. This type of land is allocated after receiving an application for a project that is wholly or partially owned by a Tanzanian citizen. The authorities responsible for approval and allocation depend on the size of the parcel requested (see below). Once this type of land is leased, it ceases to exist as a Customary Right of Occupancy.

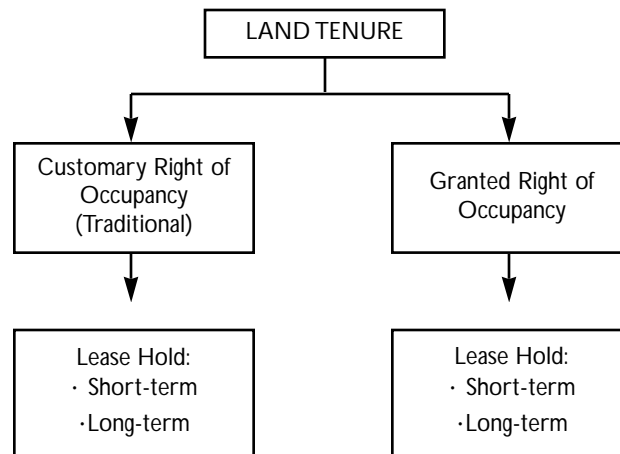
2.1.1.2 Granted Right of Occupancy (lease)

Under the Granted Right of Occupancy tenure system, the occupier is granted a certain parcel of land and entitled to take possession of that land under specific terms and conditions. This system is also recognized in the current legal framework. The procedure for obtaining this sort of occupancy is under the control of the government. This is the type of occupancy that most investors will seek.

2.1.2 FEATURES OF THE RIGHT OF OCCUPANCY:

- A definite term for the occupation and use of land
- Development conditions imposed on the occupier of that land
- The occupier of that land has no right to subdivide, transfer or mortgage the same without the consent of the Commissioner for Lands
- The occupier pays rent to the government

FIGURE 5 LAND TENURE SYSTEMS IN TANZANIA



- The occupier is allowed to apply for renewal for periods of less than 99 years
- The president of the United Republic of Tanzania may revoke the right of occupancy of the land occupier

2.1.3 LEASEHOLD

Leaseholds may be obtained on land classified under the Customary Right of Occupancy or the Granted Right of Occupancy system.

If land held under Customary Right of Occupancy is leased, then it ceases to exist as customary land.

By definition, a Granted Right of Occupancy is a leasehold for a specific period of time. It may be obtained either directly from the government or from another leaseholder. It could also be obtained from customary land, although in this case the land ceases to exist as customary land.

These are the two terms of leasehold:

- a. Short-term lease that is not more than five years and long-term lease which is more than five years but less than 99 years.
- b. Long-term lease derived under the right of occupancy needs consent of Commissioner for Lands/District Land Development officer and it is supposed to be registered.

2.1.4 LAND OCCUPANCY

There are several forms of ownership or occupancy for land. These forms of ownership or occupancy apply for lands held under Customary Right of Occupancy or Granted Right of Occupancy.

2.1.4.1 Individual

Under this kind of occupancy land is acquired by an individual under Customary Right or Granted Right of Occupancy. If the occupier has land under Customary Right of Occupancy the security depends on its utilization, brought about by effective cultivation of the land or development of some other activity. In other words, the right to occupy the land depends on its continued utilization, and ownership is only granted to the crops, buildings or other infrastructure on the land, not the land itself. Under the Granted Right of Occupancy, the occupier is given a certificate of title accompanied by terms and conditions stipulated therein.

2.1.4.2 Co-occupancy

This category applies when the land is acquired by more than one person. This could be between wife and husband, business partners, friends, etc. If an investor acquires land held under lease by co-occupants, then all members who are co-occupiers should be in agreement before the land is transferred.

2.1.4.3 Clan land

This is land occupied by a clan and it is for the use of all members of the clan and not transferable except where the whole clan membership agrees to do so.

2.1.4.4 Village land

This is land occupied by the membership of an entire village and it is for the use of all village members.

2.1.4.5 Reserved land

This is land occupied by the government, for example, national parks, forest reserve, that are gazetted.

2.1.5 CEILINGS ON LAND OCCUPANCY AND AUTHORIZING GOVERNMENT LEVELS

The amount of land that can be obtained (land ceiling) is fixed by the government on the basis of use, location, feasibility study and proven ability of the applicant to develop the said parcel of land (Section 21 of Land Policy of 1998). No single right of occupancy or derivative right thereof shall be granted, made available, or in any way otherwise disposed of to any person or corporate body in respect of land exceeding 5,000 acres. Only the president can grant a right of occupancy to an area of land in excess of 5,000 acres, and if the president grants that land, all procedures have to be reported and made available to the public. The following are the approval ceilings for different levels of government:

- 1-50 acres – Village Council is consulted and authorizes
- 51-100 acres – Village Council is consulted, but District Authority authorizes
- 101-500 acres, – Village Council and District Authority are consulted, but Regional Authority authorizes
- 501 - 5,000 acres – Only the Ministry can approve, but Village, District and Regional Authorities must be consulted
- 5,001 acres and above – Only the president can authorize, but all lower levels of government must be consulted

2.1.6 PROCEDURE OF ACQUIRING LAND

The procedure of acquiring land in Tanzania differs depending on whether the land is rural or urban. For the purpose of mariculture activities, only procedures of acquiring rural land are described because urban management and development plans rule out mariculture operation in these areas.

2.1.6.1 Procedures for acquiring rural land

The two procedures for obtaining land are:

Customary Right of Occupancy:

Village Councils allocate land after receiving an application from the investor. The Village Authority can authorize land use rights only for parcels up to 50 acres. For larger parcels, the Village Authority must be consulted, but higher-level authorities make the final authorization. However a foreigner intending to operate a 100 percent foreign company does not have access to village land under Customary Right of Occupancy. Local investors from different villages may register and obtain land in a village where the identified site is located.

Granted Right of Occupancy:

Application is submitted to the village by the interested investor. The application is accepted and the Village Council informs the District Authority if the amount of land requested for use is less than 50 acres. Otherwise, higher levels of government must ultimately approve the request after sequential approval by lower government levels as noted in 2.1.5 (Ceilings on land occupancy and authorizing government levels).

The steps here are:

- The land is surveyed and the applicant given a letter of offer
- Development can commence at any time after receiving a letter of offer
- The survey plan must be approved by the Ministry before paying the required fees (deed plan, registration and survey fee, land rent and stamp duty)
- The procedure to obtain the certificate of occupancy and title deed can then be undertaken

2.1.6.1.1 Title deed

The certificate of occupancy is signed and sealed, this is then registered in the region or zone to make it a title deed. However the procedure and precautions of double allocation necessitates delays in obtaining title deeds.

Recommendations

The investor should work with TIC to obtain a permit to conduct studies on a prospective parcel of land through liaising with the district authorities that will help the investor contact village authorities to obtain such permission.

After the acquisition of EIA permit and approval of the project at the Screening Forum, Village Assembly and District Councils, the requested land and letter of offer should be provided where ceiling allows. The investor should then be allowed to start the project development.

2.1.6.1.2 Compulsory acquisition

There are two cases where compensation comes in with reference to land acquisition, one enacted in law, and one recommended.

Recommendation

Given that wise and appropriate use of land now and for the future is of the upmost importance to the sound development of the nation, final land use rights should be contingent upon successful completion of the EIA, Technical Feasibility Study and other reviews (see Chapter 1). Possession of the Environmental Permit should be taken as evidence that the investor has successfully completed the review process.

1. The Land Acquisition Act of 1967 (Act No. 47) empowers the president to acquire land for public purposes. Land granted as stated above may be acquired by the president if need arises. However where acquisition is done, compensation is to paid fully, promptly and fairly in accordance with section 3 (1) (f) of the Land Act of 1998.

2.1.6.1.3 Change of use

In a case where the occupier of a parcel of land wants to change the use of that land, for example from salt ponds to fish farming, an application is made to the Commissioner for

Recommendations

Where mariculture may in some circumstance affect the local economy so that direct or indirect compensation is in order. For example, a project may indirectly deprive individuals other than the landowner of their ability to continue certain types of economic use, such as fishing or rice farming. In these cases, legal means to address these issues are needed.

Additionally, it should be recognized that no mariculture project can succeed if local opinion is against it, whether the operator is within legal bounds or not. Generally, it is thought that local opinion will be positive because of the employment opportunities that such projects offer. However, large-scale investors may consider contributing to the public good by offering non-payment types of compensation that benefit the community as a whole. This might include supporting educational or health initiatives within the community.

Lands who gives permission through a Deed of Variation. An application letter is submitted to the District Land Officer. This would then be sent to Commissioner for Lands who will seek advice from Director of Housing and Human Settlements. Then the permit is granted. This process may not take long if there is close follow-up, otherwise the routine office procedure may be slower. The criteria for approving change of use are mainly consideration of reasons given by the applicant. No consultation is made in approving the application for change of use.

2.1.6.1.4 *Transfer*

The holder of certificate of title can transfer the right of occupancy at any time the decision to do so is made. The main condition that must be adhered to is that the land being transferred is developed according to the terms and development conditions originally stipulated in the title. Consent to transfer is given by the Commissioner for Lands. For efficiency, the Commissioner for Lands gives power to the District Land Officers to give consent on the behalf of the Commissioner. However, in Dar es Salaam region, only the Commissioner's office may give consent. Breach of any of the original

Recommendation

Given that new mariculture projects may have potential social, economic and environmental impacts, consultation with District Environmental Committees, Fisheries or NEMC should be conducted before a change of use is approved and the appropriate permitting procedure followed.

conditions may hinder the consent to be granted. The following are the documents that need to be submitted by the applicant.

- Application letter – the applicant gives reasons for the transfer of that property
- Two copies of transfer deed – transfer deeds are documents that show the consideration under which the land use was originally granted and the names and signatures of both the seller and the buyer
- Certificate of Title – the seller attaches the certificate of title
- Consent fee – fee is paid and receipt is attached
- Land rent – a photocopy of the most recent receipt of land rent is attached
- Stamp duty and land registration fee are paid

2.1.6.1.5 *Revocation of right of occupancy*

This is a termination of a right of occupancy by the government for good cause or in the public interest. The power to revoke a right of occupancy is vested in the president according to section 10 of the land ordinance (caption 113) where it states, “the president may revoke a right of occupancy for good cause or in public interest.”

Good cause occurs on breach of one or more of the terms and conditions expressed or implied in a grant of right of occupancy such as non-payment of land rent, failure by the occupier to develop the land accordingly, abandonment, or non-use of land for a period of three years. On the other hand, a right of occupancy is revoked for public interest when land is required for exclusive public purposes, for mining or other purposes associated with mining.

2.2 WATER UTILIZATION (CONTROL AND REGULATION)

All waters in Tanzania are vested in the United Republic of Tanzania. Therefore, any person or industry that wishes to use an appreciable amount of water must be permitted by obtaining a water use right. A serious consideration in the development of mariculture and other industries potentially utilizing marine or brackish waters is that there is currently no procedure to obtain such a water use right for any source of water other than freshwater. However, water policy is under revision and will address some of the issues related to mariculture, including the use of brackish water.

The Water Utilization and Regulation Act (No. 42 of 1974 that repeals Cap. 410) applies to everyone in the Tanzania Mainland including government departments, local authorities, the private sector, individuals and villages. Under this Act all water sources are divided into two categories namely national water sources and regional /basin water sources.

The Minister responsible for water is empowered to declare any water source to be a national water supply where, in his opinion, it is in the public interest that the use of water from such a source is regulated on a national basis. All other sources not so declared are regarded as regional water supplies.

The Minister responsible for water appoints a public officer to be the Principal Water Officer with jurisdiction over all national water supplies. The Regional Commissioner in each region appoints a Regional/Basin Water Officer with jurisdiction over regional/basin water supplies.

A Central Water Advisory Board advises the Principal Water Officer while the Regional/Basin Water Officers are advised by Regional/Basin Water Advisory Boards. Both Central and Regional/Basin boards advise the respective officers on all matters concerning the apportionment of water supplies, and the determination, diminution or modification of water right. The boards also advise on measures to be taken in case of drought, and the priorities to be given from time to time and in accordance with prevailing circumstances for the different purposes for which water is required in any area in Tanzania. The Water Advisory Boards should have a member from Fisheries and

other relevant sectors who advise on matters related to fisheries and aquaculture. An EIA is also mandatory for large-scale abstraction of water.

The Principal Water Officer grants water rights for National Water Supplies while the Regional/Basin Officer grants rights for Regional/Basin Water Supplies.

2.2.1 REGULATION OF FRESHWATER, BRACKISH WATER AND SEAWATER

Mariculture may involve use or occupation of various types of water along the coastal zone. The coastal area is home to large areas of brackish water, and tidal influence may cause great variations in what salinity of water is present in a specified geographic location at any moment. Thus, the limitation of regulatory policy to freshwater is an issue that needs to be addressed.

Recommendations

It is recommended that representatives of the Fisheries Division and other relevant sectors sit in on the Regional/River Basin Boards to help ensure that mariculture activities receive recognition in allocation of water and to provide expertise in the case of questions regarding the technical feasibility of projects. Additional linkage with NEMC may be needed to assure that questions of environmental impact are considered.

It is recommended that final water use rights not be granted to mariculture projects until the technical feasibility and the lack of environmental impacts has been demonstrated in the approval process. This is best applied to both large-scale and small-scale projects.

For reference purposes, the following are commonly accepted standards and categories of water salinities (Driscoll, 1986):

Freshwater has total dissolved solids of 0-100 mg/l. Brackish water has total dissolved solids of 100-1000 mg/l. Seawater has total dissolved solids of more than 1000 mg/l.

Although the water policy stipulates that all waters in the country are under the jurisdiction of the Water Department, regulatory acts apply only to freshwater currently. There are no regulations covering abstraction or occupation of brackish water and seawater, although these issues will be addressed in the new Water Policy. Given that these sources of water represent a potentially valuable economic resource, their use should be accommodated in the regulatory framework.

Aside from questions of use or abstraction, occupancy of aquatic areas is also an issue for mariculture. Currently, this is not well-regulated.

2.2.2 WATER RIGHTS

A water right is granted by law to take possession of water occurring in a natural source of supply and to divert the water for a beneficial use on, or in connection with, land.

It is a right of use of water and not a right to the corpus of water itself. Anyone having lawful access to any water may abstract and use the same for domestic purposes without the necessity of obtaining a Water Right provided no construction works are made for the abstraction of water.

The main legislation to control the extraction of water for different uses is that of the Water Utilization and Regulation Act (No. 42 of 1974, which repealed Cap. 410 of 1959). Acts No. 10 of 1981, No. 17 of 1989 and No. 8 of 1997 have amended the Act. Both the principal Act (No. 42), and its amendments are for the protection of the water resource and the user so that there is balance between the different uses.

Recommendation

The Water Department is currently revising its policy to harmonize its policy and legislation to include the use and occupation of brackish water and seawater. These issues are of intersectoral concern, thus this initiative includes consultation with other sectors such as Navigation, Home Affairs, Immigration, Marine Police, Fisheries Division, and the Division of Forestry and Beekeeping. It is recommended that this intersectoral approach continue in the process of granting provisional and final water use rights for large- and small-scale projects. This can be achieved through participation of representatives from the Water Department in the approval forum and the District Technical Team review process.

There are relatively few guidelines for the use and abstraction of water, and these do not provide oversight for the wide range of means by which aquaculture and mariculture activities could use the various types and sources of water within the nation. The following uses have specific limitations stated in the water regulations:

The occupier of any land is allowed to sink a well or bore-hole on the property and abstract up to 22,700 liters per day without possessing a water right provided that the well or borehole is not within 230 meters of any other well or borehole or within 90 meters of any surface water body.

As the regulations contains the following phrase, “subject to the above provisions, no person is allowed to divert, dam, store, abstract or use water, or for any such purpose construct or maintain any works, except in accordance with an existing right or with a water right granted under the Act,” this limits the use of water for mariculture purposes. Therefore, water regulation and policy requires restructuring to allow appropriate types of water use for mariculture while carefully guarding the quality of the nation’s water sources.

2.2.2.1 Grant of water rights

The Principal Water Officer grants water rights in respect to national water supplies, whereas it is the Regional/Basin Water Officer that grants water rights to regional/basin water supplies.

2.2.2.2 Procedure for obtaining water rights

Once the source of water to be used has been identified, an application giving details as required by the water application form available in the Water Department shall be made. An application fee is payable to the Permanent Secretary of the Ministry responsible for water (Water Act 1974). The application form shall be submitted to the Principal Water Officer for National Water Sources and to the Regional/Basin Water Officer for regional/basin sources. These are at the ministry headquarters and regional/basins offices respectively.

Recommendation

For all ranges of salinity, the policy and regulation needs to accommodate uses other than wells or boreholes, such as abstraction through pumping and diversion. Also, issues of catchment and subsequent use must be considered.

Regulations covering the volume that may be used per day without obtaining a right of water use need to accommodate instances of multiple mariculture projects in the same vicinity which may have cumulative effects on the water table or other source of water.

Once the application form has been filled out and submitted (normally in quadruplicate) the water officer prepares a notice setting out the particulars of the application and causes it to be published in an official gazette. The gazette is served upon all persons named in the application as being affected by the grant of the right for which the application is made. It is also served upon such other persons deemed fit and it is displayed at the appropriate district office for which the application and potential grant of water rights will be exercised.

The Water Department is responsible for granting a water right. A Principal Water Officer or Regional/Basin Water Officer signs the water right after being advised by either the Central or Regional/Basin Water Advisory Board. This law is applicable to freshwater sources and therefore does not include marine waters.

Recommendations

In the absence of regulations covering the use and occupation of brackish water and seawater, the Division of Fisheries should take the initiative to coordinate the use of these waters for mariculture purposes with other sectors such as Water, Navigation, Home Affairs, Immigration, and Marine Police.

Where marine or brackish waters are involved in mariculture development, intersectoral coordination should be used as a management approach in allowing use, while policy and regulation are developed.

Additionally, water policy should be reviewed and amended with an eye towards regulating the use of marine and brackish water for industrial uses such as mariculture.

If there is any objection to the application from a member of the public, this may be registered with the water officer (Part IV Section 15(2), Water Utilization and Regulation Act No. 42 of 1974). The Water Advisory Board considers the objection. The advice of the Water Advisory Board shall be taken into consideration by the water officer in making a decision to accept or reject the application.

A water officer has discretion of refusing to consider any objection to an application for a water right if the objection is received forty days after the prescribed date.

After receiving all reaction/comments from affected persons, a water officer hands over these comments to the chairperson of the advisory boards who convenes a meeting to consider the application.

After receiving the advise of the Water Advisory Board a water officer grants such right or dismisses the application as it is appropriate.

An investor can proceed to the point of obtaining provisional water rights prior to construction. After construction, an inspection will be conducted. Final Water Use Right will be granted if all is satisfactory and within bounds of the originally stated conditions.

A water right is either made in the name of the applicant which cannot be transferred to any other person without the consent of the water officer, or as an appurtenant to the land and is transferred with the land whenever the ownership of the land, or part of the land changes hands.

Although the current policy and acts do not require an EIA in order to obtain water use rights, the new water policy being drafted recommends development of a system of implementing EIAs for all major socioeconomic activities which may affect the quantities or quality of water resources (New Draft Policy).

2.2.2.3 *Conditions implied in water rights*

That the water used under a water right:

- Is either made in the name of the applicant which cannot be transferred to any other person without the consent of the water officer, or as an appurtenant to the land which can be transferred with the land whenever the ownership of the land or part of the land changes hands
- Be returned to the streams or body of water from which it was taken or to such other stream or body of water as may be authorized by the water officer
- Be substantially undiminished in quantity
- Shall not be polluted with any matter derived from such use to such extent as to be likely to cause injury either directly or indirectly to public health, to livestock or fish, to crops, orchards or gardens which are irrigated by such water, or to any product in the processing of which such water is used. Recommended water quality standards for discharge into receiving systems are available in the Water Department
- Shall take precaution to the satisfaction of the water officer to prevent accumulation of silt, sand gravel, stones, sawdust, refuse sewerage, sisal waster or any other substance likely to injuriously affect use, in any receiving river, stream or water

Although general water quality standards for effluents exist, there is a lack of water quality monitoring programs, except on project-specific activities. It is therefore difficult to assess continual compliance to specified water quality standards.

Where any person who is the holder of a water right or has applied for the grant or

water right without easement and has failed to secure an easement by agreement with the owner or occupier of the land over which the easement is required, he/she applies to the appropriate Water Officer for the creation of such easement.

Appeals against any decision in respect to national water sources made by the Principal Water Officer are sent to the Ministry responsible for water while those of the Regional Water Officer are sent to respective regional commissioners. However, their decisions are final.

Water use rights do not imply any guarantee that the quantity of water referred to in the water use right is or will be available (Part IV Section 15 (3) a-b and (4), Water Act 1974).

2.2.3 NEED FOR ZONING AS A MANAGEMENT TOOL FOR LAND AND WATER USE

Coastal habitats contain many areas where water and land overlap in a dynamic fashion, changing seasonally and with the tides. Mariculture bridges many habitat types, ranging from agricultural land to brackish wetlands to marine areas. Coastal habitats and coastal development have therefore proven difficult to manage given that the nature and use of coastal areas rarely coincides with the institutional and legal frameworks developed by man (see Chapter 4).

In the case of Tanzania, there is fragmentation and lack of harmony for regulation of individual habitats, and there is little integration for simultaneous consideration of land and marine tenure issues. Zoning as a management tool can help regulate use in these areas, but initial steps must be taken before zoning can be applied.

Recommendation

Environmental standards, baseline data on environmental conditions, and monitoring guidelines are needed to assure that mariculture projects do not violate criteria for water use.

Recommendations

Before zoning can be implemented as a management tool, a number of preliminary steps are necessary:

All habitat types must come under the jurisdiction of one or more concerned institutions. There are currently a number of habitats which are not fully the responsibility of any institution, or where such jurisdiction exists, are often given low priority for oversight and regulation.

Where jurisdiction over a habitat or coastal area is shared between institutions, any conflicts in jurisdiction or regulation must be identified and addressed. There are a number of habitat types, intertidal areas for example, that may fall under the conflicting jurisdiction of more than one institution. Additionally, a strong regulatory framework for particular habitats may be lacking.

The National Integrated Coastal Policy is now under final stages of approval. It contains a number of recommendations that address ways of implementing zoning for management.

An implementing body such as the proposed Inter-Ministerial Committee (proposed in National ICM Policy) must be empowered to enact changes and enforce policy.

Zoning and land use planning can be enacted and implemented after a careful study of defined areas.

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Chapter Three

ENVIRONMENTAL IMPACT ASSESSMENT

3

3.0 INTRODUCTION

This chapter is a description of Environmental Impact Assessment (EIA) procedures for mariculture projects. This description builds on the proposed national general Environmental Impact Assessment guidelines and procedures that were formulated for applicability to a wider range of sectors. The mariculture-specific EIA procedures are intended to address social, economic and environmental issues associated with mariculture projects. This chapter also highlights the role of EIA in the review and permitting process to promote the development of a sustainable mariculture industry in Tanzania.

3.1 ENVIRONMENTAL IMPACT ASSESSMENT³

This chapter describes the EIA as prescribed in the National EIA Guidelines. Chapter One describes modifications to the general EIA procedure to adapt it to use for a sector-specific activity. Mariculture Environmental Impact Assessment is a process that can be used to improve decisionmaking and ensure that the development options under consideration are ecologically, socially and economically sustainable. The environmental and socioeconomic aspects are major components that need to be integrated into mariculture project planning. EIA should not be viewed as a tool for regulation only. Investors can benefit from this form of analysis since environmental impacts can cause losses in production and economic losses. The identification, prediction, evaluation, and analysis of potential implications of mariculture development, as well as mitigation measures for such implications, are the main focus of the EIA process.

³Environment Impact Assessment and Impact Assessment are used synonymously in this document.

3.1.1 OBJECTIVES

- To aid decisionmaking during the project approval process by providing a systematic examination of the potential environmental implications of a proposed project action and offering alternatives
- To ensure that potential environmental impacts are minimized and monitoring protocols are put in place. This can be achieved by incorporating EIA criteria in the planning and approval processes
- To maintain the well-being and quality of life of the stakeholders and the long-term viability of the project by detecting and mitigating potentially adverse socioeconomic impacts

3.1.2 IMPORTANCE OF ENVIRONMENTAL IMPACT ASSESSMENTS

The EIA is an important management tool for improving the long-term viability of projects. Its use helps to avoid mistakes that are expensive and may damage the environment, or social and economic well being of the people. A meaningful EIA commences as early as possible in the project cycle so that the findings are incorporated in project planning.

The analysis of World Bank-supported projects in Africa revealed that EIA usually costs less than 0.1 percent of overall project costs (IRA/IIED 1996). This is true when EIA is undertaken as early as possible in the project cycle. Some of the potential benefits of assessing environmental impacts at the initial stages of a project include lower project costs in the long term, and alternative designs which provide options for decisionmakers and the public to choose from. EIA can be an important development planning tool where mitigation activities are incorporated into project planning to address and minimize adverse impacts. The principal groups of stakeholders are the investors, service providers, reviewers, decisionmakers and the public.

Principal Stakeholders

Investors: These are responsible for commissioning and paying for the EIA process. They may include government ministries and departments, private sector companies and development agencies.

Service providers: These undertake or provide input to the EIA process. Service providers may include individuals, organizations, research and academic institutions, Non-Governmental Organizations (NGOs), and both local and international consulting companies.

Reviewers: These are responsible for quality control (screening and monitoring) and communicate their findings to decisionmakers. In Tanzania, NEMC is the coordinating agency and collaborates with government ministries, colleges, NGOs, universities, and local and international experts.

Decisionmakers: These are responsible for making decisions on project development once the EIA has been reviewed. With regard to mariculture development, the Fisheries Division is the lead government department in decisionmaking.

Public: This is the most important group of stakeholders. It has a great role to play in improving project design by providing ideas and unforeseen information. The public also contributes to monitoring. This also includes interest groups that are not directly affected by the project but have interest in particular aspects (e.g. conservation organizations).

Source: IRA/IIED (1996)

3.1.3 FUNCTIONS

According to UNEP (1996) the EIA report has at least three functions:

- To assist the investor to design and implement the proposed mariculture project in a way that minimizes or eliminates negative effects on the environment and maximizes the benefits
- To assist the evaluation and review teams to decide whether a proposed mariculture project should be approved and advice on terms and conditions that should be applied
- To assist the public to understand the implications to the community and environment of the proposed mariculture project.

3.1.4 LEGAL BASIS

Although EIA is a critical management tool for mariculture development, no general formal requirement for EIA currently exists in Tanzania. Thus, investors are under no

legal requirement to comply with execution of the EIA process until the proposed national general EIA guidelines and procedures are legally adopted. Despite this, a number of EIA studies have been conducted in Tanzania. These have focused on large development projects supported by donor agencies.

Recommendation

The Office of the Vice President should formally adopt the national general EIA guidelines and procedures that were proposed by the National Environment Management Council in 1997. The enactment of an environmental protection bill by the cabinet is of paramount importance.

Since the proposed national general EIA guidelines and procedures are not specific to mariculture, there is no mention of the lead institution for mariculture development in the guidelines. However the National Fisheries Sector Policy and Strategy Statement of 1997 and the Fisheries Act of 1970 recognize the Fisheries Division to be the custodian of mariculture development activities in Tanzania.

Recommendation

The Fisheries Division, which is the lead institution with regard to mariculture development, should enforce mariculture EIA guidelines, through legislation, that will be used as the guiding rule during the final approval of mariculture projects.

Other sectors with a stake on the coast including Agriculture, Tourism, Antiquity, Water, Lands, Tanzania Harbors Authority, Forestry and Beekeeping, Minerals, and Energy should recognize mariculture guidelines in their plans. These institutions should also be consulted during the EIA process to ensure that the EIA includes adequate stakeholder input and technical expertise.

Lack of legal recognition of EIA guidelines has also led donor and multilateral agencies including USAID, World Bank, African Development Bank, SEACAM, NORAD and others to introduce alternative EIA guidelines that must be followed by applicants of funds from those donors. In some cases, unauthorized parties have screened and reviewed EIAs without having the required tools.

Recommendation

Where compliance to EIA guidelines from other sources is required, care must be taken to make sure that requirements of the nationally approved mariculture guidelines are effectively met. No excuse shall be made for such oversight.

Only trained and authorized bodies that are provided with nationally-approved guidelines should screen mariculture projects (see section 3.2.2 for proposed expertise for screening mariculture projects).

According to the proposed national general EIA guidelines and procedures, the investor will meet all costs involved in the mariculture EIA process.

Steps in a typical EIA process

- 1. Registration:** An administrative procedure that allows a new project to be screened
- 2. Screening:** A review that determines the level of assessment necessary
- 3. Scoping:** Identification of information needs and terms of reference
- 4. Preliminary assessment:** The magnitude and significance of key impacts are evaluated
- 5. Assessment (EIA study):** Impact identification, analysis, mitigation and documentation
- 6. Review:** Assessing the quality of EIA and compliance with Terms of Reference
- 7. Decisionmaking:** This is a permitting process that involves a large number of trade-off including economic, social gain benefits and environmental loss
- 8. Monitoring:** Assessing the effect on natural resources and accuracy of predicted impacts
- 9. Auditing:** Learning from experience and refining the project design
- 10. Decommissioning:** This may include abandoning the project and rehabilitating the site to restore the damaged environment, abandoning the site without rehabilitation or changing the use of the site

Source: IRA/IIED (1996)

3.2. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCEDURES

The proposed national EIA guidelines and procedures recognize that a typical EIA process consists of a number of different steps or elements as shown in the box on the previous page. The EIA process described in this section involves all stages shown in Figure 7 on page 137, which comprise the proposed general National EIA Guidelines. In the following sections, the application of the currently proposed EIA guidelines to mariculture is reviewed and suggested modifications for each step are inserted in the subsequent boxes.

Recommendation

As the proposed EIA guidelines were formulated for applicability to a number of different types of projects, it is recommended that modifications to adapt the existing EIA guidelines to specific mariculture requirements should be adopted for implementation in the Fisheries and Tanzania Investment Center (TIC) regulations.

3.2.1 REGISTRATION

This is a simple administrative procedure that requires investors to officially register new mariculture projects and that allows the project to be screened by the National Environment Management Council (NEMC) or any other authorized body.

Mariculture-Specific Modifications

For mariculture projects, investors will be required to submit project proposals containing information about the following general factors:

- Location (map and site plan)
- Scale of project (extensive or semi-intensive)
- Topography and soil type
- Technology to be used
- Existing land use pattern
- Surrounding features (physical and biological)
- Types and amounts of raw materials required
- Types, rates and amounts of wastes or effluents to be produced
- Source and quantity of water required
- Type and origin of species to be cultured
- Duration of the project and expected harvest per crop
- Operational plan and other associated industries (hatchery, fish meal industry, processing plant)

A detailed list and specifics are given in Chapter 1. These factors will form the basis for decisionmaking during the project screening process.

According to the proposed national EIA guidelines and procedures the investor submits a copy of project proposal or concept together with completed special application forms available at NEMC offices, environmental units of sectoral ministries, municipal council offices, districts and the Tanzania Investment Center (TIC).

The proposed national general EIA guidelines and procedures also indicate that the role of the national Technical Review Committee under NEMC's guidance is basically to assist NEMC in review of scoping and EIA reports, whereas the role of sectoral environmental units will be:

- To issue EIA registration forms and provide information on policy and legislation relevant to the project
- To assist in the general EIA process

3.2.2 SCREENING

This is the first step during which a decision about the level at which an EIA needs to be carried out is determined. Screening is conducted by using information provided in the registration form and the project brief or concept report. NEMC is mandated to coordinate cross-sectoral technical teams when screening all development projects including mariculture. The following box shows the composition of a national cross-sectoral technical team for screening mariculture projects.

Mariculture-Specific Modifications

The composition of a cross-sectoral Technical Review Committee that assists NEMC in screening mariculture projects should include:

- NEMC (chairman)
- Division of Environment
- Fisheries Division (secretary)
- Forestry and Beekeeping Division
- Urban and Rural Planning
- Agriculture
- Water
- Minerals
- Tanzania Investment Center (TIC)
- Ministry of Trade and Industries
- Local government
- Ministry of Transport and Communication
- Wildlife Division
- Other relevant sectors, e.g. Social Welfare, Antiquity, Tanzania Harbors Authority

In the proposed general national EIA guidelines and procedures it is suggested that district sub-offices will screen projects that are less risky and less contentious. In another process, the Institutional and Legal Framework for Environment Management Project (ILFEMP) has also suggested that a cross-sectoral District Environmental Management Team should be established. District Environmental Management Officers would coordinate these committees. However, such offices are yet to be established in the districts. As a result, all projects are supposed to be screened at the head office of NEMC. This is tedious to NEMC, and costly and time consuming to the investor.

Mariculture-Specific Modifications

While waiting for the establishment of District Environmental Management Teams or sub-offices, NEMC will continue to guide EIAs. In the case of very small-scale projects that are reviewed at the local level, the investor may not be aware of the need to undergo Preliminary Environmental Assessment (PEA). In these cases, when a proposal is submitted to the District Technical Team, the District Natural Resources officer will liaise with NEMC to assist the investor in completing the requirement for PEA.

Once the District Environmental Management Teams are established, the committees should replace the District Technical Teams in the EIA process. The District Environmental Management Officer will assume the responsibility of providing written feedback to NEMC.

A decision on whether or not the project needs a national-level screening will be made during the screening of the project proposal or the preliminary environmental assessment report. The basis for decision will be the scale and magnitude of identified impacts.

According to the proposed national EIA guidelines and procedures, EIA is mandatory for all projects (including mariculture) that are known to have potential impacts on the environment. Small projects that are of negligible environmental impacts are exempted from full or detailed EIA at this stage. However, small projects are required to first be vetted by the checklist of indicators for potential impacts and if needed, a PEA. In the case of projects that are found to contravene government investment policies, laws or policies, no further consideration past the stage of PEA or Initial Environment Examination (IEE) will be given. These projects must be revised for further consideration.

Mariculture-Specific Recommendation

In order to avoid or reduce potential cumulative impacts of many small mariculture projects located in one ecological system, the carrying capacity of that ecosystem, the existing land use pattern, and approved survey maps or management plans should be considered during the project screening.

Mariculture projects will be differentiated according to two filtering mechanisms to determine whether PEA or full-scale EIA must be performed. This is essentially the same as deciding whether the project must follow the large-scale or small-scale approval procedures. Projects that meet the investment threshold of TIC (Chapter 1) will automatically be subjected to the large-scale approval procedure and it is most likely that EIA screening will determine that a full EIA is required. However, any project falling below the TIC investment threshold still must be examined to determine whether a full-scale EIA or only a PEA will be conducted.

Therefore the checklist of indicators for potential impacts (Chapter 1) was developed. This list contains a number of questions regarding factors such as size, use of exotic species, another number of other projects that may indicate the potential for impacts. If the project possesses any of these triggering factors, it must undergo PEA to determine whether a full EIA and consequently the **MAJOR** permit procedure is needed.

Mariculture-Specific Recommendations

Fisheries should coordinate research leading to a decision on the criteria to be followed while setting threshold for mariculture operations in Tanzania.

In the absence of threshold, the checklist of indicators in Chapter 1 can be used to detect the potential for impacts and thus the need for a PEA. The general indicators used are:

1. Size
2. Use of exotic species
3. Number of projects in the same area
4. Potential socioeconomic impacts
5. Other potential impacts
6. Associated activities that may cause impacts

These indicators should be periodically reviewed and reassessed based on the rate of growth of mariculture industry in the country.

The proposed national general EIA guidelines and procedures also directs that EIA is mandatory for development projects sited in sensitive areas including those prone to natural disasters like storms, earthquakes, land slides, volcanoes etc. Other conditions for which EIA is mandatory are sites such as wetlands and mangrove swamps, areas susceptible to erosion, areas with threatened species, historical sites, polluted areas and agricultural land. Burial sites, recharge areas of aquifers, sacred areas, gazetted land, wildlife corridors, hot spring areas, coral reefs, islands, lagoons and estuaries, continental shelves, beach fronts, intertidal zones and marine reserves are also considered sensitive or have valuable resources that can be easily harmed by the development activity. Public concern about the proposed mariculture project is another important factor to be considered during project screening.

Mariculture-Specific Recommendations

Siting is one of the important factors considered during project screening. The siting criteria listed in Chapter 4 of these guidelines are specific to mariculture development and should be taken into consideration during project planning as they are among the most stringent factors in project screening. The criteria can be refined over time as more country-specific experience is gained in mariculture development.

Other important factors should include type of technology to be employed and proximity to existing farms of similar type.

Semi-intensive culture systems are recommended in the Fisheries Policy and Strategy of 1997. However, the policy does not state whether intensive culture is allowed or not.

Mariculture-Specific Recommendations

To avoid the introduction of inappropriate biotechnology, genetic manipulations and the use of antibiotics that cannot be managed by the existing national capacity, intensive culture systems should not be allowed until proper evaluations based on experience with other systems can be conducted and the potential impacts accurately gauged.

However, careful study of specific cases of intensive culture occurring in other countries is merited, and small-scale research into intensive systems in country should not be barred if conducted under carefully controlled and monitored conditions.

3.2.3 SCOPING

This is a consultative process that identifies information needs and reviews alternative options to the project. The identification and evaluation of community and scientific concerns about the proposed mariculture project is done at this stage so that they can be addressed systematically in the environmental assessment report. The process also defines the scope of environmental assessment appropriate to the proposed project. The most important output of scoping is the drafting of Terms of Reference (ToR) to guide the environmental assessment process. This process commences after the screening process recommends that the project should be subjected to a full (detailed) EIA or a PEA.

The proposed national general EIA guidelines and procedures show that the main objectives of scoping are:

- To provide an opportunity for the investor, consultant, government authorities, and interested and affected parties to exchange and express views about the proposed project prior to the environmental assessment study.
- To focus the study on reasonable alternatives and relevant issues to ensure that the resulting EIA report is useful to decisionmakers and address concerns of interested and affected parties
- To determine the ToR and boundaries of the EIA study
- To improve the efficiency of the assessment process by saving time and resources which might be required if consultation had not taken place

The proposed national general guidelines also indicate that, scoping is a responsibility of the investor and the consultants. In case the investor or a consultant lacks capacity, assistance is requested from a multi-disciplinary or advisory group to guide the process.

Mariculture-Specific Modifications

Option 1. The investor, through a National Coastal Management Office, should subcontract a multi-sectoral technical team to do scoping.

Option 2. The investor should sub-contract a nationally registered consulting firm to do scoping.

Option 3. The Fisheries extension officers should assist small-scale investors with scoping. This is the best option for investors lacking the resources to hire consultants or where the project is such a small scale that a team of consultants is not merited.

The second option was chosen by the directors of government institutions.

Mariculture consultants or experts in all cases should be registered through the Fisheries Division in order to be considered qualified to conduct scoping for mariculture projects. This also serves to help investors locate qualified consultants.

Although scoping can be done by any of the experts proposed in Options 1, 2 or 3, the proposed ToR should be submitted to a multi-sectoral technical team coordinated by NEMC, or to a District Technical Team for approval.

The scoping process requires thorough consultation with the entire spectrum of stakeholders from the village level to the national level including interested parties. The proposed national general EIA guidelines direct that a list of affected and interested parties be prepared so that methodologies of informing them about the project are developed. Public consultation needs to be a two-way process by which information about the project is disseminated, and in turn, useful information and opinions from local people are received. It is important to allocate adequate opportunities to participants in the scoping exercise. One advantage of public consultation is that fears and interests of the communities are easily addressed in the subsequent EIA report. Consultation with NEMC and District Technical Teams during scoping of mariculture projects is very crucial.

3.2.3.1 Characteristics of Terms of Reference (ToR)

According to the proposed national general EIA guidelines and procedures, the resulting draft ToR are required to address the need for an EIA report to include the following information:

- A description of the proposed project and an analysis or reason for that project
- The objective of the project
- Other options for carrying out the project
- Alternatives to the proposed project
- A description of the present environment that would be affected directly or indirectly
- Description of the future environment predicting its condition if the project did not take place
- The impact that may be caused to the environment by the project
- Proposed measures to mitigate all the predicted adverse impacts
- An evaluation of opportunities and constraints to the environment of the project
- A proposal for an environmental management program for the project

The proposed national general EIA guidelines also indicate that the draft ToR be submitted to NEMC for scrutiny and approval.

Mariculture-Specific Modifications

The national general EIA guidelines specify that the ToR drafted by the consultants or assigned experts include the elements listed above. In addition, three modifications are recommended for the scoping phase: inclusion of additional information, a plan for conducting the assessment and a plan for public consultation. The steps would be:

A) Develop a ToR for the completing the assessment. This defines "what" will get done. Outcomes of the screening should be incorporated in the ToR. This should include, but not be limited to:

- A description of the proposed project and analysis or reason for that project
- The objective of the project
- A review of and response to criteria from sectors that are involved in the mariculture review and approval process as well as any comments provided during the Screening Forum. A plan should be developed for consultation with all concerned institutions and incorporation of their comments and reviews into the final EIA report.

- Other options for carrying out the project based on the institutions' comments from the screening forum and their review criteria
- Comparative evaluation of options that considers:
 - A description of the present environment that would be affected directly or indirectly
 - Description of the future environment predicting its condition if the undertaking did not take place
 - The impact that may be caused to the environment by the undertaking
 - Proposed measures to mitigate all the predicted adverse impacts and costs
 - An evaluation of opportunities and constraints to the environment of the undertaking
- Identification of the environmentally preferred options and the legal and policy basis for these
- A proposal for environmental management and monitoring program that addresses the environmental impacts of the preferred option
- A plan to consult with all concerned institutions and incorporate their comments and reviews in the final EIA report

B) Develop a plan for executing the assessment. This defines "how" it will get done and this should include, but not be limited to:

- Objective of the EIA study
- Boundaries of the study
- Methodologies to be used
- Operational details of the study including personnel, costs and schedule

C) Develop a plan for ensuring adequate public consultation. Public consultation should seek to solicit information and opinions from stakeholders and members of the public that may be directly or indirectly affected by the project. This information will be used to determine if the project is acceptable to the public and whether social, environmental or economic impacts exist. Adequate public consultation will include, but not be limited to the following:

- The public should first be advised through notices, radio, or newspapers that a project has been proposed and the nature of the project
- The consultants carry out public consultation based on methods described in the ToR such as individual or group interviews, surveys or informal meetings
- Care is given to seek out those who might not participate in public meetings by using surveys or questionnaires
- Public officials are included in the public forum
- Results of the public consultation should be archived in written form and be available for public review
- Letters from the village and district obtained during the initial consultations should be included

Where necessary the national Cross-Sectoral Review Team or District Technical Team will visit the project site for physical verification of the scoping report.

3.2.4 *PRELIMINARY ENVIRONMENTAL ASSESSMENT (PEA)*

This term is sometimes used synonymously with Initial Environmental Examination (IEE). In these guidelines the two descriptions refer to the identification of key impacts on the environment, describing their magnitude and significance, and evaluate their importance to decisionmakers. According to the proposed national general EIA guidelines and procedures all development projects (including mariculture) that have minor impacts to the environment should undertake Preliminary Environmental Assessment only.

Mariculture-Specific Modifications

Once the ToR has been developed, it should be submitted to NEMC. Review of the ToR will occur within 45 days and NEMC will respond to the investor in writing as to whether the ToR is acceptable. NEMC may request support for a visit to the site for physical verification of the scoping report.

If the ToR is not approved, the investor will be advised on how to revise it. If the ToR is acceptable, the investor then proceeds to conduct an EIA.

3.2.5 *IMPACT ASSESSMENT*

This is the process of identifying and defining more specifically the potential impacts to be investigated in detail. Environmental assessment also deals with impact analysis that determines the causes, significance of the effects of various impacts and proposed measures to mitigate and optimize the benefits of the project. The focus is on impacts that are related to the physical features, ecology processes, social and cultural features,

Mariculture-Specific Modifications

In the modified permit procedures for mariculture, the PEA is used to help differentiate between projects that are required to undergo the **MAJOR** or the **MINOR** procedures. Large-scale projects as defined by the TIC investment threshold automatically proceed through the **MAJOR** process that requires PEA or EIA. Projects falling below the investment threshold are first vetted with the checklist of indicators for potential impacts, and if potential is detected, then an EIA is required.

The environmental Permit for the approved PEA report will be issued by the Executive of NEMC upon receipt of a copy of PEA and review of the report from the District Executive Director.

heritage, and economy of the area of influence. The proposed national general EIA guidelines and procedures do not show how to go about assessing the environmental impact of a project (i.e. methodology). However, they show how to write an assessment report and what should be included in the report.

In this section guidance is given to describe the stages involved in assessment of mariculture projects (sections 3.2.5.1 to 3.2.5.5). Methods and tools used in impact assessment are also discussed.

Purpose of Environmental Assessment

- To identify and concentrate on problems, conflicts, or natural constraints that could affect the viability of a project
- To predict the likely environmental impacts of projects
- To identify measures to minimize the problems and outline ways to improve the project's suitability for its proposed environment
- To present predictions and options to decisionmakers and the public before irrevocable decisions are made

Source: United Nations Environment Programme (1996)

A typical environmental assessment process involves the following stages (IRA/IIED 1996):

3.2.5.1 Impact identification

The emphasis is on impacts that need detailed analysis. According to the Australian Environmental Protection Agency (1995a) impact assessment should focus on things like physical deviations, ecological changes, interruption of existing land use, disruption of social settings, impairment of existing carrying capacity of infrastructure, influence on culture and disturbance of heritage.

Common tools in impact identification include checklists, matrices, map overlays, network analysis and Geographical Information Systems (GIS).

Once impacts are identified, the next step should be to predict the extent of the changes in the environmental conditions that are caused by the proposed mariculture project. It

is also important to classify whether the impact is long-term or short-term, primary (direct) or secondary (indirect), positive or negative, cumulative or not cumulative, reversible or irreversible. In order to do this it requires an understanding of the important cause and effect relationships.

Typical environmental descriptors include:

- Magnitude:** This is the absolute or relative change in size or intensity of the environment in the future.
- Direction:** An impact will represent a positive (beneficial) or negative change.
- Extent:** This refers to the coverage or area affected by the impact. A distinction is made between onsite and offsite impacts.
- Duration:** This is the time period over which the impact will exist. Duration may vary between short-term, long-term and permanent.
- Frequency:** This refers to the frequency at which the impact occurs.
- Reversibility:** Refers to the permanence of the impact. Some impacts are reversible by natural means at natural rates, or are reversible by various forms of human intervention at reasonable cost, or they are irreversible. Irreversible impacts are likely to be more severe as they assume permanent damage to the environment.
- Likelihood of occurrence:** Refers to the possibility of a particular impact occurring as forecast.

3.2.5.2 Examination of alternatives

Considers alternative sites, designs or operating processes. Risk assessment and cost benefit analysis is included in the discussion of alternatives (EPA, 1995a). It is important to ensure that the advantages of the most appropriate or preferred option are clear. In the proposed national EIA guidelines it is indicated that in order to determine which alternative is in the best interest of the community at large, an evaluation must be carried out prior to project implementation. The proposed national general EIA guidelines and procedures suggest that the following considerations be contemplated and included when considering alternatives.

Method of evaluation: evaluation can be based on expert opinion or other techniques such as panel evaluation and should include:

- Risk assessment or cost/benefit analysis
- Comparison of alternatives
- Recommendations

Mariculture-Specific Modifications

When assessing mariculture project alternatives, consider the proposed project, the no-action alternative, as well as other alternatives to the proposed project.

The no-action alternative serves as a baseline against which other alternatives can be measured.

3.2.5.3 Evaluation and impact analysis

This involves determining the significance of impacts at local, national and international levels. The significance of an impact depends on the intensity and context.

The significance of an impact of mariculture project depends on the degree to which it:

- Affects public health
- Affects unique characteristics
- Is likely to be controversial
- Is highly uncertain, or involves unique or unknown risks
- Establishes precedent
- Adversely affects nationally defined historic places, endangered or threatened species, or habitat

3.2.5.4 Development of mitigation options

Seeks to determine measures to minimize or prevent impacts as early as possible in the project cycle so that these can be incorporated in the project plan. Mitigation is a general concept that could include the following list of categories:

- Avoiding the impact altogether by not implementing a particular action

- Minimizing the impact by limiting the magnitude of the action
- Rectifying impacts by repairing or restoring particular features of the affected environment
- Reducing impacts over time by performing maintenance activities during the life of the action
- Compensating for impacts by providing additions and substitutes for the environment affected by the action

The development of mitigation options results in a matrix of mitigation measures that include the cause and effects of the impact, significance of the effect and proposed mitigation measures or alternatives. Where mitigation opportunities are beyond the scope of an individual project, mitigation may be raised to the level of sector- or strategic-level mitigation. This can be achieved through zoning, adoption of Code of Conduct and Practices, disease exchange and stock movement protocols, regulations, economic and financial incentives, market incentives and institutional issues. Mitigation of impacts associated with location and siting, construction and designing, operation and management are within the capability of individual farms or group of farms. General checklists, GIS, and networks are useful impact identification tools.

3.2.5.5 Report writing and information dissemination and documentation

This is achieved conventionally through compilation of EIA information. The main objective of this section is to provide a report format as well as aspects that should be covered in the PEA and full EIA reports. The mariculture EIA or PEA reports should principally include:

- The original ToR
- Purpose and function of the EIA or PEA report
- Executive or non-technical summary
- Description of the aims of the proposed mariculture project
- Description of the proposed project and its alternatives
- Discussion of the project and current land use or relevant policies
- Description of the expected conditions
- Evaluation of impacts for each alternative

- Comparative evaluation of alternatives
- Identification of environmentally preferred options
- Appendices
- Methodology applied during the study
- Legal and policy relevance
- Definition of technical terms
- Project monitoring and management plan
- A list of the sectors participating in the study

3.2.6 REVIEWING

According to the proposed national general EIA guidelines and procedures, the main aim of EIA review is to measure strengths and weaknesses of the EIA or PEA report. The review also identifies issues that are not covered, inaccuracies of information, problems with logic, or conflicts apparent in the assessment process. On the basis of the review, the information provided is made available to decisionmakers to determine whether the proposal and its effects are acceptable.

According to UNEP (1996), the following are the objectives of a review process:

- To determine whether the information is correct and scientifically and technically sound
- To decide whether the information has been presented so that it can be understood by both decisionmakers and the public
- To determine whether the EIA report is an adequate assessment of environmental effects, and of sufficient relevance and quality for decisionmaking
- To determine whether additional information or prescriptions are required
- To collect and collate the range of stakeholder opinions about the acceptability of the proposal and the quality of the EIA process
- To ensure that the EIA report and process complies with the terms of reference
- To determine whether the proposal complies with existing plans, policies, standards and codes of conduct
- To ensure that the EIA process was conducted appropriately, and the point of view of all parties involved were taken into account

The proposed national general EIA guidelines and procedures indicate that EIA reports will be reviewed by NEMC with the assistance of a multi-sectoral and interdisciplinary group.

The most relevant tools to aid the review process include:

- Site verification through visits and discussion with local officials and residents
- Use of scoping report and approved ToR
- Report-writing guidelines and environmental check characteristics for a particular mariculture project
- Expert opinion
- Adapted standard review criteria

Mariculture-Specific Modifications

NEMC will review the EIA report within 45 days of issuing a confirmation that the report was received. The review will be done with the TRC. NEMC will then prepare a review report evaluating the strengths and weaknesses of the EIA report. The investor may be required to revise the report if there are gaps in the information or process. NEMC may also pursue independent confirmation of the information.

According to the proposed national general guidelines and procedures there are four review areas:

Area one

- Description of the project, local environment and baseline conditions. The focus is more on the purpose and objective, design, size and scale of development, and raw materials used in construction and operation phases
- Site descriptions of affected areas are clearly shown and land required is specified in relation to existing land use patterns
- The adequacy of baseline information describing the environment of the study area which could be the basis for impact prediction and monitoring

Area two

- Consideration is given to methodologies used in the analysis of impacts
- The logic used to identify potential impacts for all phases of the project
- Scoping methods are adequately described and justified
- Groups affected by the project are clearly identified

Area three

- The focus is on the consideration of other project alternatives
- All significant impacts have been considered for mitigation
- An effective environmental monitoring and management plan is in place
- Commitment to mitigation measures

Area four

- The focus is to see whether there was adequate and genuine consultations with all stakeholders and their concerns are incorporated in the EIA report
- Presentation of the information is appropriate and logical
- The report is balanced with no undue emphasis or prominence of bias
- There are no gaps and conflicting statements
- The non-technical summary of the analysis and main findings are clear and justified

If the review team is not satisfied by the report, the team will provide the investor with a list of identified weaknesses for revision. The revised version will be resubmitted to the same team for further review.

Public involvement is crucial during review in order to promote more democratic forms of decisionmaking and minimize serious conflicts within the society. The proposed general EIA guidelines and procedures also suggest that the public must be consulted. Public consultation can be done by putting notices in newspapers, radio, public placers and posters (public notes), presentation of EIA reports in public libraries (public review), workshops, meetings (public hearing) and use of questionnaires to collect public views to assist in making the final decision. NEMC or the District Technical Teams will collect public views within 21 days.

A public hearing(s) will be conducted for mariculture projects that have strong public concerns. This should be used as a chance for the public to express concerns or ideas about the proposed mariculture project. NEMC will coordinate the public hearing and collect views from participants or respondents. Issues of mandatory and voluntary compensation for foregone resources (apart from land) will be reviewed at the public hearing.

At the end of the review process the EIA will be classified by NEMC according to the rating proposed in the national general EIA guidelines and procedures (NEMC, 1997) as shown below.

- A Excellent - No task left incomplete
- B Good - Only minor omissions and inadequacies
- C Satisfactory, despite omissions and inadequacies
- D Parts are well attempted but must as a whole be considered
 unsatisfactory because of omissions and/or inadequacies
- E Poor - Significant omissions or inadequacies

Methods of Public Consultation

1. Meetings and workshops

These are gatherings of affected and interested parties to exchange information and views on the proposal. The importance of these meetings include:

- Provision of background information on the proposed mariculture project
- Identification of other interested and affected parties
- Response to any question or concern regarding proposed mariculture project
- Actively seeking information which could include perceptions of needs, attitudes to specific aspects of the proposed mariculture project and issues of concern
- Identification of reasonable alternatives and or significant issues associated with the proposed mariculture project
- Provision of feedback to the public (e.g. progress of investigations or completion of the EIA)

2. News advertisements

These are used to provide information to the general public on a proposed mariculture project and at the same time solicit comments from the public. The advertisement may include response forms on which readers can express their views. The way in which an advertisement is placed determines the number of people that are reached. It is important to place the advertisement in a prominent place in the newspaper. The limitation of this process is that it excludes members of the community who are illiterate and the poor who cannot afford to buy the newspaper. Therefore it is important to use a number of methods in order to reach as many people as possible.

3. Surveys, interviews and questionnaires

Surveys can provide an expression public feelings but not just the people that are most directly affected. They are also useful in gathering opinions of people who are not willing to speak out in the public meetings.

4. Advisory groups

- Include NGOs, Community-Based Organizations (CBOs), and village organizations
- May provide a cross sampling of public views and concerns. Members of the group have a chance to be informed about the issues before coming to conclusions and have a better understanding of the consequences of the decision
- Enhance personal relations. The result is that members of the group develop a deeper understanding of the concerns of other stakeholders and establish relationships that serve as a moderating influence on more extreme ideas
- Serve as a communication link back to the community
- Assist in determining the ToR for the EIA

Source: National Environment Management Council (1997)

3.2.7 DECISIONMAKING

An EIA is designed to inform and promote environmentally sustainable decisionmaking at all levels, from planning to farm operation and management. The EIA process itself involves significant input into design and planning. Therefore an EIA may be considered as a process of review, negotiation and incremental decisionmaking. The final use of an EIA report and associated decisions by a responsible authority is to ensure that the EIA will not have a long-term impact on environmental management.

NEMC is responsible for decisionmaking and provision of an environmental permit. The process involves a large number of trade-offs between economic and social gain benefits, and environmental loss. The latter implies assigning relative priorities. These trade-offs are explicitly justified and reported with decisions related to the EIA. The decisionmaking report is comprised of:

- A statement explaining the decision
- An explanation of environmental preference
- The social, economic and environmental factors considered in making the decision
- An explanation of the mitigation measures adopted
- A summary of the monitoring and enforcement program that has been adopted to ensure that mitigation measures are implemented
- Supporting documents from other institutions obtained during this process

ENVIRONMENTAL PERMIT

At this point, NEMC will issue the Environmental Permit and development can proceed.

3.2.7.1 Appeals

The proposed national general EIA guidelines and procedures suggest that an investor or any affected/interested party has the right to appeal decisions made during the EIA process. The guidelines elaborate that if dissatisfied with the decision reached at any stage in the EIA or PEA process, an appeal should be made to the minister responsible for environment. The minister shall appoint a panel of five people to listen to the appeal. The chairman shall be the high court judge and the remaining shall include three experts

and one member from the general public. The results of the appeal shall be communicated to NEMC for action.

Mariculture-Specific Modifications

An investor or the affected community has the right to appeal if not in agreement with the decision made by the review team. Once the mariculture guidelines are legally adopted all appeals should be made to the minister responsible for environment. The minister shall appoint a panel of five people to listen to the appeal. The chairman shall be the high court judge and the remaining shall include two experts, one member from the general public, and the other member shall be the chairman of the private sector board. The results of the appeal shall be communicated to NEMC for action.

3.2.8 MONITORING

3.2.8.1 Introduction

Monitoring refers to the mandatory and regulated collection of sociological, biological, physical or chemical data from preselected locations such that ecological and sociological changes attributed to mariculture operations can be quantified and evaluated. It is an integral part of environmental management, but it is neither well developed nor legally accommodated within the institutional and regulatory framework of the nation. The Science and Technical Working Group of the Tanzania Coastal Management Partnership has directed its efforts to developing strategies for ecosystem monitoring, but no attempt has been made to develop mariculture-specific monitoring guidelines. The discussion below identifies the areas where monitoring plans and environmental standards should be formulated, and recommendations are made for the institutionalization of these.

Effective monitoring is an essential and important tool for effective environmental assessment and the promotion of sustainable development, therefore monitoring is required not only to ensure that mitigation and environmental management plans are implemented, but also to measure the efficiency and accuracy of the previous impact analysis. All information gathered within the monitoring subprograms, such as those for

social and cultural aspects, water, land, and air quality are evaluated and reviewed leading to program modifications if necessary.

According to the module of best practice in the Australian EPA (1995b), monitoring also provides the information for periodic review and alteration of the project management plan as necessary, thus ensuring that environmental protection is optimized at all stages of development through best practices. In this way undesirable environmental impacts will be detected early and remedies effectively applied.

The overall goal of monitoring is to demonstrate to government institutions, private sector and members of the public that mariculture operations comply with environmental quality objectives determined through the EIA process and achieve good environmental performance.

The management of mariculture development is within the mandate of the Fisheries Division. However, mariculture activities affect many other sectors like forestry and beekeeping, mining, water, lands and human settlement development, trade and industries, agriculture, and environment, as well as the private sector. Therefore monitoring of impacts of mariculture development requires a coordinated approach and is a function of all sectors having a stake in the coastal and marine environment. To assure that an intersectoral approach adequate to the task is taken, a multi-sectoral team with members drawn from various government sectors will monitor mariculture activities and provide reports to NEMC.

3.2.8.2 Objectives

The main purpose of monitoring mariculture operations should be to ensure that:

- Project design and operations adhere to mitigation measures recommended in the EIA report
- Farm management is improved through optimization of husbandry practices
- Product quality is improved and maintained (bacterial, chemical, or natural toxin contamination is protected)

- Best information for research is collected through identification of trends and unexpected impacts
- Long- and short-term trends are detected

3.2.8.3 Principles of monitoring

Biophysical and social factors govern the best practices for each site. Therefore the diversity of ecosystems, employed mariculture technology, land uses and topography greatly influence the design of the monitoring program. Figure 6 shows stages involved in designing a monitoring program and these define the subprograms that form the monitoring program and include such aspects as water quality, land degradation, ecology, air pollution, noise, process and waste, and social and economic aspects.

3.2.8.4 Scope

The scope of a monitoring program depends on the size of the project, operation systems and location. More intensive monitoring is required for large mariculture projects. The level of monitoring is related to the level of the EIA. Monitoring is done on an individual farm level for a project EIA, or on a group level for a group of farms involved in the monitoring scheme, or on a sector level for estuaries, bays, lagoons, or wetlands that are likely to be affected by mariculture activities.

3.2.8.5 Mariculture Standards

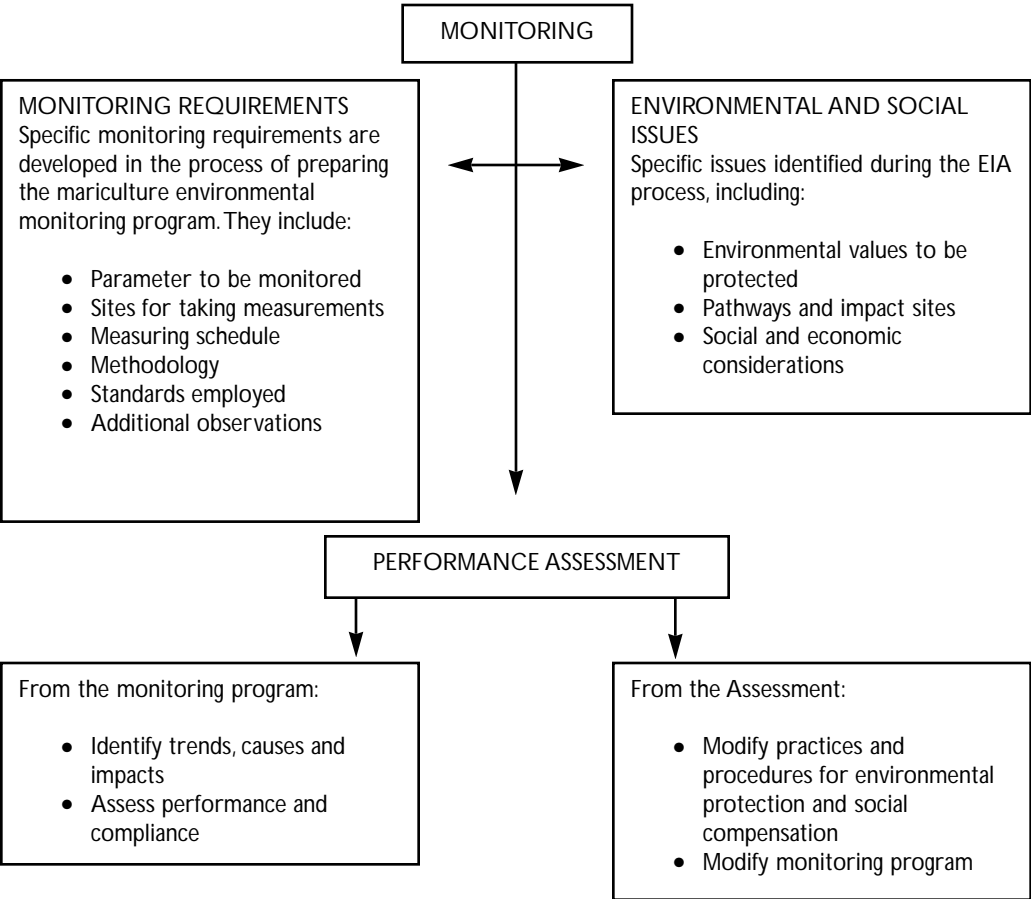
Mariculture development in Tanzania has been slow. As a result, national standards for monitoring mariculture operations are not available. However, a review of mariculture initiatives and experiments show that mariculture has great potential in Tanzania. There is an opportunity to develop sustainable forms of mariculture through learning from experiences in other parts. Many of the standards needed for mariculture development can be readily adapted from other nations.

Recommendation

In the absence of national mariculture monitoring standards, the use of regional and international code of conduct and practices, agreements, protocols and adherence to relevant sectoral regulations and policies should be adopted. Examples of sectoral regulations include the Mangrove Management Plan (1991), Effluent Standards for Receiving Water (1981), Fisheries Policy (1997) and proposed EIA guidelines.

The Fisheries Division should coordinate research into development of mariculture monitoring standards and make recommendations for development of these.

FIGURE 6 PROCESS OF ENVIRONMENTAL MONITORING AND PERFORMANCE ASSESSMENT



(Source: Modified from Best Practice Environmental Management in Mining 1995)

3.2.8.6 Surveillance

Surveillance and inspection as a part of compliance monitoring should be participatory, using the villagers, local government, and the investors.

Local government through the District Technical Committees should develop monitoring and surveillance protocols for all mariculture projects within their jurisdiction.

3.2.9 ANNUAL ENVIRONMENTAL REPORT

The investor is required to prepare an Annual Environmental Report (AER) and submit it to Fisheries and NEMC. The AER includes explanations about current and proposed activities, environmental management and rehabilitation plans.

3.2.10 ENVIRONMENTAL AUDITING

Environmental auditing is a management tool comprising of a systematic, documented, periodic and objective evaluation of how well environmental organizations, management and equipment are performing with the aim of helping to safeguard the environment by:

- Facilitating management control of environmental practices
- Assessing compliance with company policies which include meeting regulatory requirements

The proposed national general EIA guidelines and procedures do not contain guidance for environmental auditing for mariculture development in Tanzania.

Recommendation

In order to reduce risks and improve the performance of mariculture projects, auditing guidance is provided to enable easy assessment of the accuracy of the measures predicted in the EIA.

3.2.10.1 Reasons to undertake environmental auditing

With improved awareness of the need for environmental protection, the mariculture industry will increasingly need to rely on environmental audits. The principal aims of an

environmental audit are to identify and evaluate potential liabilities, risks and hazards. This in turn will assist in assessing the viability of operations after including the cost of reducing environmental risks and reducing liability to acceptable levels. Therefore an environmental audit as a management tool can lead to strategies that minimize risk, improve environmental performance, and provide an opportunity to learn through experience.

Unlike EIA which is carried out prior to developing a new project or expanding an existing facility an environmental audit is conducted in existing facilities and operations to assess the environmental impact of current activities by looking at current operations and their immediate past history (EPA 1995c). In fact, environmental audit can be used to assess the predictions made in an EIA and measure whether those predictions were accurate, and if not, make new recommendations to ensure that the environment is protected.

3.2.10.2 Types of environmental audit recommended for mariculture projects

The recommended range of environmental audits for mariculture projects include:

- Environmental management audit— This type of audit is conducted where the company is yet to establish an environmental management system
- Compliance audit—This is an examination of the compliance of an organization, a facility or mariculture operation with environmental legislation, licenses, approvals and other documentation
- Environmental impact audit—This is a special type of environmental audit, which is carried out on an operation that has been the subject of an EIA. It is used to assess the extent to which previous predictions or commitments contained in the EIA are reflected in monitoring during the operation phase of the mariculture project
- Environmental impact performance – This is regarded as an on-going management activity designed to assess practices and procedures which, in the event of failure, could result in environmental impacts

3.2.10.3 *Responsibility*

The responsibility of conducting environmental audits for mariculture projects lies within environmental management institutions. Since the undertaking requires highly qualified practitioners, it is recommended that NEMC or the Division of Environment (DoE) should conduct the auditing. These institutions will, at the cost of the investor, subcontract qualified and experienced experts to undertake environmental auditing. The availability of adequate and good quality monitoring data makes auditing easier and more meaningful.

3.2.10.4 *Decommissioning*

This refers to the situation where an investor decides not to continue with the operation for one reason or another. During decommissioning of a mariculture project three main options should be considered:

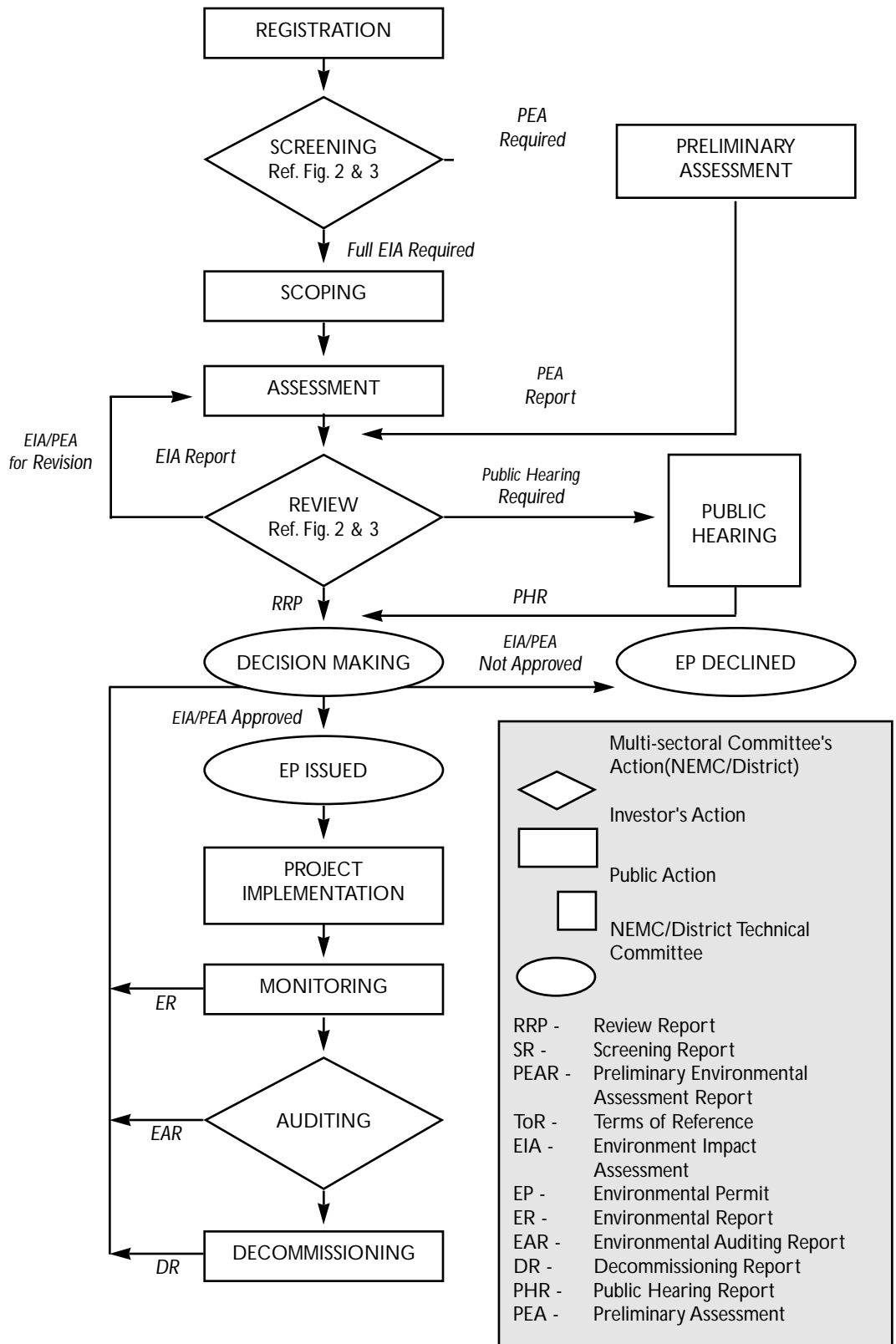
- Option 1. Close the project and leave the area as it is
- Option 2. Close the project and rehabilitate the area to restore the
damaged environment
- Option 3. Close the project and start another activity in the same area
(this option will require a new EIA)

The impacts resulting from each of the three options should be identified and mitigation measures for each of the identified impacts must be proposed.

FIGURE 7

SUGGESTED GENERAL EIA PROCEDURES

Source: Modified From Proposed National EIA Guidelines 1997



Chapter Four

SITE AND SPECIES SELECTION

4

The guidelines for site and species selection are intended as a broad framework to guide mariculture development efforts in a manner that efficiently promotes industry development while protecting the environment and the quality of life for coastal residents. The criteria contained in this section represent a first step in developing criteria for a number of steps in the permitting process such as the EIA and feasibility study. As more experience is gained in mariculture and a better understanding of how mariculture activities fit with the social and environmental context of the nation, more specific criteria can be developed.

4.1 *OBJECTIVES OF GUIDELINES FOR SITE AND SPECIES SELECTION*

Carefully choosing appropriate culture species and sites is a key requirement for establishing profitable mariculture operations that are environmentally sustainable and socially acceptable. Since choosing the right species and site is key to the feasibility of the operation, this should be of great interest to prospective investors.

The prospective mariculture investor in Tanzania is fortunate in that many species can potentially be cultured in a wide range of coastal sites. In the process of site selection, there are two major concerns:

1) **Avoiding environmental damage**

Care must be taken in siting any project in coastal areas, since coastal habitats are the foundation of biodiversity and support nearly all coastal economic activities such as fisheries, agriculture, forestry and sustainable mariculture development. These habitats require careful integration of activities in selected sites to avoid damaging ecologically critical areas and disturbing other economic activities.

2) Selecting a site with the appropriate bio-physical conditions for the species to be cultured, as well as being an adequate site in an operational sense

Each species and type of culture system has special requirements that must be satisfied by the site, otherwise efficient culture will not be possible. There are also additional considerations that must be available if an operation can function efficiently (e.g. good access).

A thorough planning process prior to implementation that includes assessment of which species are most appropriate under given circumstances is necessary to establish viable operations. It is risky to promote any form of mariculture where the biology of the species and the requirement for technology is not well known, since few stakeholders have the time, interest or financial resources to develop competency in researching these topics. The best target species for investment are those whose culture technology has already been demonstrated. Therefore, a comprehensive analysis of suitable sites and appropriate species is a key step in mariculture project planning. Choosing the best species and the most appropriate sites to culture that species increases the probability that the endeavor will be profitable, while protecting the environment.

Recommendation

Criteria for species selection, site selection and culture technology assorted by responsible institution are detailed in Chapter 1, Section 1.7.

4.2 USE OF SITING AND SPECIES SELECTION GUIDELINES

To initiate approval proceedings to legalize a mariculture operation, the investor must submit a project proposal to the Division of Fisheries, NEMC and TIC. Each of these institutions will review the proposal to evaluate it according to their criteria. A number of other institutions may also become involved in the review process. There are four principal uses for the siting and species guidelines in the approval procedure:

1) The Division of Fisheries may use these criteria to prepare guidelines for the feasibility study that assesses the technical aspects of the project. These sites and species guidelines establish evaluation criteria to be used by the Division of Fisheries during the review process of the applicant's feasibility study.

2) Adherence to these guidelines can help avoid environmental damage resulting from locating projects in inappropriate sites. They also help enhance the probability that the project will be successful, thereby reducing environmental damage from abandoned projects. NEMC may wish to consider making use of these guidelines while conducting the EIA for mariculture projects.

3) They are also useful in helping investors to choose likely culture species, and to identify and evaluate sites for their respective projects. TIC may wish to take this into account, perhaps via the opinions rendered during the first screening meeting of the Division of Fisheries, NEMC, the district representatives and TIC. TIC may also use the guidelines to promote mariculture business opportunities to prospective investors.

4) Other institutions may wish to use these guidelines as a reference for their particular institutional reviews.

Recommendation

The siting and species guidelines can be valuable additions to the current evaluation criteria and procedures used by the Division of Fisheries, NEMC, TIC and the District Technical Committees to evaluate and approve mariculture projects.

If used by all concerned institutions, this can help ensure a coherent approach to mariculture promotion and approval.

4.3 *THE NATURE OF THE SPECIES AND SITE SELECTION GUIDELINES*

These guidelines reflect the best scientific knowledge that is available to date and are based on national and international experience developing mariculture systems that are financially, environmentally and socially sustainable. However, the guidelines should not be viewed as static. As scientific and technical knowledge advances, the guidelines must be periodically reviewed and modified. Additionally, these guidelines are general in nature. As mariculture development advances in Tanzania, the guidelines must be modified to reflect the conditions and requirements that are specific to the nation's experience.

Recommendation

The general siting and species selection guidelines should be reviewed periodically and revised on the basis of improved scientific and technical knowledge. They must also be modified periodically to reflect experience gained in Tanzania-specific conditions.

4.4 *STATUS OF GOVERNANCE FOR SITE AND SPECIES SELECTION*

Governance can be defined as the process by which policies, laws and institutions address the issues of concern to a society. There are essentially two mechanisms of enhancing governance in respect to mariculture: government policy and regulations, and self-regulation by industry. These guidelines may be used to strengthen both capacities.

The legal regulatory approach is crucial in order to develop a sustainable mariculture industry. It is essential for preservation of environmental quality, curbing potential negative environment impacts and allocating natural resources between competing users. Currently there is no comprehensive system of regulation for mariculture. There are fragmented regulations that are scattered among the policies, acts and regulations of various institutions e.g. Fisheries, Land, Water, and Forestry. Such regulations are not

designed specifically for mariculture and as a result they do not fully address the needs of mariculture. Examples of existing regulatory frameworks for mariculture management include land use planning, zoning schemes for mangroves and water use rights.

The Fisheries Sector Policy and Strategy Statement of 1997 clearly states strategies that will be followed by the Fisheries Division in overseeing aquaculture development in Tanzania. For example, as far as site and species selection are concerned it is stated that Fisheries Division will strive to, "initiate the establishment of code of conduct for aquaculture to provide guidelines to address issues such as site selection, construction, suitable species, introduction of exotic species, water abstraction, spread of disease and effluent control" (URT, 1997: p. 12). However, Fisheries Policy on aquaculture issues is yet to be operationalized; the code of conduct remains to be fully developed and implemented. Therefore the present work is complimenting ongoing efforts by the Fisheries Division and should help establish the basis of a formal code of conduct.

Another challenge exists because no one institution has complete jurisdiction over mariculture issues. This is exacerbated because of weaknesses in inter-institutional coordination and communication. There is also no comprehensive enforcement or oversight that assures compliance with existing regulations for siting and species selection.

Recommendation

The Fisheries Code of Conduct under development should be considered a priority item for completion. Liaising with other technical institutions could assist in development of this.

4.5 *USE AND MANAGEMENT OF MARICULTURE SITES*

The use and management of a variety of coastal habitats that can serve as mariculture sites is detailed below. A common theme for all potential mariculture sites is that for each habitat type, there is no comprehensive institutional oversight, nor set of regulations that comprehensively regulates its use. The outcome of this presents dual risks. In some cases, an investor could potentially use a particular habitat site in ways which are not legally prohibited, but which could cause negative impacts. On the other hand, in the absence of guiding regulations, government personnel may decide to take an overly conservative approach to permitting, and thus prohibit projects that would be appropriate and beneficial. Establishing siting criteria can help avoid this dilemma.

4.6 *COASTAL HABITATS THAT MAY SERVE AS MARICULTURE SITES*

There is a wide range of coastal habitats which are potential mariculture sites including:

- Mangrove areas
- Intertidal areas
- Estuaries, lagoons and bays
- Coral reefs
- Agricultural land and unarable land, such as rocky areas, salt flats, and marismas
- Freshwater and brackish wetlands

It should be noted that many of these habitat types are recognized as wetlands including coral reefs. As such, the framework provided by the RAMSAR convention (Iran, 1971) for management and wise use will prove helpful. Tanzania was a party to the convention.

4.6.1 *MANGROVE AREAS*

Use for mariculture

Mangrove areas are targeted for mariculture activities for several reasons. The proximity of mangroves to sources of fresh, brackish or seawater often means that a large variety of species can be cultured in these areas. Mangroves have also historically been viewed as

wastelands and have been under public ownership. The desire to find a productive use for these supposed "wastelands" and the facility with which concessions could be granted, meant that they were targets for mariculture. Use of mangrove areas for some forms of mariculture ultimately proved to be environmentally destructive. Prawn culture in particular, was regarded as a good use of mangrove areas in the past, but this practice is no longer recommended because clearing mangroves for prawn culture has been found to be environmentally and socially harmful. Mangrove areas have also been shown to have soil characteristics that are unsuitable for prawn culture.

It is now widely recognized that mangroves are extremely valuable both ecologically and economically and therefore should be preserved intact where possible. They also play an important role socially, since many coastal dwellers use them as sources of firewood, fishing areas and sources of other food.

Mangrove areas can be used as mariculture sites, provided that extensive cutting is not required and that the activity can be integrated into the array of traditional uses such as gathering and fishing that traditionally take place in mangrove areas.

Examples of appropriate uses of mangrove areas for mariculture activities may include the culture of mollusks, mangrove crabs (*Scylla serrata*), finfish (e.g. mullets, milkfish) and silviculture (culture of mangrove species).

Potential impacts

Siting mariculture operations in mangrove areas may cause a number of environmental impacts, particularly when these areas are cleared for ponds. Cutting of mangroves can cause loss of nursery areas for aquatic life, shelter for wildlife and birds, protection from coastal erosion, and loss of fishing and gathering areas for communities. Even when cutting is not required, care must be taken that water flow is not altered within mangrove areas, contaminants are not released that harm the trees, and that privatizing previously held public lands does not cause social and economic impacts.

Jurisdiction and management

Mangroves are managed by the Forestry and Beekeeping Division through the Mangrove Management Project. Any activity taking place within the mangrove area is subject to the approval of the Director of Forestry and Beekeeping. However, several other institutions may also have authority over use of mangroves for mariculture.

There are three scenarios which might involve mangrove areas and mariculture projects:

- 1) Projects proposed for areas classified as Zone IV (mariculture permitted under certain conditions)
- 2) Projects proposed for non-Zone IV areas (mariculture not permitted)
- 3) Change in land use utilization for existing activities (e.g. using a salt pond to culture fish)

Siting of mariculture activities in mangrove areas is confined to Zone IV as stipulated in the Mangrove Management Plan (MMP) (Semesi, 1991). The MMP effectively prohibits all mariculture activities in mangrove areas other than Zone IV regardless of whether the project produces real impacts or not. Therefore, even small-scale, low-impact mariculture activities that are believed to be compatible with preservation of mangrove areas have not been permitted to date. This is due to the application of the precautionary principle, but this issue should be revisited in light of recent development of aquaculture technology that may allow small-scale, low intensity projects (e.g. cage culture, raft culture) to take place in mangrove areas without impacts.

Although the MMP states that mariculture activities may be permitted in Zone IV, several proposals have been denied due to lack of knowledge regarding possible impacts and inavailability of written criteria that govern permitting of mariculture projects within Zone IV areas. Forestry and Beekeeping Division is required to consult other institutions to evaluate questions of potential impacts on the mangrove forest.

Prior to 1991 when the MMP was not in place, the Ministry of Lands gave permission for both occupancy and specific use of land, including mangroves. Jurisdiction by the

Ministry of Lands over occupancy and specific use of land has resulted in conflict with the MMP where land has been classified as mangrove reserve since the original classification.

One weakness of the MMP is that there is currently no time frame given for revision of the zoning scheme. Mangrove forests change over time. Mangroves have grown up in areas which were previously not classified as mangrove and were therefore in legal use. Conversely, mangrove areas may retract. There is a need to periodically re-evaluate zoning due to natural changes in mangrove forests, which may alter the MMP's ability to permit mariculture within specific areas.

An example of how multi-sectoral coordination for the management of mangrove areas can be conducted is seen in the manner in which a multi-sectoral committee was appointed to oversee the management of the Rufiji Delta mangrove area that was being considered as a mariculture site. The controversial proposal to farm prawns in the Rufiji Delta led the government to establish an intersectoral committee to oversee activities in the delta with respect to prawn farming. This committee is comprised of representatives from MMP/ Fisheries, TAFIRI, Division of Environment, Marine Parks and Reserves Unit, and the Planning Commission. A similar committee or advisory board could be a mechanism by which management of these areas could be made more effective.

Recommendations

It is recommended that in order to ensure that the MMP regulations are adhered to, siting procedures should involve other stakeholders through intersectoral mechanisms involving the following sectors. Further details are presented in Chapter 1, Section 1.7.

Fisheries: To guide the feasibility study of the proposed project and assist NEMC to render an opinion as to the impact on surrounding or adjacent mangroves

NEMC: To guide an EIA study for the project. Where necessary, communicating with the Division of Fisheries for assistance in evaluating potential impacts

Forestry: Manages mangrove forests and oversees mariculture activities in Zone IV

Lands: Provides title deed to the investor or authorizes certificate of variance

Mining: Currently responsible for issuing permits for solar salt production. It is recommended that Mining should collaborate with other sectors, particularly Forestry and Beekeeping, during the process of issuing permits

Local government: Approves land and water use rights. It is recommended that local government in collaboration with the community do an initial assessment on the availability of the land for mariculture activities before contacting other institutions in order to avoid conflicts.

Increased stakeholder consultation in the approval process where mangroves and mariculture are involved should be encouraged as recommended in Paragraph 2.3 (p. 18-22) of the MMP. This will reduce chances of potential conflicts among the various user groups. Criteria for stakeholder involvement are included in the plan. The institutions involved will need to formulate good mechanisms for dealing with new issue or gray areas when these are encountered.

It is recommended that the MMP should involve the public so that potential conflicts can be averted early in the process.

4.6.2 INTERTIDAL AREAS

Use for mariculture

Intertidal areas can be ideal mariculture sites. These areas experience an extensive tidal range and are most commonly used for culture of shellfish, bivalves and seaweed.

Intertidal areas are currently the most intensively used type of habitat in Tanzania, since seaweed culture is the primary form of mariculture and it continues to expand. It is expected that use of intertidal zones for seaweed culture will continue to expand into new areas, and intensify in areas currently used. These areas remain among the most vulnerable of fragile habitat types, particularly since no one institution has jurisdiction over their use.

Potential impacts

Intertidal areas contain a variety of habitat types such as sand flats, coral reefs and sea grass areas which may be damaged either directly or indirectly by mariculture activities. For example, if seaweed farms are sited in sea grass areas, the sensitive sea grass can be eliminated by continual trampling. Seaweed farmers can also come into conflict with other resource users such as hoteliers or fishers because of access issues. Careful planning and siting, as well as setting upper limits to the number or density of farms can help avoid these problems.

Jurisdiction and management of intertidal areas

Currently intertidal areas are subject to several multiple uses such as seaweed culture, fishing, tourism, and providing general access between the shore and sea. There is no single sector which can claim responsibility for management of the area and this makes it difficult to address the issues of ownership, access, and conflict with traditional users such as fishers and gatherers.

Recommendations

A system of coordinated management and institutional oversight is needed. This could be accomplished by the Fisheries Division in collaboration with other sectors such as the Maritime Department, Tourism and local government.

A priority for planning is the mapping and characterization of these areas as the informational base for spatial planning so as to accommodate the varying needs of different users.

As pressures increase upon the use of the intertidal area, criteria are needed to determine safe limits of use by the various activities, and a system of vigilance and conservation needs to be instituted.

4.6.3 ESTUARIES, LAGOONS AND BAYS

Uses for mariculture

Sheltered aquatic areas may offer good sites for mariculture. These areas are commonly used for net pens, cage culture, bottom culture, rafts, and longline culture for a variety of species, including finfish, mollusks and shrimp.

Potential impacts

Because sheltered aquatic areas are normally sites of human habitation and other activities, resource user conflicts are likely impacts if pens, cages or other structures are placed in these areas. Good planning and a consultative process with stakeholders before establishing mariculture activities in these areas can help avoid these types of conflicts. Because these areas are usually near population centers, the investor must be aware of the potential for vandalism and theft that may affect the profitability of the operation. The mariculture operator will most likely be obliged to provide their own system of security.

Environmental contamination can result from pen, cage or longline culture if wastes from the operation accumulate beneath the structures, or otherwise contaminate the waters. Careful estimates of the amount of waste to be generated by the operations and the capacity of the aquatic system to absorb contaminants are needed as part of the EIA process. Care must also be taken not to disturb important benthic communities such as sea grass beds or coral reefs. Alteration of water flow should also be avoided where possible.

Jurisdiction and management

These areas are not under the jurisdiction of a single sector and generally lack oversight except for very specific areas for navigation issues. The Water Department and the Harbors Authority have jurisdiction over some aspects of these waters. The Water Department controls water use rights and the Harbors Authority controls issues related to navigation and projects within the peri-harbor area. The fact that these areas fall under the public domain could lead to conflict with other forms of resource use such as fishing, tourism and navigation.

The result is that mariculture could be conducted with almost no regulatory oversight, or they may not be allowed in these sorts of water bodies at all in the absence of a regulatory body.

Recommendations

First, a system of management and regulation for these types of water bodies is required in relation to mariculture issues.

Secondly, in areas where mariculture development is poised to begin (e.g. Tanga), there is a need to determine the carrying capacity of specific areas and a system of zoning developed accordingly.

To address these, the Division of Fisheries should collaborate with other sectors such as Tourism, Maritime, and MMP where applicable, and the local government to develop

Recommendations, continued

means of regulating and planning for economic activities in these areas. Fishing in these areas is under the jurisdiction of Fisheries, tourism activities are under the Division of Tourism, and navigation falls under the Maritime Department.

The use of marine and brackish waters for mariculture uses is not covered by the Water Utilization Act (Water Department). Occupation or right of use of open water is also not covered. See Chapter 2.

4.6.4 CORAL REEFS

Use for mariculture

Many reef species can be cultivated in or near coral reef areas, but only under limited and strictly regulated conditions to protect these sensitive areas. Culture of giant clams (*Tridacna* sp.), pearl oysters (*Pinctada* sp.), sponges and corals for the aquarium trade do not adversely affect the integrity of the reef if carefully implemented. These activities are common in many other countries. Cultivation of certain species for extraction of pharmaceutical compounds is increasingly being explored in other countries and may be a possibility in Tanzania someday.

Potential impacts

Coral reef areas are fragile and may be damaged by activities such as anchoring by boats, or by placing solid structures such as cages on them. Sedimentation from mariculture wastes or shading from solid structures could also harm corals. Thus, any mariculture activity proposed to occur in these areas must include mechanisms that prevent these impacts from occurring. However, use of areas adjacent or near coral reef areas for mariculture can have beneficial impacts as these can provide economic incentives to protect reefs and may help relieve pressures upon coral reefs by providing alternative economic activities.

Jurisdiction and management

The Marine Parks and Reserves Unit, through its mandate, has to prepare a zoning scheme for all coral reefs and other protected areas within its jurisdiction so as to accommodate mariculture activities. Division of Fisheries is also involved in the management of coral reef areas as stipulated in the Fisheries Act of 1970. The campaign to eliminate dynamite fishing is relevant to mariculture as it will establish a law enforcement capability on the coast.

Recommendation

Zoning schemes for coral reef areas should take mariculture into consideration. Detailed guidelines that identify and provide for compatible mariculture uses should be included.

4.6.5 AGRICULTURAL AND UNARABLE LAND

Use for mariculture

Extensive areas of agricultural and unarable land suitable for mariculture are found in coastal areas and could be used for earthen pond culture. Unarable land includes saltflats and marismas behind mangroves.

Potential impacts

While both types of land are commonly used for all types of mariculture, care must be taken to avoid disturbing habitat areas and caution is dictated to protect the water supply. If arable land is used for brackish or saltwater culture, care must be taken not to cause salinization of the groundwater through seepage or through discharge of effluents. This can be avoided by lining ponds and water intake canals, discharging water containing salt only back to the original source, and by understanding the groundwater situation so that subsidence or contamination is avoided by pumping.

Areas such as sand flats and marismas may be regarded as lacking economic value, and are thus targeted for pond construction. However, care must be taken with use of these areas since they provide habitat for wildlife and waterfowl.

Jurisdiction and management

Management of lands is under the jurisdiction of Lands and the use of freshwater on such land is under the Water Department (Chapter 2). The major gaps in this area are in regard to the use of brackish or marine waters, and the abstraction of such in areas which could potentially be contaminated by salt.

Recommendations

Measures for the prevention of salinization of arable land may be added to the water policy.

Care should be taken not to overutilize certain habitat types such as marismas and saltflats on the theory that they serve no purpose. The ecological value of these areas should be considered during planning for mariculture development.

4.6.6 FRESHWATER AND BRACKISH WETLANDS

Some of the lagoons and estuaries described above may have adjacent swamps which in the past were thought to serve no useful purpose and sometimes were turned into fish ponds through reclamation. However, the ecological and economic value of wetlands is now properly recognized since these serve as nursery areas, fishing grounds, and habitats for wildlife. These areas are subject to annual flooding, during which much of the area may be under water. Freshwater fish farming in this zone will have some practical problems and constraints. The major requirements to be considered include provision of water to the ponds, provision of drainage, and the permeability of the soil as this zone lacks a high clay content in the soil. Aside from conversion to earthen pond, cage culture may be practiced in areas with standing water.

Potential impacts

Wetlands should be protected from conversion to other uses or draining them as this removes valuable habitat areas and may affect other economic uses. The form of mariculture most likely to be environmentally friendly in these areas is cage culture.

With this form of aquaculture, care must be taken not to disturb sensitive vegetation or wildlife. Traditional uses of these areas must also be respected.

Jurisdiction and Management

Management of lands is under the jurisdiction of Lands and the use of freshwater on such land is under the Water Department (Chapter 2). The major gaps in this area regard the lack of regulations for use of brackish or marine waters, and the abstraction of such in areas which could potentially be contaminated by salt.

Most Coastal Habitats Are Not Comprehensively and Completely Regulated and Managed

As can be seen from the above discussion, a general challenge for coastal management is that most coastal habitats are not under the jurisdiction of any one institution. Most fall under the jurisdiction of several institutions depending on the proposed use. In some cases, there is little oversight for specialized activities conducted in a particular type of habitat.

Similarly, mariculture activities, as well as many other economic activities are not completely addressed in the regulatory framework of the nation, thus approving or prohibiting particular uses becomes difficult. These jurisdictional and regulatory gaps impede both economic development and protection of sensitive coastal environments.

Recommendation 1

Assigning jurisdiction for coastal habitats not currently covered to one or more responsible institutions will allow these institutions to more effectively manage and regulating the use of each habitat is needed.

Recommendation 2

Revising the regulatory framework to accommodate mariculture activities within particular habitats will provide a basis for decisionmaking on allowable types and forms of mariculture.

4.7 *SITE SELECTION AND TYPE OF CULTURE SYSTEM*

Most mariculture activities can be broadly divided into two types: 1) earthen pond culture; and 2) open water culture systems. Each type has a number of variants. Additionally, hatcheries which supply juveniles of any species for grow-out constitute a third type of culture operation which has unique characteristics. The following discussion is intended to establish broad, general criteria for choosing sites that will allow each type of operation to be biologically and financially successful, while avoiding most of the well-known potential problems with operations or impacts.

These criteria will be useful to orient the potential investor, as well as those personnel of public institutions responsible for regulation of mariculture activities.

4.7.1 *SITE SELECTION CRITERIA FOR EARTHEN POND CULTURE*

The following are general considerations for earthen pond culture. More detailed criteria are given in following sections for individual species.

1. *Location.* The ideal position for a pond is one where it can receive water supply by gravity or tidal flow, and discharge the used water under gravity. Ponds should be ideally located in areas where construction will cause the least disturbance to sensitive habitats or other economic activities.

2. *Water quantity and quality.* The availability of water of appropriate quality is important for all systems of mariculture. The temperature of the water will be an important factor in determining whether the selected species can be cultured on the site. Salinity and other water quality parameters are also important environmental factors which have to be taken into account.

The availability of water is particularly critical for pond culture. There must be a sufficient volume to satisfy the needs of the operation in all seasons, without affecting

the needs of other users. Diverting natural water flows in such a manner that downstream use or habitats are impacted should be avoided.

Attention to discharge quality and quantity is required. High turbidity can affect primary productivity, and consequently, fish productivity. The use of settling tanks, different types of filters and repeated application of gypsum can alleviate turbidity problems. Suitable pH of the water for culture purposes lies in the range 6.7-8.6. The capacity of the receiving water to dilute the discharge to acceptable levels should be considered. A general principle should be that the discharge from ponds should not be of lesser quality than the water taken in from the natural system. Specific water quality standards for each specific water body type are needed to quantitatively evaluate the impact of discharges.

3. Soil quality - Impermeable soil is the best with which to construct a pond. Acid sulphate soils should be avoided. Potential and existing acid sulphate soils are generally found in mangrove swamps and marshy back swamps, on the seaward side of river deltas and on marine and estuarine plains.

Earthen ponds can be constructed in agricultural land, saltflats, unarable land, and Mangrove Zone IV as stipulated in the Mangrove Management Plan.

4.7.2 SITE SELECTION CRITERIA FOR OPEN WATER CULTURE SYSTEMS

Open water culture includes mollusc culture in shallow salt water areas, seaweed farming in coastal seas, pen and cage culture in sea water bodies. In selecting sites for such systems of culture, the main considerations are hydrographic and climatic conditions. The most suitable and preferred areas are bays, estuaries and lagoons that are protected from strong winds and rough seas. While moderate currents and water flows are necessary to maintain water quality and removal of waste products from farm sites, frequent storms and turbulent seas will make it difficult to practice most types of culture. Winds will directly affect culture installations above the water surface, whereas waves affect both the submerged structures and the organisms under culture. In most cases low current velocities are preferred.

For bottom culture system (e.g. mollusc culture), the nature of the sea bed is important. Suitable stable substrates are needed for the attachment of the animals. Care must also be taken that benthic communities are not affected.

For the culture of filter feeders (e.g. oysters, mussels) it is essential to select sites with high primary production. In order to make natural food available to the animals, the current speed should not exceed five cm/s. Other water quality considerations may include avoidance of sites where pollution from other activities, chemical contamination, or bacterial contamination could effect production or human health.

Where culture operations depend on wild seed/spat, it is advisable to select sites where there is an abundance of seed/spat.

Available sites in open water include lagoons, bays, estuaries and intertidal areas.

4.7.3 SITE SELECTION CRITERIA FOR HATCHERY PRODUCTION

The methods used to produce seed or stock for aquaculture production vary considerably with the species cultivated and the type of technology, as well as with the level of operation (e.g. extensive or intensive). Sophisticated hatchery systems are not necessary in areas where it is feasible and economical to collect eggs, larvae or fry from the natural environment or where techniques for artificial propagation are poorly developed. However, even in these situations, it is generally accepted that ultimately, hatchery production of seed will be necessary in order to stabilize and ensure regular supplies and introduce breeding techniques for the production of improved seed for better growth and production.

There are different types of hatchery facilities in use, depending on the species, locality and investment capabilities of the aquaculturists. However, regardless of these differences, the requirements of a hatchery are the same, namely:

- Presence of the necessary facilities for holding or rearing an adequate broodstock
- Spawning or stripping, and fertilization of ova

- Incubation of fertilized ova
- Rearing of larvae to the required stage for transfer to nurseries or other culture facilities

Hatchery site selection criteria include the following:

- Where possible, the facility should be located as near as possible to the end users of the stock so that lengthy transportation periods are reduced
- When local species are being spawned, care should be taken to maintain genetic diversity and local broodstock should be used where possible
- If exotic species are being bred, quarantine conditions should be instituted to prevent escape into the wild
- Excellent water quality is needed since the young of many species may be more sensitive to contaminants than mature individuals. Where possible, wells are suggested as a means of preventing contamination from pollutants, bacterial sources or turbidity. Abstraction of water should not produce adverse environmental or social effects
- All hatcheries will need a source of abundant and clean freshwater for cleaning and human use
- Discharge of water from hatcheries must be managed to avoid release of chemicals or pharmaceuticals. No physical effects such as erosion or turbidity should result.
- Hatcheries generally require well-trained technical staff. If the hatchery is located in a very isolated area, or if good transport is not available, then it may be hard to retain technicians for a long period of time. Unskilled labor must also be available locally
- The environmental and socioeconomic impacts of establishing a commercial operation in a new area must be considered

Construction of the hatchery should be conducted in such a way that sensitive habitats are not disturbed. The general siting guidelines for the various habitats should be followed in this case.

Guidance Statements on Site Selection

The following summarize the recommendations for siting each of the three principal types of culture.

Site Selection - Pond Culture Systems

In selecting ideal locations for an earthen pond culture system, an investor shall take into account soil quality, water quality and quantity, socioeconomic and environmental factors.

Therefore, qualitative and quantitative analysis of these aspects is essential, and which must be conducted by a competent party. The location chosen should interfere minimally with sensitive habitats and other economic activities. Successful operation is dependent on compliance to the specified standards before embarking on any operation.

Site Selection - Open Water Systems

In selecting the ideal location for an open water culture system, an investor shall take into account water quality, substrate type, primary productivity, hydrography, availability of seeds, degree of exposure and socioeconomic factors. Conflicts with other uses should be avoided.

Site Selection - Hatcheries

The location of a hatchery for both finfish and shellfish requires optimum water quality, water quantity, accessibility, appropriate topography, technology and adherence to environmental standards. This is important for high quality seed production.

4.8 SPECIES SELECTION

Tanzania has a relatively limited range of experience with mariculture, but the potential exists to cultivate a large number of tropical aquatic species. Attention to species selection is important because in spite of the tremendous potential for mariculture, resources and personnel to support development efforts are limited. If mariculture development is to be successful, the use of limited resources must be efficient. This can be achieved if species that have demonstrated success are prioritized.

The following species have been successfully cultured in Tanzania

(Mshigeni, 1983; Mafwenga, 1994):

Seaweed - *Kappaphycus alvarezii* (*Eucheuma cottonii*), *Eucheuma denticulatum* (more commonly known as *E. spinosum*)

Finfish - *Oreochromis* spp. (tilapia).

4.8.1 SEAWEED

The area under cultivation for seaweed and the number of people involved are on the increase. Conflicts with other resource users (e.g. tourists and fishers) have already been reported (TCMP, 1999). This indicates that some form of legislation or management tool such as zoning is needed to resolve or avoid potential conflicts. According to Mtolera et al. (1992) the technology for *Eucheuma* farming has been well adopted by villagers. However, a number of issues still remain poorly studied, for example, ecological consequences of seaweed farming and its long-term impact on the socioeconomic set-up of the local communities.

The following species are already under cultivation in the country: *Eucheuma cottonii* (source of carrageenans) and *E. spinosum* (source of carrageenans). An agarophyte (agar producer) *Gracilaria* sp. could also be cultivated using the same technology.

1. Suitability for culture

Seaweed culture has the advantage that the technology is simple and has been demonstrated to be easily adopted by villagers. Women are the primary cultivators of seaweed and the additional income has benefitted their families and communities. It is a low maintenance activity that allows the farmer to engage in other activities as well. There are abundant natural habitat areas with good water quality where the industry can expand. An international market exists, and marketing channels have been developed within Tanzania

2. *Ease of technology*

The culture technology is low, and very little investment is required to start since labor and capital costs are low. The species reaches market size quickly and with little attention.

3. *Challenges and opportunities for development*

Despite the rapid spread of the technology, there is room for improvement. Quality of existing harvests can be improved if technical assistance is given to the farmer.

Currently, most technical and marketing assistance, as well as the materials for start-up, are provided by the seaweed marketing companies in return for a low, fixed price for the crop. This system was established on the mainland to encourage the companies to start operations, but it has resulted in low and stagnant prices. Also, the system of allocating exclusive rights of a villages' production to the companies has eliminated free competition which might mean higher prices to the farmer.

Providing assistance to villagers to enable them to become more independent would entail technical assistance, micro-loans, and training in marketing. An alternative might be to remove the system of economic bondage and allow the marketing companies to compete for the right to purchase the production.

4. *Culture technology*

The culture of the red algae (*Eucheuma* spp.) has become a commercial operation in Tanzania, particularly on Zanzibar. Two methods are commonly used in seaweed farming. There is the pole and line method which is applicable in shallow waters and there is also the floats and raft method used in open waters.

The fixed, off-bottom monoline method is presently the most common technique used in the culture of *Eucheuma*. Selected *Eucheuma* cuttings (50-100 g) are tied to the monolines at 25-30 cm intervals using soft plastic tying material. The plants are allowed to grow to one kilogram or more before they are harvested. Depending on growth rate, the crop may be harvested after 1-2 months. In places where the space requirement for the fixed off-bottom monoline method is not available or where the method does not

work (e.g. due to intense grazing, changes in the degree of water movement brought about by monsoons), floating methods (raft and longlines) are used. The principles employed here are the same as those for the fixed, off-bottom monoline method except that the monolines to which seedlings/cuttings are tied are themselves attached to the raft system.

Site selection for seaweed culture

Any attempt to open up new areas for seaweed farming should be preceded by careful site selection. The following general guidelines are used in the preliminary evaluation of sites:

- Reefs that are intended for seaweed farming should be far away from freshwater sources as salinities below 30 percent may have adverse effects on the growth rate of seaweeds
- The area should be buffered from direct wave action so as to minimize its destructive effects
- Areas with coarse, sandy or coralline bottom substrate with moderate water currents seem to support good seaweed farms. Reefs that are characterized by soft substrate, such as fine sand or silt, are generally not suitable for seaweed farming
- Water depth during low tide is another important factor which can affect farming costs
- Areas with 0.6 - 1 meter depth during low tide are ideal for pole and line method
- Open waters are suitable for the floats and raft method
- Areas with constant water movement are suitable for seaweed farming. In general, water movement facilitates quick nutrient exchange, a factor which initiates rapid growth of seaweeds. These movements also prevent extreme fluctuations in other physical and chemical factors (i.e. temperature, salinity, pH, dissolved gases, etc.), fluctuations which can adversely affect the seaweed growth rate
- The impacts associated with space utilization can be either positive or negative. A notable positive effect is the enhancement of productivity of barren or degraded ecosystems. Negative effects could include user conflicts or possible ecological damage. Both of these can be mitigated by careful design, use of best management practices and placing limits on development. Hence, siting of the seaweed farm

must take into account the negative effects by determining the carrying capacity of an area in relation to other users and the environment

- Navigational routes should be avoided when selecting seaweed farm sites

To address the above issues, siting of seaweed farms should be conducted in consultation with villagers, fishermen, and all other stakeholders. The Fisheries Division should take the lead in coordination.

4.8.2 TILAPIA

Most tilapia are tolerant to brackish waters (Balarin and Hatoon, 1979). The more important species for commercial aquaculture include *Tilapia zillii*, *Oreochromis mossambicus*, *O. niloticus*, *O. aureus*, and *O. andersonii*. These species can withstand brackish waters and presently attempts have been made by Tanga Coastal Zone Conservation and Development Program to culture *O. mossambicus* in cages in brackish water. Freshwater tilapia species are also quite common and this could be a productive activity in coastal areas where freshwater supplies are abundant.

This section is relevant to other finfish species that have been tested and found feasible, but are not widely cultured (e.g. rabbitfish, *Siganus* spp.), and those that are cultured elsewhere but not in Tanzania (e.g. mullet, *Mugil cephalus*, milkfish, *Chanos chanos*).

1. Suitability for culture

Consumer acceptance of finfish, particularly marine and brackish water species, is high. The species listed above have a fast growth rate and these species have a wide range of food types (euryphagous). They are also hardy species that suffer from few diseases and resist handling. They can be cultured in high densities and they tolerate a wide range of salinity and temperature conditions. These species can be propagated artificially and are very fecund, so that seed will be available.

2. Ease of technology

Technology is simple and been demonstrated to be easily adopted by villagers. An international market exists, and marketing channels already exist within Tanzania.

3. *Challenges and opportunities*

The main challenges to development are partly related to staff disposition. Generally speaking, little contact exists between farmers and extension agents. This is, to some extent, attributable to a lack of transportation to extension agents. As a result, fish farmers generally practice poor pond management with no composting and very limited feeding. The reported poor growth rate of stocked fish (Mafwenga, 1994) is due to poor management or lack of supplementary feeding. Low production of seed fry for distribution to farmers limits aquaculture fish production to very low levels.

Apart from these challenges, opportunities exist to increase tilapia production for food. Since there is enough experience in the country regarding tilapia culture, it is also feasible to encourage fish farmers to move from subsistence fish culture to commercial fish farming. Current research efforts at Sokoine University of Agriculture and TAFIRI (Mwanza Center) are directed at the production and formulation of cheap tilapia feeds for fish farmers. The existing extension capacity could be marshalled by the Fisheries Division so as to disseminate whatever research findings will be reported.

4. *Culture technology*

The species of tilapia considered here are euryhaline and grow well in brackish and salt waters.

The most common and widely practiced system of culture of these species is in earthen ponds and similar impoundments. Polyculture where more than one species in a system are reared is encouraged with the purpose of maximizing production. This is made possible by using species which complement each other or take advantage of conditions created by each other.

Culture for finfish can either be land-based or water-based. Land-based finfish culture involves the construction of earthen ponds, whereas water-based finfish culture uses cages or pens to culture the fish. Culture of the species in floating cages and pens are techniques that have been experimented here and in other countries. These involve holding the fish in a confined part of a larger body of water while maintaining the free exchange of water between the enclosure and the larger water body.

Land-based systems

To select a good site for land-based finfish culture, the following factors should be considered:

- The texture of soil should be loamy-clay
- Water supply should be continuous and its quality should be good
- The topography of the area should allow the extension of the ponds, should be free from floods and should have a good altitude that is favorable to targeted species

Environmental impacts brought about by culture practices should be overcome.

Extensive land degradation, especially of mangrove areas, has been experienced with the farming of herbivorous and detritus-feeding fish species such as tilapia, milkfish and mullets in brackish water ponds (Barg, 1992). Avoiding mangrove areas in siting of ponds is advisable.

Other problems are related to nutrient and organic enrichment within and outside the culture unit. These problems stem from uneaten food and excreta, and are generally characterized by an increase in suspended solids, biochemical oxygen demand, and carbon, nitrogen and phosphorus content. Removal of suspended matter from ponds can be achieved in sedimentation ponds stocked with filter-feeding organisms, such as oysters or mussels. Nutrient loads can be reduced when seaweeds such as *Ulva*, *Gracilaria* and *Caulerpa* are polycultured with the fish in ponds or cultivated in exit canals (Barg, 1992).

Open water systems

To select a site for water-based finfish culture, some factors mentioned below should be considered:

- Sites should not be near discharge points from chemical industries
- Water should have sufficient depth for mariculture practices
- Water current should be between 0.2 and 0.5 m/s

- The area should be protected from strong winds and waves
- Water in estuaries, lagoons and bays should not flow fast as cage or pen culture will lose food and as such affect the viability of extensive and semi-intensive operations
- There should be a limit to the number of cages or pens in a unit area
- Extensive culture in the area that has naturally occurring food should exist so as to supplement artificial feed that may not be sufficient
- Environmental impacts to the area should be assessed

Because of the potential for user conflicts, fishermen and other users of water bodies should compromise on how cages and pens can be set at particular sites so as to allow open areas to be utilized by other users.

Resolving these issues requires intersectoral coordination between the Fisheries Division and Ministry of Transport along with local communities.

Recommendations

Seaweed and tilapia culture, which were demonstrated to be appropriate for small-scale mariculture should be given priority for use of resources for mariculture development.

Priority areas of emphasis for culture of these species would be to strengthen the technical capacity of current participants, increase economic returns to farmers, and restructure the current system of allocation of villages to seaweed buyers.

Tilapia culture can be expanded in freshwater and brackish water, and improved by providing technical training, assuring a supply of seed, assisting with scaling -up operations and marketing.

The following species have been tested and found feasible, but are not widely cultured (Bwathondi, 1982; Kayombo, 1991; Mgaya et al., 1999): Prawns - *Penaeus monodon*, *Penaeus indicus*; Finfish - rabbitfish (*Siganus* spp.); molluscs: oyster (*Saccostrea cucullata*), cockles (*Anadara antiquata*).

Recommendations

The local market for mollusc products is small. Since development of this type of mariculture depends on the availability of marketing outlets, there is a need to develop the marketing infrastructure along with the culture of molluscs.

Prawn and rabbitfish culture may be included in the list of species which could be promoted immediately. Emphasis should be placed on developing the technology further and adapting it to fit Tanzanian conditions. Particular attention should be paid to the environmental aspects of management.

The following species are cultured elsewhere, but not in Tanzania (Heslinga et al., 1984; Vakily, 1989; Pillay, 1990; Castanos, 1997): Crustaceans: mudcrabs (*Scylla serrata*), brine shrimp (*Artemia*); molluscs: mussels (*Perna* spp.), pearl oyster (*Pinctada* spp.), giant clams (*Tridacna* spp.), conch (*Strombus* spp.); sponges (*Porifera*).

Recommendations

Culture of these species, particularly *Artemia* and conch, are highly experimental elsewhere. Mussels, sponges, giant clams and pearl oysters have much better known technology. Due to the limited resources available, research activities including trials should be limited to a few proven species. If any of these species were to be chosen for promotion, it would require a large amount of resources over at least a five-year period, and a well-designed development effort.

4.8.3 PRAWNS (*PENAEUS MONODON*)

1. *Suitability for culture*

The culture technology for prawns is well known. They tolerate a wide range of environmental parameters such as salinity and temperature. Food conversion ratios are favorable. Demand is high for prawns and the price tends to remain high as compared to other aquaculture crops. The species grows very fast thus attaining market size within short time (at least two crops per year). A major drawback to prawn culture is the requirement for a relatively high level of technical expertise and the high investment requirements. Diseases can also be a problem, particularly in semi-intensive and intensive culture.

2. *Challenges and opportunities for development*

Opportunities:

- Many major prawn farmers have experienced problems with environmental contamination which has adversely affected production. Non-industrialized countries with clean water have an advantage and may attract investors interested in this industry
- Because prawn culture is new in Tanzania, the nation has the opportunity to transfer new technologies from other nations and adopt environmentally friendly methods from the beginning
- Prawn consumption and demand are increasingly globally, thus expanding opportunities for export
- There is the possibility of international investment if well-researched and documented prawn culture opportunities exist

Challenges

- Lack of experience in the nation with prawn culture, thus extension support is not available
- Inadequate budgetary support to development efforts in this area
- Poor infrastructure and lack of supporting services such as feed mills and hatcheries

- Wild stocks of postlarvae may not support industry development due to the high proportion of a non-commercial species (*P. indicus*)
- Lack of adequate technical support to aquaculture in general, resulting in bad site selection (acid sulphate soils, inadequate freshwater supply), and bad pond design and management
- Potential pond sites are difficult to access and very dispersed
- Lack of collaboration and coordination between planning, research, and management staff, impairing the flow of information
- Lack of coordination among the various institutions and other stakeholders
- The legal framework governing mariculture is weak

3. *Culture technology*

Traditional and modern prawn culture are carried out mainly in earthen ponds. In traditional systems, natural stocking is achieved through the intake of tidal water carrying large numbers of prawn larvae. Modern shrimp farms now include hatchery units, together with nursery facilities. Semi-intensive culture is most common. There are some indications that semi-intensive culture produces the least environmentally negative effects while producing a more reliable crop than extensive and intensive techniques.

The prawn seed stock should be obtained from the indigenous species. This applies to other culturable species as well. The development of a prawn farm must always take into consideration the local custom of the communities around the site. It is important that all projects should be fully approved by local communities.

4. *Guidelines for prawn grow-out farms*

Prawn ponds are sited in areas that may have been converted from the original salt pans, coconut or sugar plantations, rice paddies or abandoned land. They may also be sited in areas near sources of brackish or seawater, but outside of the intact mangrove zone. The following approach for prawn pond siting is recommended:

- Locate ponds in mangrove areas, inland from the mangroves. This should be considered as the first alternative
- Prohibit prawn farming in mangrove areas except for the establishment of ponds

behind the mangrove belt if the EIA documents that no negative impact is inflicted on the mangrove forest or other adjoining land

- Discourage prawn farming systems that depend on clearing mangroves
- Protect the biodiversity of an area. Mangrove areas and wetlands require protection from unregulated expansion of shrimp farming development
- Protect arable land and freshwater sources from salinization as a result of prawn farming
- Manage site selection through use of EIA and coastal zone management plans
- Include site selection criteria in the EIA process
- Restrict expansion to avoid taxing the carrying capacity of the ecosystem. One important aspect is the ability to estimate the environment's capacity to absorb farm impacts (e.g. to absorb a certain quantity and quality of pollutant without any negative effect on the environment itself but also without negatively affecting production)
- Protect critical habitat areas (e.g. areas with a high biodiversity) from prawn farming development through strictly enforced zoning
- Include performance requirements for the protection of the natural habitat surrounding the ponds in pond-siting protocols
- Give preference to converting salt flats or salt pans already in use for salt production for siting prawn ponds, rather than building new ponds
- Maintain an appropriate buffer distance between the inlet and outlet of water to the ponds in order to reduce the risks of water discharge being recycled in ponds
- Minimize disturbance during construction by discarding soil and residues removed from the site to outside wetland areas or coastal waterways (this could cause salinization of other areas if the soil contains salt. A better practice is to pile up soil and save it for latter construction purpose such as repairs. Organic vegetable matter could either be composted, buried, or burnt, but avoid dumping it elsewhere if mixed with saline soil)
- Encourage prawn farming to develop alternative strategies for treatment of wastewater (biological, mechanical, etc.)
- Avoid soils with high acid-sulphate. When this is unavoidable, incorporate into the pond design the ability to exchange approximately 25 percent of the pond water volume daily by either tidal exchange or pumping. Excessive pumping of this level can cause impacts of its own. If ponds are sited in acid-sulphate soil, it is preferable

to use lime to lower the pH by treating soil in between harvests, lining the pond with clay obtained from another source, or if feasible, use plastic pond liners

- Do not site the pond over tidal creeks because they are believed to form the primary habitat for the post-larval stage of several fish species normally cultivated in ponds. The creek beds also form poor foundations for bunds, and slumping is likely to result
- Do not block tidal creeks and other channels, which allow tidal flushing of adjacent mangroves
- Avoid the diversion of freshwater runoff away from the mangrove. If freshwater has to be diverted it should be redirected to the mangrove by means of shallow channels along seaward margins of the ponds
- As most of the sites suitable for prawn culture are utilized for other purposes, such as agriculture, forestry and salt works, it is important to consider the land use pattern of the area such that the culture techniques will not affect or be affected by other land uses
- Pumping should be minimized to avoid contaminating the pond with pathogenic organisms or other contaminants, while conserving natural productivity. Pumping should only take place in semi-intensive culture when required to lower salinity (when salinity reaches 50 percent or above) or in emergency situations of low oxygen (morning measurement is 2 mg/l or less). This requires monitoring of pond conditions. If monitoring does not occur, and pumping is set at a fixed rate, then water exchange should not exceed 10-15 percent a day (Boyd and Haws, 1999)

5. Prawn hatchery

Water quality

The primary water quality consideration is pollution from effluents and fluctuation in salinity within an optimum range.

A hatchery should be located along the coast adjacent to a large body of oceanic quality seawater. The further a hatchery is located from the ocean, the more likely the facility will to experience difficulties in terms of pumping water, water quality and access to broodstock. Optimum salinity range is 26 to 32 percent Locating the hatchery adjacent

to a major river system should be avoided unless careful analysis of the watershed has been performed. Care must be taken to avoid sources of urban and agricultural pollution. Chemically treated water from the hatchery should not be discharged unless treated appropriately according to the chemical used. Most hydrocarbon pesticides or heavy metals pollution is quite serious and should be avoided at all costs. The pH should fluctuate around eight.

Elevation and topography

The chosen site should be flat and elevated above the maximum high tide mark but within reasonable pumping distance (3 to 4 m above the maximum high tide mark).

Freshwater availability

Freshwater must be available at the hatchery site both for cleaning and for the workers. Extent of the water table must be known before a well can be considered.

Availability of mated females

A source of broodstock should be found within 100 km of the proposed hatchery site, if possible, and the stock should be disease free.

The fisheries department has to consult the following departments—Agriculture, Forestry, Lands, Water—and other stakeholders during site selection for shrimp farming.

4.8.4 MUDCRAB (*SCYLLA SERRATA*)

1. *Suitability for culture*

Crabs are luxury items, and are well appreciated (abroad) for their taste and texture. These are acknowledged to be low in fat, high in protein, and are excellent sources of minerals and vitamins. Mud crabs have a high natural abundance and the young may be gathered easily for culture. They can be cultured at a low level of technology, with low labor and capital costs. Small-scale culture of mud crabs can be conducted in mangrove areas without cutting or damaging the mangroves.

2. Challenges and opportunities for development

The principal challenges will be in transferring the technology that has been previously demonstrated elsewhere (Indonesia and Philippines). Mangrove crabs can be cultured in small cages located within mangrove areas in such a way that it is not necessary to cut trees, but this form of culture would probably not be allowed under current MMP regulations.

3. Culture technology

Monoculture of the mudcrab is practiced in ponds which should preferably be located in the estuarine areas where the tidal difference is great enough to facilitate change of water. For cleanliness, sandy bottoms are preferred. In ponds with mud walls, bamboo screens are placed obliquely toward the inside of the pond to prevent escape.

Hatchery-produced seed crabs are planted at a stocking rate of three crabs per m². The size of the crabs stocked varies from 7 cm to 12 cm in carapace width. The feeds usually given are snails, trash fish, fish viscerals, and almost any kind of animal food. Harvest depends on market demand. Stock may be selectively harvested after 45-60 days.

4.8.5 BRINE SHRIMP (ARTEMIA)

1. Suitability for culture

Artemia are increasingly valued on international markets, for both aquarium food and as food for prawns (postlarvae) and other cultured species. *Artemia* can be grown in conjunction with salt ponds upland of the mangroves. Cysts are easily available in crystallization ponds (saltworks).

2. Challenges and opportunities for development

It is envisaged that once hatchery development (for finfish and prawn culture) has taken off, *Artemia* cyst production from solar salt works may not sustain mariculture operations unless scaling up of the systems is implemented. The technology for cyst production is not sophisticated and its development can easily be supported by the government. The use of these salt flats for commercially sustainable enterprise would complement the government's priority to utilize salt flats for development purposes. Producing *Artemia*

cysts as a cash crop has the advantages of being easy to handle, they can be sold at all seasons of the year, and if stored in a cool, dry place, will live for several years. The ease and speed with which the cysts can be hatched make their use very convenient in hatcheries.

3. Culture technology

Artemia can be cultured in raceways, tanks, and ponds. Solar saltworks and ponds can be used for full-cycle *Artemia* culture.

Since all salt ponds are turned into freshwater ponds during the long rainy (southeast monsoon) season *Artemia* inoculations have to be carried out at the beginning of every dry season.

Ponds are fertilized to boost phytoplankton productivity (the diet for *Artemia*). Cyst production after inoculation in the salt ponds could produce enough cysts for both local and export markets. This production system is based on indigenous strains of *Artemia*, precluding the need for importing foreign strains of *Artemia* into the country.

4.8.6 MOLLUSCS

- Edible oysters (*Saccostrea cucullata*)
- Pearl oysters (*Pinctada* sp.)
- Mussels (*Perna* sp.)
- Giant clam (*Tridacna gigas*)
- Conch (*Strombus* sp.)
- Cockles (*Anadara* spp.)

1. Suitability for culture

The culture technology for these bivalves is usually simple and uses locally available materials. Operations are labor intensive, but have a low requirement for capital investment. When used for food purposes, the product contributes to improved nutrition. Otherwise, the product may be sold if a market is available. In the case of

pearl culture, the product is highly valued with a good external market. Minimum environmental impact is typical of bivalve culture, although some conflicts with other resource users may occur once operations become large, or if the project is not carefully sited.

2. *Challenges and opportunities for development*

The obstacles to mollusc culture include: poorly developed markets, shortages of qualified personnel particularly in hatchery production, and lack of financial support to coastal communities. Furthermore, many estuaries, bays, and lagoons with bivalve culture potential are likely to carry hazardous levels of human pathogens, making the public health problem a serious concern. It is certainly in the interest of the industry to ensure the safety of its product. In some cases, this may be resolved through temporarily transferring harvested shellfish to areas with clean water for a given period of time before selling in order to purge them of dangerous pathogens (depuration). Bivalve (oyster, cockle, mussel etc.) culture lends itself to very small-scale operations and may involve the entire family. For example, women may be involved in maintenance, harvesting, processing and marketing, and should not be overlooked in the development scheme.

3. *Culture technology*

Bivalves (Oysters, mussels, cockles, giant clams)

Both small and large-scale commercial farming adopt extensive systems, depending largely on wild seed stock and natural food production. Natural reproduction is often augmented by concentrating brood stocks and providing substrates for spat settlement. The use of suitable and improved sites for different phases of growth and fattening and the eradication or control of pests and predators are the essential elements of the system. Other production systems relate to the development of off-bottom culture and methods of hatchery spawning and larval rearing. Larvae and adults can be reared on selected microalgae.

Oysters of the genus *Pinctada* are cultured for pearls. Pearls are produced by deliberately introducing an irritant (e.g. shell bead) with a small piece of mantle tissue into the gonad. The mantle tissue grows around the nucleus and deposits an increasing number of layers of nacreous shell until a pearl is formed. This is one possibly lucrative activity for the coral reef areas of the nation as environmental effects are nil.

Bivalves, being sedentary organisms require substrate for spat settlement and subsequent growth during which time they filter feed on phytoplankton, detritus, protozoa and bacteria. Culture of oysters, mussels, clams and cockles relies on naturally available phytoplankton and requires considerable acreage of intertidal areas and near-shore waters.

Gastropods (Conch)

Conchs are among the most valuable marine gastropods. The seed is usually produced in the hatchery and grow-out takes place either in land-based operations (raceways, etc.) or sea-based in suspended cages. They are herbivorous feeding preferentially on red and brown sea weeds. Benthic diatoms are very suitable food for the spat.

4.8.7 SPONGES

1. Suitability for culture

Sponges are easily cultured from small cuttings which can be taken from the wild, then maintained on the farm. The labor and capital costs are low. Sponges are in high demand and are highly acceptable in foreign markets. There is minimal environmental impact.

2. Challenges and opportunities for development

The major challenge is to locate the appropriate culture species in Tanzania and to begin to cultivate a population of broodstock so that wild populations are not affected in the future. Sponges can be cultivated in fairly shallow near-shore areas using low levels of technology, making it an appropriate form of culture for villages.

3. Culture technology

Searching for wild sponges that are commercially valuable is an important task that should be carried out before setting up the farm. Sponge farms constitute a horizontal line set up by attaching heavy support lines (polypropylene rope) to anchors that are roughly parallel to each other. Lighter growing lines are strung between support lines, and the sponges themselves are hung from the growing lines. The best location for a sponge farm is in the lagoon, or a sheltered near-shore area. The following factors must be considered when selecting a farm site: 1) the site must be away from fresh water; and

2) water depth must be at least 1.5 m deep at low tide (MacMillan, 1996).

Parent sponge is cut into pieces and each cutting will grow into new, full-sized sponge, provided the environment is suitable. The only care needed is periodic cleaning of the lines, and sinking of the lines to protect them should bad weather threaten the farm. Broodstock can be obtained from wild stocks. Sponges should be harvested when they reach commercial size (about 800 g).

4.8.8 MANGROVES

Up to six species can be cultured depending on the site and demand.

1. Suitability for culture

The government has explicitly stated interest and support for this activity. There are abundant natural habitat areas with good water quality, both in disturbed and undisturbed areas. Replanting mangroves could help re-establish degraded areas and provide a renewable source of mangrove wood for many purposes. The technology is simple, and natural seed is easily available.

2. Challenges and opportunities for development

Although mangrove planting is being encouraged by the government, the public will have little incentive to plant mangroves unless some benefit can be obtained. At the moment, replanted mangroves cannot be harvested without strictly imposed conditions. Unless villagers have some guarantee that they can harvest the mangrove, these efforts will probably not progress quickly.

3. Culture technology

It is not difficult to produce mangrove seedlings and transplant them. Mangrove planting can start with either propagules or seeds depending on the species. Propagules are collected from mother trees of the following species, *Ceriops tagal*, *Rhizophora mucronata* and *Bruguiera gymnorhiza* and transplanted in suitable areas. Mature seeds from species that do not produce propagules (e.g. *Avicennia marina*, *Xylocarpus granatum* and *Heritiera*

littoralis) are collected and sown in nursery. The resulting seedlings are then transplanted in selected plots. One caution is that when attempting to replant areas where mangroves have been removed, and where other changes may have occurred (e.g. pond construction), it is important that the original volume, flow and quality of water be maintained or restored. Once the hydrodynamics and salinity of an area has been changed, restoration of the original species may not be possible, since each species has specific environmental requirements.

Chapter Five

MARICULTURE DEVELOPMENT, PROMOTION AND FUNDING

5

5.1 *MARICULTURE DEVELOPMENT OFFERS OPPORTUNITIES FOR SUSTAINABLE ECONOMIC DEVELOPMENT*

The coastal fisheries of the Western Indian Ocean are considered to be fully or over-exploited (FAO 1997a). As global demand for fisheries product continues to increase, aquaculture production is expected to be increasingly relied upon to meet demand (FAO 1997b). A similar trend is expected in Tanzania. Fish is an important source of protein in the Tanzania diet. Demand for fish and other marine products is expected to continue to increase in the future as the population grows, and the number of tourists requiring high quality seafood increases. Aquaculture is the only means by which to supplement the growing demand for fish without severely impacting wild stocks through increased fishing.

Freshwater fish farming has met with some success, but in some inland areas has been limited by insufficient water supplies. The coastal areas have abundant water resources. The development of brackish water and marine farms, utilizing the abundant water sources of coastal lagoons, estuaries, and near-shore areas should therefore be given serious consideration. Freshwater aquaculture also has potential in the coastal districts where freshwater supplies are abundant. In this discussion, the definition of the term mariculture is expanded to include coastal freshwater aquaculture as any distinction becomes somewhat artificial. The coastal zone of Tanzania contains diverse habitat types that could host numerous forms of mariculture to supply food, employment and export earnings.

Coastal areas are currently under-exploited with regard to mariculture. In part, this is due to a lack of recognition of mariculture's rich potential and the lack of technical capacity to transfer and implement proven culture systems. Another inhibiting factor has been the reluctance to allow large-scale projects to be developed in the absence of

comprehensive regulations and policy governing mariculture, since Tanzania has been a leader among African nations in protecting its fragile coastal habitats.

There has been a large measure of success, however, with the development of seaweed farming. Seaweed farming has produced positive social and economic benefits for coastal communities, with village women particularly benefiting. The factors that led to the success of seaweed farming can be applied to other forms of mariculture to provide further opportunities for sustainable economic development.

Recommendations

Mariculture is recognized as offering great potential as a form of economic development for coastal areas. Its development should be accorded consideration for allocation of adequate resources in national and sectoral plans.

Pursuant to this recommendation, it is suggested that the Division of Fisheries accord equal emphasis and priority to mariculture as freshwater aquaculture, and that both be regarded as development opportunities for the nation.

5.2 LARGE- AND SMALL-SCALE MARICULTURE DEVELOPMENT OPPORTUNITIES

Mariculture development can vary in size from very small-scale family operations that produce food only for family consumption, to very large, commercial-scale projects that employ hundreds of people. All types can contribute to the economy and improve the quality of life for coastal residents.

Small-scale seaweed production has been a noted success of small-scale economic development. However, the full potential of this industry has yet to be fully exploited. A number of gaps and bottlenecks exist which must be addressed in order to strengthen and expand this sector. To do so requires a commitment from national- and district-level fisheries institutions to facilitate and support industry development at the local level.

Opportunities also exist to develop large-scale mariculture projects to provide employment, food and foreign export earnings. A number of recent proposals for mariculture projects have been for large-scale projects, often backed with foreign investment. These projects have encountered a variety of difficulties in getting established. The public sector can promote large-scale development by providing assistance to investors to overcome obstacles and barriers, while applying stringent requirements for environmental and social responsibility. The latter depends on the adoption, implementation and enforcement of guidelines such as these, with modifications as experience in mariculture promotion and regulation accumulates. The result can be a vibrant mariculture industry that is sustainable in all aspects.

A third type of development opportunity exists; intermediate- and large-scale projects owned and operated by nationals. The level of investment that could be offered by local entrepreneurs could be significant, but may fall below the threshold requirements that currently exist for receiving government facilitation, such as the one-stop permitting offered by TIC. Modification and adaptation of current investment incentives, benefits and the degree of assistance offered by the public sector to meet the needs of local investors can help give Tanzanians an equal stake in commercial mariculture development.

Recommendations

To derive maximum benefit for the nation's citizens from the numerous opportunities offered by mariculture development, it is recommended that development efforts focus on:

- Improving and strengthening the current seaweed culture industry by finding ways to increase the economic benefits accruing to current farmers, and by expanding the industry into new areas within the country. This can be achieved by designating seaweed culture as a priority area of development and allocating suitable resources and personnel in support of the industry
- Researching and developing local and international markets for the seaweed industry, encouraging formation of marketing associations as well as the aggregation of product to enable sales to buyers needing large volumes of product, and adopting zoning to reduce conflicts with other uses
- Promote and support other types of small-scale mariculture by national- and district-level institutions being accorded equal importance and support as large-scale projects
- Encourage the establishment of locally owned and operated commercial mariculture projects of intermediate- and large-scale. This can be done through provision of financial incentives, tax exemption and other benefits by lowering the required amount of investment from US \$100,000 to a lesser amount
- Offer similar streamlining services and facilitation in the approval process to small- and intermediate-scale investors will help bring Tanzanian investors into the picture. This will require strengthening of the ability of the Fisheries Division to offer these services to increased numbers of stakeholders. The large-scale investor has the advantage that TIC will liaise with other institutions to streamline acquisition of land, water use, and other permits and benefits.

5.3 FACILITATING MARICULTURE DEVELOPMENT THROUGH ENHANCED TECHNOLOGY DEVELOPMENT AND TRANSFER

Promoting integrated and sustainable approaches to sustainable mariculture development to benefit coastal residents depends on improving technology development, transfer and adoption. Given that mariculture is relatively new, the institutional aspects of mariculture development and regulation need strengthening. Most of the major challenges are non-technical in nature and include such things as creating an institutional framework that supports promotion, reorganization and strengthening of current efforts, capacity building, socioeconomic aspects, extension services, and private sector development.

Promotion of any economic activity relies on good, long-term integrated planning and implementation. In the case of mariculture promotion, the key is in the extension support provided to industry development.

The individual components of mariculture development are discussed below and recommendations made for resolving challenges and issues. Additionally, many of the current issues could be simultaneously resolved by creating a more efficient institutional arrangement to develop and transfer aquaculture technology. One institutional arrangement that could answer this need would be a Cooperative Research and Extension Program. Such a program would consist of integrating the functions of existing institutions and professionals through joint planning and implementation, and could increase effectiveness with little additional costs.

5.3.1 INSTITUTIONAL FRAMEWORK

Responsibility for mariculture promotion and development is currently the responsibility of the Division of Fisheries at the national level. At the district level, responsibility lies with the District Fisheries Officer, who is located under the District Executive Director. At the national level, mariculture has a rather low priority, being the minor part of the Aquaculture and Extension Services within the Division of Fisheries, which dedicates most of its effort to freshwater aquaculture. At the district level, planning and budgeting are localized affairs with each district responsible for their own

activities. There is little linkage between the national and district levels, nor between the individual districts. Additionally, although mariculture is a field closely related to the interests and skills of other institutions (e.g. Ministry of Agriculture, Division of Forestry and Beekeeping) linkages between institutions at the national level are weak. Stronger linkages exist at the district level where extension agents of many sectors are located in the same venue and often cooperate on projects of joint interest as part of the Natural Resources Department.

The lack of communication and coordination between levels of government, and between Ministries and Divisions at the national level makes efficient and nation-wide identification and implementation of development priorities difficult. It is also difficult for the large scale investor to navigate such a system since the legal requirements to establish an operation are split between governmental levels.

An institutional mechanism is needed that allows for communication and planning for mariculture issues that concern multiple institutions or levels of government.

Recommendation

Formation of a Multisectoral Mariculture Committee or Advisory Board that is composed of representatives of the various institutions concerned with mariculture issues and with representation from the national and district levels could serve as the mechanism by which mariculture issues of common concern can be discussed and resolved through joint planning. The current Mariculture Working Group, under the proposed National Integrated Coastal Management Program could evolve into playing this role. This multisectoral body would be linked to the Fisheries Division at the national level and could help identify and plan for development initiatives. Additionally, for shared priorities and initiatives, the group could help find the means to share resources and capacity between institutions to promote efficiency and reduce redundancy.

This body could be comprised of the same representation as the Technical Review Committee which reviews project proposals and assists in the EIA process (Chapter 1 and Chapter 3).

5.3.2 *PLANNING*

Currently the Division of Fisheries at the national level plan and budget separately from the districts. At the district level, the Fisheries Officer is more likely to plan in a coordinated fashion with other sectors because of the structure of the District Natural Resources Department. This is less common at the national level. Additionally, there is no long-term and comprehensive vision or plan specifically for mariculture development in the nation. Mariculture is assumed to be covered by planning for aquaculture, although long-range planning for this is also lacking. There is a five-year Action Plan for Fisheries (1998-2003), and as rolling review is conducted, it is recommended that issues of mariculture and cooperative extension be integrated.

Recommendations

- Develop an integrated Mariculture Plan by the intersectoral Mariculture Committee in tandem with the Fisheries Division and periodically updated on a rolling basis. Such a plan would not supplant the district level planning initiatives, but would serve to help establish common goals and find means of sharing capacity to work towards these goals. The interests and contributions of other sectors can be incorporated and utilized either by direct representation on the committee, or by structured and regular consultation
- Strengthen the district-level planning process by collaborative planning involving all sectors. Establishing a multisectoral body under the District Council for planning purposes would create a forum to allow exchange of views, and if linked to producers groups, can be a strong mechanism for planning and development

5.3.3 *INSTITUTIONAL SUPPORT*

Currently mariculture development is not considered a priority area for promotion and support as compared to other economic activities. Because of its low priority, resources and professional capacity are similarly limited. One result of these limitations is that the amount of technical assistance that can be provided to an investor is limited and does not necessarily see the investor through all stages of project planning and implementation.

Recommendations

- The Fisheries Division should give high priority to mariculture development in conjunction with other relevant institutions whose recognition of the potential of mariculture will greatly facilitate the development process
- These institutions might consider strengthening their capacity to render technical assistance to small- and large-scale investors and cooperate in supporting mariculture activities, especially during the planning and start-up phases
- More funds should be allocated for the management of sustainable forms of mariculture and more efficient use should be made of existing funding sources
- Emphasis should be placed on providing incentives, resources and increased technical capacity to encourage and enable extension workers to initiate and support community-based mariculture projects for small-scale development
- Priorities for technical assistance should include long-term programs of technology transfer through the establishment of pilot mariculture projects and demonstration of economic viability to local communities who will later take up commercial projects on their own

The consequence is that the investor may be left on his or her own during critical stages of project development with little guidance.

5.3.4 TRAINING

More trained professionals are needed in mariculture and related fields. Although there is currently a well-trained cadre of aquaculture professionals working in Tanzania, most are fully employed at the national level, and there is a need for more professionals at the local and district levels. Fewer students are entering aquaculture as a profession as it does not offer alternative employment opportunities, as do other fields of professional employment since the principal employer is the Fisheries Division.

A wider range of technical capacity is also needed. Most personnel working in mariculture and aquaculture have traditional fisheries management and basic aquaculture

training. Other skills such as small business development, environmental management, nutrition, genetics, and aquaculture engineering need to be brought into the array of existing skills through training.

Recommendations

- The government should direct resources towards the training of aquaculture specialists from certificate to degree levels to alleviate the current acute shortage of trained manpower. Efforts must be made to place trained professionals at the local and district levels and assure that professionals at all levels have opportunities to update and strengthen their skills periodically. Incentives such as scholarships for fields related to mariculture development might be offered, and employment for such trainees assured after graduation
- On-going training for aquaculture professionals is required in order to strengthen their capacity to promote and implement mariculture projects
- Training in mariculture-related topics should be offered to technical professionals in other sectors (i.e. agriculture, forestry), as well as increasing the offer of training in other fields to aquaculture professionals. This will enhance the ability to plan and work collaboratively on interdisciplinary topics and increase capacity in fields where technical assistance is currently not available

5.3.5 APPLIED RESEARCH AND EXTENSION

Research efforts are primarily determined independently by individual researchers, institutions, or programs based on self-generated funding, with the result that there has been no comprehensive program of applied research guided by common objectives. Since research is dependent mostly on short-term funding, many promising research endeavors are not continued, with the result that few species or aquaculture systems have been fully tested or proven within Tanzania. Funding is also limited and applied research priorities are often determined by NGOs or international aid agencies, which may operate in isolation from public institutions or research institutions.

Recommendations

- The emphasis of applied research should be subjects identified in a National Mariculture Development Plan as essential for rapid and sustainable development of the industry. Such a plan could be developed and reviewed on a rolling basis by representatives of public institutions, researchers, extension agents and private industry. This will help ensure that there is a more comprehensive approach to applied research
- In particular, applied research efforts should focus on the culture of species proven to be feasible in Tanzania (e.g. seaweed and tilapia, see Chapter 4), technology which has been proven elsewhere and which can be easily transferred to Tanzania, and on small- to medium-scale production technologies for local farmers
- Researchers should be made aware that collaboration and formation of partnerships with the community where the research is taking place are ethical requirements and that sharing and returning research results in a form that can be understood by laymen is an integral part of their research activities. When research is supported by government funds, this should be a requirement.
- Effective transfer of the results of applied research could be enhanced through a Cooperative Research and Extension Program. Such a program could be operated as a joint endeavor between public institutions such as the Fisheries Division and Agriculture, research and training institutions (UDSM, TAFIRI), NGOs and the private sector (see below)
- Long-term and sufficient funding should be sought to support applied research efforts to fully develop and transfer technology for new species and systems
- Dissemination of research results should be a priority since these often fail to reach extension workers, the district committees and the community. One solution would be instituting a requirement that a copy of all research reports be submitted to the Fisheries Division, with subsequent redistribution to the District Fisheries Officers. Research results should also be archived in libraries and databases

Much of the research has also been conducted without proper linkages with extension workers, so that even when results are good, they are not necessarily transferred to, or adopted by the stakeholders. The result has been fragmented and non-directed efforts that do not necessarily move a species or culture system through the complete process of research and development, with subsequent successful adoption.

5.3.6 *EXTENSION SERVICES*

Extension is the means by which technology is transferred and adopted. The main focus of extension is on people and the factors influencing their thinking and subsequent actions. Extension relies on the introduction of new information and technology, and provides capacity building in a form that enables stakeholders to make use of these. Extension must be viewed as a sustained effort, since time is needed to demonstrate the usefulness of the new methods until they become routinely used. Extension efforts must also be reiterative and interactive with applied research; new efforts seldom succeed completely on the first attempt, and further modification and experimentation is often needed.

Presently, government extension services for aquaculture, and particularly mariculture, are very limited. A few NGOs, such as the Tanga Coastal Zone Conservation and Development Program (TCZCDP) provide extension assistance for mariculture. Neither NGOs nor government efforts are grounded in a long-term, sufficiently funded comprehensive plan.

5.3.7 *EXTENSION AND TRAINING FACILITIES*

Facilities such as demonstration farms can be a very effective method in transferring new technology. There are few existing facilities, and these suffer from scarce lack of resources.

Recommendations

- Creation of a Cooperative Research and Extension Program can serve as the vehicle to link applied research, extension and adoption of technology to improve the effectiveness of this process. It can also help provide the basis for integrated planning and communication between the isolated and fragmented entities working in these areas
- Extension capabilities at the national and district levels should be strengthened through on-going capacity building for the extension agents. The National Level Fisheries Division can assist the district levels by providing training opportunities, facilitating establishment of new projects, facilitating communication and coordination between districts, in addition to serving as a link with new technologies and progress in the international arena
- Extension agents should also be provided with sufficient means to execute their work including transportation, communications, materials, supplies, technical information and assistance in helping clients obtain legal permissions and other necessities
- Efforts to promote mariculture should be increased. Mass media and other forms of public outreach can be used to explain the potential of mariculture development at the local level

Recommendations

Improved extension facilities such as demonstration centers, training resources and hatcheries are needed. These could be funded, staffed and directed under the Cooperative Research and Extension Program. Emphasis should be placed on consolidating the resources and personnel allocated to operating such facilities to improve efficiency and help ensure long-term sustainability of the facilities.

5.4 CREATING A COOPERATIVE RESEARCH AND EXTENSION PROGRAM FOR MARICULTURE DEVELOPMENT

The institutional and technical aspects of mariculture development and regulation clearly require strengthening if mariculture is to become a significant industry within the country. Research, training and extension activities related to mariculture suffer from lack of resources, are conducted largely in isolation, and are not closely linked. Consequently, mariculture development has been slow and continues to be so. Opportunities to establish sustainable forms of mariculture along the coast to the advantage of coastal populations would increase if technology transfer were strengthened by cooperative institutional efforts.

Cooperative Research and Extension (CRE) is a multisectoral and inter-institutional planning and implementation mechanism for the transfer and adoption of new technologies (Figure 8). CRE is based on the principal that if researchers, extension agents and private industry work together, the development and application of new methods will be more efficient and more suited to directly answering development needs. CRE integrates existing institutions and programs and harmonizes their efforts and roles to maximize efficiency while minimizing costs.

Recommendations

A Cooperative Research and Extension Program can be developed within the existing institutional framework to promote sharing of experience and transfer of technology to stakeholders through an intersectoral approach, including sharing roles and responsibilities for extension and research. In the suggested CRE model, the Division of Fisheries occupies a central role by leading the Intersectoral Mariculture Committee and taking the lead in facilitating joint planning and overseeing the general efforts. In this model, the Division of Fisheries would be primarily responsible for aquaculture extension although it would also be involved in planning and executing applied research to ensure that such work addresses the needs of the stakeholders and that results are transferred. The research and training institutes such as UDMS, TAFIRI and IMS would conduct most of the applied research but also provide some extension assistance. NGOs and the various programs can also play both roles, but it is suggested that these groups work closely with other institutions to promote long-term results when transferring technology.

FIGURE 8 COOPERATIVE RESEARCH AND EXTENSION SCHEME

Research & Educational Institutions	Public Sector Technical Institutions, NGOs	Private Sector (including communities)
University of Dar es Salaam TAFIRI Mbegani Kunduchi Nyegezi Sokoine University of Agriculture Forestry Training Institute of Olmotönyi Division of Fisheries Multisectoral Mariculture	Committee Ministry of Agriculture District Fisheries officers and Technical Committees NGOs University of Dar es Salaam TAFIRI Mbegani Kunduchi Nyegezi	Large-scale private industry Small-scale private industry Community groups
Applied Research and Development	Extension	Implementation
Creation of New Technologies	Technology Transfer	Adoption of New Technologies
	Feedback	

5.4.1 INSTITUTIONAL ROLES AND RESPONSIBILITIES IN A COLLABORATIVE RESEARCH AND EXTENSION (CRE) PROGRAM

Objective of CRE

The overall goal is to establish a strong, private mariculture sector (both small- and large-scale) that renders economic benefits to the nation and local communities. Success of a CRE program depends on the cooperation of multiple parties resulting in mutual benefits. Within this framework, research, extension and adoption of technology are viewed as integral parts of the same development spectrum. Professionals and institutions may play multiple but interlinking roles within this spectrum.

Applied Research and Development

Research and development for mariculture necessarily focuses on providing information and technology that is precisely targeted to provide culture systems that can be easily adapted by stakeholders in the industry. This may include development of new technology and new species, or may focus on transferring and modifying technology and methods already proven to be feasible in other regions. In both cases, the desired outcome is simple, appropriate, and economically feasible culture systems that extension agents can promote and transfer to private industry.

Applied research and development is most commonly the role of educational and technical institutions, although often executed in collaboration with extension agents and institutions responsible for technology transfer. Researchers rely upon those who conduct extension to identify and prioritize the needs of industry for new and improved technology. In Tanzania, this role belongs to USDM, TAFIRI and other educational/research institutions (Fig. 8), as well as NGOs and programs.

Extension

Extension programs are the means of transferring technology and ensuring that it is adopted. Successful adoption of technology depends on the ability to communicate and demonstrate appropriate technologies, and modify people's behaviors. Successful extension relies on long-term assistance that answers the needs of private industry.

Resources that enable extension agents to establish demonstrations, provide information, assist farmers and be readily available for consultation by the public is necessary.

Mariculture extension in Tanzania is the role of the personnel of the Fisheries Division, Fisheries Officers at the district level, the technical institutes (Kunduchi, Mbegani, and Nyegezi) and various NGOs. In CRE programs, personnel may hold joint appointments as researchers and extensionists, which helps integrate the creation of technology and its transfer. Sharing of personnel and roles also facilitates integrated planning and execution.

Adoption of Technology

The primary audience for the transfer of technology is industry stakeholders, both large- and small-scale. While private industry is the primary recipient of technology, within a CRE scheme, private industry assists with technology development and supports research and development efforts. All new technologies need to be tested on a commercial scale under realistic conditions, and industry members cooperate in planning such trials, provide facilities, and financial support. Industry also provides jobs and training opportunities for professionals and students needing practical experience. When CRE work is demonstrated to answer the needs of private industry, it is often willing to provide support in recognition of that benefits will in time be returned.

5.4.2 FUNDING FOR CRE

Funding for a CRE scheme could come from a number of sources including the budget at the national level, district level, from NGOs, research proposals, support from private industry, and international donor agencies. An important point is that by linking and coordinating these efforts, not only are resources more likely to be used in a meaningful and efficient way, funding agencies are often more likely to provide funding knowing that useful benefits are more probable. However, this requires a joint planning scheme and the willingness of the different sectors to cooperate.

5.5 TECHNICAL ISSUES OF MARICULTURE DEVELOPMENT

5.5.1 LOCAL FEASIBILITY OF SITES AND THE POTENTIAL OF CULTURABLE SPECIES

These Guidelines and the Mariculture Issue Profile (TCMP 1999) summarize the past experience and known results of mariculture experimentation in the country. However, for species other than seaweed and tilapia, no species or culture system has been fully demonstrated to be feasible in the biological, social or economic aspects in Tanzania. This includes the high value species such as prawns, the culture of which has been repeatedly proposed in Tanzania, which may offer tremendous potential.

Recommendation

Applied research efforts might select one or two additional species or culture systems with the highest potential as focus areas, and move these through the complete spectrum of technology transfer.

5.5.2 CARRYING CAPACITY OF LOCAL SITES AND INTEGRATION WITH OTHER USES

It is known that the coastal and near-shore areas have tremendous potential for culture of a wide variety of species. However, little specific information is available regarding specific local areas that are suited for particular types of mariculture. The ability of specific areas to host numerous or large aquaculture projects is also unknown, as are potential conflicts or limitations presented by other resources uses or impacts (i.e. competition between seaweed farmers and hoteliers, impacts from agricultural contamination). This limits the ability to plan for mariculture promotion. It also limits the ability to promote specific areas to potential investors as good sites.

Recommendation

Mariculture planning is required at both the national and local levels. In both cases, bio-physical, spatial and social analysis is required to determine optimal areas for promotion of mariculture, and of which type. Consideration of carrying capacity, resource availability, competition with other uses, and suitability of sites must be included.

A system of zoning for multiple resource uses is appropriate and would be useful in targeting development sites. It would also help alleviate conflicts between resource users that already occur. A certain amount of baseline data is required to execute such zoning efforts. However, preliminary planning efforts would now be possible in certain areas where adequate baseline data exists.

5.5.3 BEST MANAGEMENT PRACTICES AND APPROPRIATE TECHNOLOGIES

These Guidelines present preliminary recommendations for Best Management Practices for several species based on national and foreign experience. However, much more extensive work will be needed to precisely determine which practices provide the greatest benefits while minimizing impacts when conducted under Tanzanian circumstances. Linked to this is the need for appropriate technologies for all scales that can be readily adopted by Tanzanians given their specific constraints and opportunities.

Recommendation

One focus area for applied research and extension should be the development and testing of appropriate technologies and culture systems, accompanied by further refinement of best management practices. This will entail development of systems of environmental and project monitoring and evaluation.

5.5.4 SOCIOECONOMICS OF MARICULTURE PRODUCTION AND TARGET GROUPS

More information is needed on the socioeconomic aspects of mariculture, currently and its potential, in order to be able to plan comprehensively and well. Socioeconomic factors have already emerged as important issues in seaweed production, and have been largely responsible for the slow development of prawn culture. In particular, more needs to be known about target group characteristics and differentiation in terms of availability, access, use and control of resources, and access and control over benefits from mariculture.

Recommendation

In order to strengthen the seaweed sector, the socioeconomic considerations such as economic bondage, control of marketing channels, and allocation of resources must be better understood. A specific study focused on the items with recommendations to improve the current situation is needed.

As part of the process of developing the National Mariculture Development Plan, the socioeconomics of specific locales and specific culture types should be considered.

5.5.5 AVAILABILITY OF STOCK

A common limiting factor for nearly all species that can be cultured in Tanzania is the scarcity of stock (juveniles). This includes even tilapia, which are among the most easily produced animals known. In order for mariculture to be established and thrive, assuring consistent and sufficient supplies of stock is required. Three options are available:

- Collection of wild stock
- Hatchery production
- Importations

5.5.5.1 Collection of wild stock

Collection of wild stock may be possible in some cases (e.g. prawns, mollusks), but care must be taken to avoid impacting wild populations, while developing efficient means of collecting the desired animal.

Recommendation

As mariculture develops further, guidelines will be needed to regulate the practice of wild collection as a means of providing stock for mariculture.

5.5.5.2 Hatchery Production

Few hatcheries exist in Tanzania. Once development priorities are established, hatchery production should be a focus for development as well, since establishment of local hatcheries offers the best means of assuring a dependable supply of stock, creating additional employment and avoiding waste and disease issues associated with importation.

Recommendations

- The feasibility of establishing small, appropriately sized hatcheries should be evaluated. Preliminary testing and development must be executed well in advance of promotional schemes for any particular species
- Hatchery establishment can be facilitated and assisted by government institutions, but given the generally poor track record of government operated hatcheries world wide, it is recommended that private industry efforts are preferable. A more appropriate role of government institutions might be to support these private efforts where possible, rather than create its own hatcheries

5.5.5.3 Import and export of stock

Importing stock appears to be the most immediate solution to immediate needs for juveniles. It may also be needed in order to establish local broodstock with good genetic lines.

Currently, the Fisheries Division is responsible for issuing import permits while the country of origin issues the health certificate. The Quality Control Unit of the Fisheries Division issues health certificates for export of live fish and fisheries products, which may include aquaculture products.

Recommendation

Introduction of alien species should be discouraged as much as possible, but should the need arise, a proper code of practice (e.g. Turner, 1988) should be applied. A more detailed code will need to be developed as demand to import live fish, ova or plants increases. The East African Community (EAC) and the South African Development Co-operation (SADC) are preparing protocols on the importation of live fish that will be cultured in shared water bodies. These guidelines could be adapted for in-country use.

As there is no current requirement for the health of the fish to be verified by a Tanzanian authority after import, the Fisheries Division should consider undertaking such inspections and verifications.

5.6 FINANCING MARICULTURE DEVELOPMENT

Financial resources for all economic development activities are limited, but those for mariculture are particularly scarce. At the moment, there is no source of capital readily available for the investor of any scale. This general problem has been further exacerbated by the controversy surrounding mariculture and the lack of guidelines for mariculture. Additionally, many of the inputs required for mariculture development such as imported feeds, equipment and tools have not been accorded the same import and tax advantages, as have inputs for other productive activities.

Recommendations

- Once the Mariculture Guidelines have been adopted and implemented, one role of the Fisheries Division, perhaps aided by TIC, would be to demonstrate and promote forms of mariculture that are financially feasible and environmentally friendly activity to providers of credit and grants.
- Loans at reasonable rates combined with adequate technical and material support could stimulate mariculture development in rural areas. As a stronger regulatory framework for mariculture development is adopted, and better technical assistance becomes available, lending institutions may come to view mariculture as a better risk for loans. Meanwhile, the government might institute a system of microloans.
- Non-profit organizations and international donors providing financial assistance or microloans to other activities should be solicited for similar assistance to mariculture projects.
- Business incentives such as those offered to the larger investors through TIC, might also be offered to the small farmer as well.
- Assistance in small business management should also be offered as part of the extension program to stakeholders interested in mariculture since this is a critical part of assuring the financial success of mariculture businesses.
- Fisheries inputs are exempted as may be seen under relevant tariffs in the harmonized customs excise, sales tax and PTA Tariffs Handbook Serial No. 168. Where these form part of mariculture inputs they don't need further clearance but the Director of Fisheries Division may wish to check which mariculture inputs are not included. Where critical inputs are not included, the Treasury might be requested to include them in the tariffs.

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Acronyms

AER	Annual Environmental Report
CBO	Community-Based Organization
DEC	District Environment Committee
DoE	Division of Environment
DR	Decommissioning Report
DTT	District Technical Team
EAR	Environmental Auditing Report
EIA	Environment Impact Assessment
EIA	Environmental Impact Assessment
EP	Environmental Permit
EPA	Environmental Protection Agency
ER	Environmental Report
GIS	Geographical Information System
IEE	Initial Environment Examination
IIED	International Institute for Economic Development
ILFEMP	Institutional and Legal Framework for Environment
IRA	Institute of Resource Assessment Management Project
NEMC	National Environment Management Council
NGO	Non-Governmental Organization
NORAD	Norwegian Agency for Development
PEA	Preliminary Environmental Assessment
PEAR	Preliminary Environmental Assessment Report
PHR	Public Hearing Report
RRP	Review Report
SEACAM	Secretariat for East African Coastal Area Management
SR	Screening Report
TCMP	Tanzania Coastal Management Partnership
THA	Tanzania Harbors Authority
TIC	Tanzania Investment Center
ToR	Terms of Reference
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development

APPENDIX 1

(D) BRACKISH WATER AND MARINE HATCHERIES

CHECKLIST OF ENVIRONMENTAL IMPACTS AND MITIGATION STRATEGIES FOR LAND-BASED MARINE HATCHERY/NURSERY (SHRIMP, FISH) MARICULTURE PROJECTS

Actions affecting environmental resources and values	Potential environmental impacts	Potential mitigation strategies for negative environmental impacts
A. Hatchery Site selection		Appropriate site selection
1. Conflicts with other site users	On and off-site impacts resources and social conflicts	-Appropriate regional land use planning -Consultation process -Participation of local people in mariculture projects -Resettlements/compensation agreements
2. Selection of ecologically sensitive site	Potential loss of biodiversity and wetland habitat	-Careful site selection -Management plan which identifies ecologically sensitive sites -Habitat restoration (e.g. replanting of mangroves) -Maintain buffer areas around hatchery -Prior assessments of impacts
3. Hazards to mariculture from nearby pollution sources (e.g. agriculture industry)	Water pollution from industry, agriculture affecting sustainability of mariculture	-Careful site selection -Pre-treatment of water, selection of water sources -Pressure from mariculturists to reduce pollution from other sectors
4. Typhoons, flooding, hurricanes	Damage to physical facilities and loss of brood stock and pond discharge	-Careful site selection -Hatchery design taking account of extreme climatic events -Buffer zones for wind breaks (e.g. mangroves)
5. Water quality	Water quality deterioration caused by self pollution from hatchery effluent	-Careful site selection in relation to other hatcheries -For large numbers of small-scale hatcheries, common effluent treatment systems -Good hatchery management practices -Design of inflow/effluent systems to control self-pollution -Treatment of effluent/effluent controls
6. Fish/shrimp brood stock availability	Potential impacts on biodiversity caused by over harvesting of wild brood stock Lack of sustainability of hatchery due to insufficient brood stock	-Careful assessment of requirements -Development of hatcheries -Sourcing of wild brood stock

7. Disease problems	Potential impacts caused by presence of serious pathogens/disease problems	-Disease surveys of existing farms/brood stock sources to assess risk -Introduction of risk management strategies within hatcheries to reduce risk -Careful disinfection/health management protocols for brood stock and seed -Health certification and quarantine protocols -Adoption of SPF (specific pathogen free) technologies
B. Hatchery design	B. Poor design can lead to environmental problems	B Careful/appropriate design
1. Attention to problems A (1) to A (7) above	As above	As above
2. Socioeconomic impacts	Social inequities	-Participation of local people in mariculture projects (note: small-scale hatcheries/nurseries projects offer good scope for involvement of local people)
3. Impacts due to infrastructure	Local hydrological or salinity changes caused by poor design	-Roads, canals and other infrastructure should not block tidal flow -Maintain buffer areas around hatchery
4. Aesthetics	Aesthetic impacts	-Development of green buffer zones -Avoid unsightly water supply/discharge canals, pipes. Locate away from tourist sites (e.g. high value beaches)
C. Hatchery construction	Poor construction practices can lead to various environmental problems	
1. Site clearance	Damage construction to terrestrial and wetland habitats and water quality problems during construction	-Maintain buffer areas -Ensure site disturbance is limited to immediate construction area. Roads, canals, etc. should be constructed to minimize vegetation clearance -Sediments removed during construction should be disposed of in suitable locations -Excavation/disturbance of potential acid-sulfate soils should be minimized -Regulatory requirements should be followed during clearance and disposal of soils and vegetation
2. Infrastructure development (access roads, canals)	As above	As above
3. Obtaining filling materials	Removal of filling materials required for dykes, foundations, access roads may impact habitat, water quality	As above

4. Labor, worker safety	Possible impacts on environment caused by labor force (e.g. noise, groundwater draw down, sewage)	-Provision of suitable infrastructure/facilities to support labor
D. Hatchery operation and Management		
1. Solid waste disposal	Impacts on surrounding land use/wetland habitats	-Non-organic, solid waste materials should not be dumped into mangrove forests etc., but disposed of safely
2. Waste water/effluent discharge	Impacts on local water quality and sediments	-Use of settlement basins, borrow pits and other techniques to treat discharge water -Take particular care in treatment of water containing disease control/disinfectant chemicals -Water exchange minimized and water recycling when possible. Discharge of hatchery effluent into area with adequate tidal flow -Avoid contamination of freshwater with saline effluent -Disposal of dead/diseased animals in sanitary manner -Minimize leaks from water pumps, generators etc
4. Water intake and conveyance	Draw down of groundwater supplies Water pollution problems impacting water quality	-Water supplies from well-flushed supplies -Minimize use of ground waters (although may be most suitable disease-free water source)
5. Use of chemicals/water treatment	Potential impacts on workers health water pollution Impacts on mariculture product quality (e.g. chloramphenicol)	-Use of approved chemicals according to standard practices. -Reduce disease problems through preventative management, not chemicals
7. Broodstock collection/supply	Loss of biodiversity caused by harvesting of wild stock	-Fishing techniques that reduce damage to non-target stocks -Use of environmentally sound fishing techniques -Fish/shrimp stocks harvested within sustainable limits -Integrate marine brood stock fish harvesting with marine park management for protection & management of adult fish stocks -Hatchery techniques which maintain genetic diversity and appropriate selection programs
8. Feed and feed management in hatcheries	Deterioration in tank environment and poor effluent quality, leading to water quality impacts on surrounding environments	-Use low pollution/nutritionally appropriate diets -Implement effective feeding strategies -Careful feed control, monitoring

9. Disease outbreaks and disposal of mortalities	Economic impacts on stock product quality and native populations	-Implement preventative health management strategies (e.g. quarantine, isolation of infected tanks, maintain strict hygiene) -Sanitary disposal of mortalities
10. Operational failures	Sudden impacts caused by loss of stock and discharge of saline and hatchery water	-Accommodating operational failures in system design and management procedures -Routine hatchery/nursery maintenance essential
11. Labor force	Impacts on water quality and habitats due to increased population	-Provision of sanitary conditions for workers -Environmental awareness training for workers

(II) BRACKISH WATER POND CULTURE

CHECKLIST OF ENVIRONMENTAL IMPACTS AND MITIGATION STRATEGIES FOR LAND-BASED BRACKISH WATER POND (SHRIMP, FISH) MARICULTURE PROJECTS

Actions affecting environmental resources and values	Potential environmental impacts	Potential mitigation strategies for negative environmental impacts
A. Site selection		A. Appropriate site selection
1. Conflicts with other site users and interference	On and off-site impacts resources and social conflicts	-Appropriate regional land use planning -Consultation process -Participation of local people in mariculture projects -Resettlements/compensation agreements
2. Selection of ecologically sensitive site	Potential loss of biodiversity and wetland habitat	-Careful site selection and integration of mariculture into integrated coastal management -Management plan which identifies ecologically sensitive sites -Habitat restoration, e.g. replanting mangroves -Maintain buffer areas around farm -Prior assessments of impacts
3. Hazards to mariculture from nearby pollution sources (e.g. agriculture industry)	Water pollution from industry, agriculture affecting sustainability of mariculture	-Careful site selection -Pre-treatment of water -Pressure from mariculturists to reduce pollution from other sectors
4. Typhoons, flooding, hurricanes	Damage to physical facilities and loss of stock and pond discharge	-Careful site selection -Pond design taking account of extreme climatic events (e.g. pond dyke height to prevent flooding) -Buffer zones for wind breaks (e.g. mangroves)
5. Water quality	Water quality deterioration caused by self-pollution from effluent	-Careful site selection in relation to carrying capacity -Management practices and effluent controls

		-Strategic planning to keep number of farms within carrying capacity
6. Selection of site with poor soil quality	Soils inappropriate for mariculture e.g. acid-sulfate soils	-Soil surveys to identify problem soils (acid sulfate, peat) -Construction and design to minimize disturbance of problem soils
7. Fish/shrimp seed availability	Potential impacts on biodiversity caused by over harvesting of wild stocks. Lack of sustainability of mariculture due to insufficient seed supply	-Careful assessment of requirements -Development of hatcheries -Sourcing of wild brood stock
8. Disease problems	Potential impacts caused by presence of serious pathogenic/disease problems	-Disease surveys of existing farms to assess risk -Introduction of risk management strategies to reduce risk
B. Farm design	B. Poor design can lead to a variety of environmental problems	B Careful/appropriate design
1. Attention to problems A (1) to A (8) above	As above	As above
2. Socioeconomic impacts	Social inequities leading to social unrest	-Participation of local people in mariculture projects -Understand socioeconomic conditions prior to project, and ensure developments do not negatively impact local people
3. Impacts to infrastructure	Hydrological or salinity changes caused by poor design	-Roads, canals and other infrastructure should not block tidal flow -Maintain buffer areas
4. Aesthetics	Aesthetic impacts	Development of green buffer zones
C. Farm construction	Poor construction practices can lead to various environmental problems	
1. Site clearance	Damage to terrestrial and wetland habitats and water quality problems during construction	-Maintain buffer areas -Ensure site disturbance is limited to immediate construction area -Roads, canals etc. should be constructed to minimize vegetation clearance -Sediments removed during construction should be disposed of in suitable locations -Excavation/disturbance of potential acid-sulfate soils should be minimized -Regulatory requirements should be followed during clearance and disposal of soils and vegetation
2. Infrastructure	As above	As above

development (access roads, canals)		
3. Obtaining filling materials	Removal of filling materials required for dykes, foundations, access roads may impact habitat water quality	As above
4. Dyke compaction	Poorly compacted dykes will lead to seepage problems	-Dyke compaction testing during construction
5. Labor worker safely	Possible impacts on environment caused by labor force (e.g. noise, groundwater draw-down, sewage)	-Provision of suitable infrastructure to support labor
D. Farm operation and Management		
1. Solid waste disposal	Impacts on surrounding land-use/wetland habitats	-Non-organic, solid waste materials should not be dumped into mangrove forests etc., but disposed of safely
2. Waste water/effluent discharge	Impacts on local water quality and sediments	-Use of settlement basins -Environmentally sound disposal of pond bottom sediments -Water exchange minimized and water recycling -Discharge of pond effluent into areas with adequate tidal flow -Disposal of dead/diseased animals in sanitary manner -Minimize leaks from water pumps, generators, etc. -Construction of artificial wetlands for effluent clean up -Secondary mariculture (e.g. of filter feeding fish or molluscs) -Salination avoided by buffer zones, pond liners, pond dyke compaction and site selection on low seepage soils. Sandy soils require special liners to eliminate seepage
4. Water intake and conveyance	Potential impacts on hydrology from poorly flushed tidal creeks Draw-down of groundwater supplies Water pollution problems impacting water quality	-Water supplies from well-flushed supplies -Reduce or eliminate use of ground waters -Site selection to reduce/eliminate the need for use of freshwater in brackish water ponds
5. Harvesting and pond bottom management	Stirring up and discharge of pond bottom sediments leading to water pollution Sedimentation caused by inappropriate disposal of pond	-Harvesting techniques which do not stir up bottom sediments -Partial harvesting -Settlement pond to catch and trap pond sediment -Sediment management techniques which do not require sediment removal (e.g. ploughing, drying)

	sediment	-Sediment disposal away from waterways -No flushing of pond sediments with water
6. Use of chemicals/water treatment	Potential impacts on workers' health Water pollution Impacts on mariculture product quality	-Use of approved chemicals according to standard practices -Reduce disease problems through preventative management not chemicals -Education of workers in safe use/handling of chemicals
7. Seed collection/supply in hatcheries	Loss of biodiversity caused by harvesting of wild stocks.	-Improved fishing techniques which reduce damage to non-target stocks -Development of hatcheries
8. Feed and feed management in intensive culture	Deterioration in pond environment and water quality impacts on surrounding environments	-Use low pollution/nutritionally appropriate diets -Implement effective feeding strategies -Careful feed control, monitoring
9. Disease outbreaks and disposal of mortalities	Economic impacts on stock, product quality and native populations.	-Implement preventative health management strategies (e.g. quarantine, isolation of infected tanks, maintain strict hygiene). Sanitary disposal of mortalities
10. Operational failures	Sudden impacts caused by loss of stock and discharge of saline and nutrient rich pond water	-Accommodating operational failures in system design and management procedures -Routine dyke maintenance essential -Dykes should be designed to withstand flood events
11. Labor force	Impacts on water quality and habitats due to increased population	-Provision of sanitary conditions for workers -Environmental awareness training for workers
E. Critical environmental review		
How to assess/judge impact		

(III) COASTAL CAGE OR PEN CULTURE

CHECKLIST OF ENVIRONMENTAL IMPACTS AND MITIGATION STRATEGIES FOR SEA-BASED INTENSIVE FISH CAGE/PEN MARICULTURE PROJECTS

Actions affecting environmental resources and values	Potential environmental impacts	Potential mitigation strategies for negative environmental impacts
A. Cage or Pen site selection		Appropriate site selection
1. Conflicts with other site users and interference in livelihoods of local communities	On and off-site impacts resources and social conflicts	-Appropriate resource use planning -Consultation process -Participation of local people in mariculture projects -Resettlements/compensation agreements

2. Selection of ecologically sensitive site	Potential loss of biodiversity and wetland habitat	-Careful site selection -Management plan which identifies ecologically sensitive sites -Habitat restoration (e.g. replanting of mangroves) -Maintain buffer areas around hatchery -Prior assessments of impacts
3. Hazards to mariculture from nearby pollution sources (e.g. agriculture and industry)	Water pollution from industry, agriculture affecting sustainable mariculture	-Careful site selection -Pre-treatment of water. -Pressure from mariculturists to reduce pollution from other sectors
4. Typhoons, flooding, hurricanes	Damage to physical facilities, and loss of fish stock	-Careful site selection -Hatchery design taking account of extreme climatic events. -Buffer zones for wind breaks (e.g. mangroves)
5. Water quality	Water quality deterioration caused by self-pollution from mariculture effluent	-Careful site selection in relation to carrying capacity. -Management practices and effluent controls. -Strategic planning to keep number of farms within carrying capacity.
6. Fish seed	Potential impacts on biodiversity caused by overharvesting of wild stocks Lack of sustainability of mariculture due to insufficient seed supply. Introduction of exotic species may impact on indigenous species	-Careful assessment of requirements prior to farm development -Development of hatcheries -Sustainable harvesting practices for wild stocks -Prior assessment of impacts from introductions of new species.
7. Disease problems	Potential impacts caused by presence of serious pathogens/disease problems	-Disease surveys of existing farms to assess risk. -Introduction of risk management strategies to reduce risk.
B. Farm design	Poor design can lead to a variety of environmental problems	B. Careful/appropriate design
1. Attention to problems A (1) to A (7) above	As above	As above
2. Socioeconomic impacts	Social inequities leading to social unrest	-Participation of local people in mariculture projects. -Understand socioeconomic conditions prior to project and ensure developments do not negatively impact local people.
3. Interference with navigation, traditional users	Impacts on existing uses	-Site farms in ways which do not impact traditional uses -On-shore infrastructure development in ways which roads, buildings d not cause

		environmental impact -Maintain buffer areas between farms and other uses.
4. Aesthetics	Aesthetic impacts	-Development of green buffer zones -Low profile cages, minimize use of unsightly structures
C. Farm construction	Poor construction practices can lead to various environmental problems	C. Appropriate farm construction
1. Siting	Impacts on benthos during construction and disturbance of wildlife	-Maintain buffer areas. -Ensure site disturbance is limited to immediate construction area.
2. Infrastructure development (access roads, boats)	As above	As above
3. Labor, worker safety	Possible impacts on environment caused by labor force (e.g. noise, groundwater draw down, sewage)	-Provision of suitable infrastructure to support labor
D. Farm operation and Management		
1. Solid waste disposal	Impacts benthos, wildlife	-Non-organic, solid waste materials should be disposed of safely. -Culture site may be rotated to prevent extreme local impact improve growing conditions and allow for periodic recovery.
2. Waste water/effluent discharge	Impacts on local water quality and sediments	-Efficient feeding practices (minimize use of trash fish). -Site farms in areas with adequate tidal flow -Disposal of dead/diseased animals in sanitary manner. -Minimize leaks from water pumps, generators, etc. -Construction of artificial wetlands for effluent clean-up -Secondary mariculture (e.g. of filter feeding fish or molluscs) -Seaweeds in vicinity of cages
3. Harvesting and post-harvest	Discharge of harvesting waste water causing pollution	-Harvesting techniques, which capture wastes (blood, viscera etc.)
4. Use of chemicals/water	Loss of biodiversity caused by harvesting of wild stocks. Impacts on wild stocks through escapes of farmed stocks	-Improved fishing techniques that reduce damage to non-target stocks. -Development of hatcheries -Sitting in ways which minimize storm damage -Prior assessments of introductions of exotics. -Adherence to ICES/FAO Codes of Practice (Turner 1988)
6-5. Seed	Loss of biodiversity	-Improved fishing techniques which

collection/supply	caused by harvesting of wild stocks	reduce damage to non-target stocks -Development of hatcheries
6. Feed and feed management in intensive culture	Deterioration in pond environment and water quality impacts on surrounding environments	-Use low pollution/nutritionally appropriate diets -Implement effective feeding strategies -Careful feed control, monitoring.
7. Disease outbreaks and disposal of mortalities	Economic impacts on stock, product quality and native populations	-Implement preventative health management strategies. -Sanitary disposal of mortalities -Quarantine procedures/health certification for introduced fish stocks
8. Operational failures caused by storms	Sudden impacts caused by loss of fish stock	-Accommodating operational failures in management procedures. -Routine checking of nets, moorings -Farm structures designed to withstand storm events.
9.Boats, infrastructure support	Water pollution from boat engines	-Use of appropriate fuel and maintenance of engines -Minimize leakage from oil, petrol
10. Labor force	Impacts on water quality and habitats due to increased population	-Provision of sanitary conditions for workers -Environmental awareness training for workers
11. Predators and wildlife	Wildlife disturbance Predators causing damage to fish stocks. Shooting of predators by farmers	-Select sites with low numbers of predators -Implement management systems to reduce impacts (e.g. guards double nets) -Environmentally sound capture removals of predators

(IV) COASTAL MOLLUSC CULTURE

CHECK LIST OF ENVIRONMENTAL IMPACTS AND MITIGATION STRATEGIES FOR SEA-BASED INTENSIVE SEAWEED AND MOLLUSC MARICULTURE PROJECTS

Actions affecting environmental resources and values	Potential environmental impacts	Potential mitigation strategies for negative environmental impacts
A. Site selection		Appropriate site selection
1. Conflicts with other site users and interference in livelihoods of local communities	Social conflicts	-Appropriate regional land use planning -Consultation process -Participation of local people in mariculture projects -Involve local resource users in mariculture
2. Selection of ecologically	Potential loss of biodiversity and	-Careful site selection and integration of mariculture into integrated coastal

sensitive site	wetland habitat	management -Management plan which identifies ecologically sensitive sites -Habitat restoration (e.g. seaweed culture) suitable on degraded coral reef areas -Maintain buffer areas around hatchery -Prior assessments of impacts
3. Hazards to mariculture from nearby pollution sources (e.g. agriculture industry)	Water pollution from industry, agriculture affecting sustainability of mariculture	-Careful site selection -Pressure from mariculturists to reduce pollution from other sectors
4. Typhoons, hurricanes, storm damage	Damage to physical facilities and loss of stock (an important problem for sea-based mariculture)	-Careful site selection -Farm design taking account of extreme climatic events.
5. Water quality	Water quality and benthic changes caused by mariculture	-Careful site selection in relation to carrying capacity. -Management practices -Strategic planning to keep number of farms within carrying capacity. -Extensive seaweed and mollusc farms are net removes of nutrients from coastal systems and can contribute to water quality improvement).
B. Farm design	B. Poor design can lead to a variety of environmental problems	B. Careful/appropriate design
1. Attention to problems A (1) to A (5) above	As above	As above
2. Socioeconomic impacts	Social inequities leading to social unrest	-Participation of local people in mariculture projects. -Understand socioeconomic conditions prior to project and ensure developments do not negatively impact local people. -Low-cost, extensive mariculture potentially appropriate for artisanal fishers.
3. Infrastructure development (guard houses, accommodation, processing areas)	Structures (e.g. guard house, worker accommodation) may lead to negative impacts on habitat	Appropriate siting of structures
4. Aesthetics	Aesthetic impacts	-Selection of "low value" sites without tourism or fishery value -Minimize use of unsightly sea-based structures
C. Farm construction	Poor construction practices can lead to various environmental	C. Good construction practices

	problems	
1. Site clearance	Damage to corals and existing habitat Water quality problems during construction	-Ensure site disturbance is limited to immediate area -Do not site farms on high value corals -Regulatory requirements should be followed during clearance.
4. Infrastructure development (guard houses, accommodation, processing areas)	As above	As above
5. Labor, worker safety	Possible impacts on environment caused by labor force (e.g. noise, sewage, walking on reef flats)	-Provision of suitable infrastructure to support labor -Limiting movements as far as possible to the construction site
D. Farm operation and management		
1. Solid waste disposal	Impacts benthos, wildlife	-Non-organic, solid waste materials should be disposed of safely. -Careful disposal of fouling organisms from molluscs/farm structures -Rotation of farm locations to avoid accumulation in specific areas.
2. Waste water/effluent discharge	Impacts on local water quality and sediments	-Polyculture (molluscs, fish) can be promoted to improve productivity of water column -Site rotation -Keeping within carrying capacity
3. Harvesting		
4. Use of chemicals	Minimal use in seaweed culture and mollusc culture	-Use of approved chemicals according to standard practices (including anti-fouling agents on structures) -Education of workers in safe use/handling of chemicals
5. Seed collection/supply	Introduction of exotic species can lead to negative impacts on biodiversity	
6. Disease outbreaks and Disposal of mortalities	Economic impacts on stock, product quality and native populations	-Implement preventative health management strategies -Maintain stocking density within carrying capacity
7. Operational failures caused by storms	Sudden impacts caused by loss of fish stock	-Siting in areas not prone to storm damage
8. Labor force	Impacts on water quality and habitats due to increased population	-Provision of sanitary conditions for workers. -Environmental awareness training for workers

Source: Hambrey et al (2000)

APPENDIX 2

(A) NEGATIVE IMPACTS SOMETIMES ASSOCIATED WITH MARICULTURE

IMPACT	CAUSES
<ul style="list-style-type: none"> ☐ On and off site damage to natural resources ☐ Associated social conflict 	<ul style="list-style-type: none"> • Direct conversion of semi-natural habitat, or land use for other purposes • Indirect impacts <ul style="list-style-type: none"> - Organic or chemical pollution - Introduction of seawater - Over-exploitation of capture fishery resources for fish-meal or trash fish supply
On and off-site damage to sites of cultural or aesthetic value	<ul style="list-style-type: none"> • As above
Over-exploitation of wild seed or brood stock	<ul style="list-style-type: none"> • Poor fisheries management • Lack of hatchery production
Loss of biodiversity and wetland habitat	<ul style="list-style-type: none"> • Direct conversion
Water pollution	<ul style="list-style-type: none"> • Changes to hydrology
Changes to hydrology or salinity	<ul style="list-style-type: none"> • Water extraction, use and management
Solid waste production and disposal	<ul style="list-style-type: none"> • Poor food conversion • Poor pond water management • Poor pond sediment management • Poor waste disposal
Social inequality	<ul style="list-style-type: none"> • Land/resource appropriation for mariculture development • Rapid increase in income for successful farmers • Increased cost of land or resources related to profitable mariculture
Demographic impacts	<ul style="list-style-type: none"> • Use of significant outside labor or technical expertise
Aesthetic impacts	<ul style="list-style-type: none"> • Direct conversion • Extraction activities • Structures
Impact on worker health	<ul style="list-style-type: none"> • Pesticides, disinfectants, antibiotics • Waterborne diseases
Disease spread	<ul style="list-style-type: none"> • Poor husbandry and stressed stock • Mixed influent and effluent water • Exchange of water between farms • Diseased seed; diseased stork • Stock movement
Genetic pollution	<ul style="list-style-type: none"> • Introduction of new species • Introduction of new races • Introduction of associated organisms including disease
Noise and disturbance during construction	<ul style="list-style-type: none"> • Pond, cage or building construction
Secondary impacts at material extraction site	<ul style="list-style-type: none"> • Removal of materials (e.g. dyke) from burrow pits
Secondary impact on product quality	<ul style="list-style-type: none"> • Chemical and antibiotic residues in product

(B) POSITIVE IMPACTS SOMETIMES ASSOCIATED WITH MARICULTURE

Increased productivity in coastal waters and wetlands, including mangroves	<ul style="list-style-type: none">• Nutrient and organic matter released at moderate concentration to the coastal environment from semi-intensive and intensive shrimp and finfish culture
Reduced plankton and nutrient loading in coastal waters	<ul style="list-style-type: none">• Filter feeding of farmed molluscs and planktivorous fish.• Nutrient uptake by seaweed culture
Reduced extractive/exploitative pressures on semi-natural habitat	<ul style="list-style-type: none">• Provision of alternative employment and income generation
Increased individual and communal income	<ul style="list-style-type: none">• High profitability of some forms of mariculture• Increased spending in local economy
Employment generation	<ul style="list-style-type: none">• Mariculture often supports a relatively high rate of employment per unit of land
Training and education	<ul style="list-style-type: none">• Directly related to specific enterprise
Stock enhancement	<ul style="list-style-type: none">• Hatchery production of over-exploited or endangered species
Increased biodiversity	<ul style="list-style-type: none">• Greater structural habitat diversity related to pond and canal construction

Source: Hambrey et al (2000)

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