Mexico - Aquaculture Project

EA Category A

Environmental Assessment

June 1994

This report has been prepared by the Borrower or its Consultant
MEXICO AQUACULTURE PROJECT
ENVIRONMENTAL ASSESSMENT
EXECUTIVE SUMMARY

Introduction

1. The Mexico Aquaculture Project has a Category A Environmental Rating because some investments occur in or near environmentally sensitive areas (e.g., wetlands) and in some cases may involve the permanent conversion of these areas. A Sectoral Environmental Assessment (SEA) report was prepared by the Government with technical assistance from an outside consultant. It was submitted to the World Bank by the Government on June 27, 1994. Extensive interviews with representatives from key federal agencies, as well as federal and state government offices in all seven project states were conducted as preparation for the sectoral environmental assessment. In addition, workshop sessions were held with groups of fishermen and aquaculturalists to discuss environmental quality issues affecting the success and sustainability of aquaculture in Mexico. The sessions were apparently viewed as a venue for heightening SEPESCA’s awareness of producer concerns for general environmental degradation and its impacts on their livelihoods.

2. As necessary, individual environmental assessments will be prepared for subprojects with a major impact on land or water resources, according to terms of reference agreed upon by the Bank and the Government. Furthermore, to mitigate the potential negative impact of the Aquaculture Project on the environment, an environmental mitigation plan was prepared and will be funded under the project as the coastal zone and environmental management component.

3. The main purpose of this Executive Summary is to summarize the SEA and the environmental mitigation plan. The first section briefly describes the Mexican aquaculture sector, while the relationship between aquaculture and the environment in Mexico is reviewed in the second section. The existing policy framework in Mexico to manage environmental issues associated with aquaculture is assessed in the third section. The fourth section briefly outlines the description of the project and the environmental mitigation plan is presented in the fifth section.

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2. A separate Social Sector Assessment was prepared for the project. "Billie R. DeWalt and Alejandro Toledo, "Social Assessment of Mexico Aquaculture Project." April 1994. Issues raised in the social assessment are addressed in the project’s "Social Strategy and Indigenous People’s Development Plan," which will be funded under the project.
Aquaculture In Mexico

4. Aquaculture is a relatively recent activity in Mexico, which thus far, has been dominated by the production of freshwater species (tilapia, carp, catfish, charal, trout) in the coastal states. Total aquaculture production in 1993 was 176,200 tons. This represented about 14% of total fisheries production in the country and placed Mexico 14th in the world for aquaculture production. The majority of the sector's output is tilapia (46%), followed by oysters (18%), carp (15%), and shrimp (9%). Aquaculture production is concentrated in the 17 Pacific and Gulf coastal states, which accounted for 80% of total output in 1992. The 11 Pacific coastal states account for the majority of the tilapia production and almost all the shrimp output. Oysters are the principal contribution of the 6 Gulf coastal states. The share of the inland states in total output is 20% and has risen slightly since the late 1980s, reflecting the increased production of freshwater species (especially trout and carp) in inland states.

5. Aquaculture production increased steadily during the 1980s, but has either stagnated or declined in the 1990s, depending on the species, with the exception of shrimp. Since 1990, the production of freshwater fish has stagnated reflecting the declining production of fingerlings by government hatcheries, which have lacked the operating funds and infrastructure to support an expanding sector. The exception has been trout production, which has increased due to greater private sector involvement and better management of government trout hatcheries, which have traditionally charged for fingerlings. Oyster harvests have also declined, dropping by 55% between 1989 and 1993, reflecting the reduced demand for oysters in light of the chohia epidemic (1991-92) on the Gulf coast (which produces 91% of all oysters). Preliminary data for 1994 suggests that oyster output has started to recover as the epidemic has gotten under control. In contrast, shrimp production increased by 152% between 1989 and 1993, although it remains a small share of total aquaculture production (an estimated 9% for 1994) and covers only 15,600 ha, of which only 11,942 ha are in operation. The rapid expansion of shrimp production reflects its attractive economic prospects and the lifting of restrictions on private sector involvement in shrimp.

6. Aquaculture production in Mexico is characterized by a large traditional sector which relies on reservoir restocking and small pond aquaculture, and a small, but rapidly growing, modern industrial sector.

(a) **Restocking aquaculture** takes place in large natural or constructed (reservoirs, irrigation canals) water bodies. There are 13,535 dams and reservoirs in Mexico, covering approximately 1.2 million ha, although 72% of the restocking output is from a few (23) large reservoirs with surfaces exceeding than 10,000 ha. Restocking aquaculture accounts for the majority of the sector’s output and Mexico is the largest reservoir fish producer in Latin America. Government supported fingerling stations (hatcheries) annually stock hundreds of reservoirs and dams with finfish fingerlings (mainly tilapia and carp). Government policy in the 1970s focussed on restocking aquaculture and built most of the existing hatcheries. The actual harvest is by small artisan and commercial fishermen and is a form of capture fisheries. Many low income families exploit restocked reservoirs, as it requires a minimal investment and only basic technical skills.

(b) **Rural aquaculture.** Small farmers often combine agriculture and rural aquaculture. Rural aquaculture is based on the introduction of juvenile forms into small permanent or temporary
bodies of water, which may also be used for livestock and small scale irrigation. Only a relatively small fish population can be supported in a given water body with rural aquaculture, as it relies upon no inputs other than those provided by nature. Rural aquaculture is most common among subsistence-oriented producers.

(c) **Industrial aquaculture** was introduced in Mexico in the 1980s and occurs in specific areas designed for semi-intensive and intensive aquaculture production. It requires skilled labor, significant capital investments, as well as relatively high operating costs (mainly feed). Industrial aquaculture offers the greatest potential for growth. Thus far, private investors dominate industrial aquaculture.

**Aquaculture and the Environment**

7. The impact of most of Mexico’s aquaculture activities, thus far, on the environment has been relatively little. Almost all of Mexico’s aquaculture production is from rural grow-out ponds and inland water bodies, which has very little impact of the environment. In some countries, overstocking of reservoirs has led to high levels of effluent in the reservoirs and eutrophication of the impoundment, but this is not a prevalent problem in major reservoirs in Mexico. Almost all of the limited negative impacts of previous aquaculture activities relate to semi-intensive shrimp farming, which remains a relatively recent and limited activity in Mexico. Mexico has only 15,600 ha in shrimp ponds, compared to 180,000 ha contained in the much smaller country of Ecuador. The potential negative effects of aquaculture on the environment are outlined below as well as an assessment of relative importance of each issue in Mexico:

(a) **Displacement of coastal mangrove estuaries** by shrimp ponds, with consequent loss of ecosystem production, was a serious problem in many countries during the 1960-1970s. This has not been a significant problem in Mexico, in light of Mexico’s land use regulations and as the discovery of mangrove soils’ poor suitability for aquaculture in the 1980s. Moreover, most shrimp farms are located in areas where there are few mangrove forests: 83% of Mexico’s 15,600 ha of shrimp farms are in the states of Sinaloa and Sonora, which have only 17% of the country’s mangrove forests.

(b) **Alteration of local hydrology** due to construction of pond dikes, access roads and the dredging of water supply channels has occurred in some cases due to the construction of agriculture farms. The extent to which such problems are associated with aquaculture is relatively limited, given the recent introduction of industrial aquaculture in Mexico.

(c) **Eutrophication from pond water effluent** discharged during drainage or routine exchange can enrich receiving waters, resulting in local degradation in water quality and loss of ecosystem function and diversity. This occurs primarily when there is a high density of shrimp farms in areas with restricted hydrology. There have been no studies associating shrimp farm effluent with local water quality degradation, and no mention was made of the problem in numerous interviews. This could change as the density of farms on coastal lagoon systems increases, as the latter are characteristically plagued with restricted hydrology. Mitigating this threat is Mexico’s recognition of the problem that Ecuador and Honduras have experienced, and the observed tendency towards master-planning regional shrimp farm development.
(d) Eutrophication from waste feeds is a related problem occurring near large cage-culture and net-pen culture operations that are sited in areas of hydrologically restricted water exchange. Again, this issue has not emerged yet in Mexico on any significant scale, given the relatively recent introduction of cage aquaculture.

(e) Overharvesting of wild seedstock The actual impact of the capture of wild seedstock on the availability of post larvae and other non-shrimp species has never been quantified, although it is expected to be small. First, the very young of most marine species suffer extremely high mortalities due to natural causes. Second, Mexico has ambitious programs to construct and operate hatcheries, which will mitigate most concerns from this source. Finally, Mexico is taking steps to set aside large estuarine areas—such as the 100,000+ hectares of the Marismas Nacionales in Nayarit—as exclusion zones for shrimp seed fishing, assuring survival of core populations of marine coastal organisms.

(f) The introduction of exotic species such as tilapia, carp, and penaeid shrimp may displace native organisms by direct competition or the introduction of new pathogens. Tilapia were widely introduced to Mexico in the 1960s and 70s, and now occupy every watershed in the country. Artificial reservoirs account for 97% of the freshwater in Mexico, and 100% of these reservoirs have established populations of tilapia. No quantitative studies have been performed to link the introduction of exotics to loss of native aquatic species, although some impact is likely to have occurred as a result of their earlier introduction.

(g) Access of local populations to resources (e.g., fishery and forest products) has been restricted in some countries, through the exclusive concession of formerly common areas. In Honduras—where areas suitable for aquaculture had no perceived value to government policy makers, and which had never been included in any land-use planning process—this problem has resulted in extreme social discord. Thus far, it does not appear to be a major issue in Mexico.

8. Environmental Impact Affecting Aquaculture Development The successful and sustainable development of commercial aquaculture is influenced by the quality of the surrounding environment. Environmental issues affecting aquaculture include:

(a) Contamination by agricultural chemicals (fertilizers and pesticides), which is a particular concern in Chiapas and Sinaloa. Fertilizers seem to be the most problematic in Mexico. Mexico is in the process of phasing out the most persistent organochlorine pesticides to organophosphorus pesticides that have less environmental impact;

(b) Deforestation and erosion of watersheds resulting in the sedimentation of river and estuarine channels and connections to open water. Some coastal states (Chiapas and Oaxaca) are experiencing high rates of erosion from deforestation or conversion of permanent tree crops to other types of agriculture in upper watersheds. These land use changes are resulting in increased siltation of coastal lagoons. That, together with decreasing year-round freshwater flows from damming of rivers, has resulted in the gradual closing of the mouths of these lagoons, or in the siltation of natural connection channels between lagoons;
(c) **Reduction in freshwater inflow** to estuaries is a result of damming, which has greatly degraded coastal water quality and coastal morphology (e.g., the closing of lagoon mouths) in most coastal states of Mexico;

(d) **Sewage contamination** of coastal waters. Contamination of residual waters with domestic sewage is an important problem in the coast of the Gulf of Mexico. The Pacific coast is also beginning to experience sewage pollution problems in certain areas, but the situation is less critical at the moment. Bivalve shellfish quality has been severely degraded, particularly in Veracruz and Tamaulipas through bio-accumulation of human microbial pathogens;

(e) **Toxic effects on fisheries of fugitive oil contamination from petroleum extraction and transportation** in coastal areas, particularly in Veracruz, leading to reduced populations and degraded quality of shellfish and shrimp; and,

(f) **Entrainment** at thermal power plant cooling intakes has led to the destruction of large numbers of juvenile aquatic forms.

**Environmental Policy Framework for Aquaculture**

9. As Mexico implements its new policy framework for aquaculture, which emphasizes industrial aquaculture including semi-intensive shrimp production, it is at critical juncture where a strategy is needed to avoid further environmental problems. To address this challenge, the GOM has taken several key steps to mitigate the impact of aquaculture on the environment. The most important of these steps are:

(a) The landmark 1988 General Law on Ecological Equilibrium and Environmental Protection (LGEEPA) provides the legal basis for the environmental protection responsibilities of both the Secretariat of Fisheries (SEPESCA) and the Secretariat for Social Development (SEDESOL). This law and associated regulations obligate the former to the sustainable management of aquatic flora and fauna, and SEDESOL to a powerful oversight role in the evaluation of environmental impacts of SEPESCA activities. Since the passage of LGEEPA Mexico has advanced rapidly in the development of a regulatory and institutional framework for environmental management. The law makes provision for development of land use planning based among other on ecological criteria (land use plans) and environmental impact assessment procedures as described below.

(i) The environmental assessment (EA) methodology required by SEDESOL, though comprehensive and consistently required of all new projects, is not entirely effective as an environmental management tool. Principal constraints to effectiveness include a serious backlog in the evaluation of EA reports by SEDESOL's office in Mexico City, a lack of personnel qualified to provide useful review of EA reports, a lack of field review of projects by SEDESOL reviewers, and unfocused requirements for data in the EA format, often resulting in expensive collection of information of marginal utility while issues of genuine relevance may be overlooked.
(ii) This situation could be considerably improved with the completion of land use plans (Ordenamiento Ecologico), which would restrict aquaculture development to areas at least risk environmentally. However, funding is not available to implement these plans in all states with aquaculture potential and community participation needs to be incorporated into the design and upkeep of these plans to ensure their implementation.

(b) The SEDESOL Attorney General’s Office for Environmental Protection was created within the past 2 years to assure compliance with EA conditions and federal government regulations. This agency has offices in all of the project states, has jurisdiction over most aquaculture operations, and is backed by fairly powerful legal powers. Nonetheless, the agency has been preoccupied with monitoring the most serious environmental problems in the country and has been able to give aquaculture development relatively little attention.

**The Mexico Aquaculture Project - Summary Description**

10. The project would focus on aquaculture development and the management of related coastal zone and environmental issues in Oaxaca, Chiapas, Baja California Sur, Nayarit, Sinaloa, Tamaulipas and Veracruz. It would have the six following components:

(a) **Technology Generation, Adaptation and Transfer** to support: three regional research funds which would grant resources on a competitive basis to private researchers, educational facilities, and government agencies; expanded SEPESCA training programs; improved diagnostic laboratories; and specific pathogen free facilities for shrimp broodstock;

(b) **Aquaculture Development** to expand industrial and rural/reservoir aquaculture production among low income producers, mainly in the social sector (ejidos, cooperatives, indigenous groups), via support for nine aquaculture park subprojects including on-farm investment and operating costs (year one); eight hatchery rehabilitation subprojects and the construction of six rural larvae collection centers and training programs in larvae collection;

(c) **Marketing** to support: the implementation of the HACCP (Hazard Analysis Critical Control Points) public health program to facilitate access to the US and EU market via investments in training and modernization of qualified processing plants; marketing/processing infrastructure for aquaculture (to be financed by the GOM, the private sector and commercial banks); the construction of three depuration facilities for oysters (to be managed by cooperatives with 100% cost recovery); a market and trade information system; and, a publicity campaign to promote fish consumption;

(d) **Coastal Zone and Environmental Management** to support: three community based coastal zone management pilots; institutional strengthening for state and federal government agencies involved in coastal zone planning; the design of aquaculture land maps plans for Veracruz and Baja California; an improved environmental assessment process for aquaculture projects; monitoring programs for fragile coastal ecosystems; and, protected areas for wildlands to compensate for the conversion of wetlands into shrimp farms under the project;
(e) Institutional Development and Strengthening to support: training programs for SEPESCA staff; improved equipment for SEPESCA state and federal delegations; improved access to international databases, publications and conferences; studies; and the project coordination unit; and,

(f) Social Strategy and Indigenous Peoples Development Plan to support: a technical assistance grant fund for producers; a grant fund to finance technical assistance activities carried-out by NGOs, educational facilities or private technical assistance companies that are targeted towards indigenous groups, women and other marginal groups; community, NGO and government programs to monitor access to coastal and fishing resources; regular community and NGO evaluations of project activities; and, a social evaluation unit within SEPESCA.

Aquaculture Project Environmental Mitigation Plan

11. The overall objective of the component is to mitigate any negative environmental impact that could result from the development of the aquaculture industry by: increasing community participation in the resolution of resource use conflicts in fragile coastal areas; strengthening government environmental evaluation processes for aquaculture investments; supporting land use mapping for aquaculture investments to ensure that they occur in areas most suitable for the activity; developing compensatory wildland areas when aquaculture development transforms fragile coastal ecosystems into aquaculture parks; and, improving government and community monitoring of coastal resources.

(a) Coastal Resource Management Pilots. The three coastal resource management programs would incorporate public and resource user participation to prepare site-specific integrated resource management plans to guide case-by-case decision making as well as stimulate restoration and conservation initiatives. The pilots will focus on key lagoon-mangrove ecosystems, and in particular on Mar Muerto in Chiapas, Tamiahua in Veracruz and Agua Brava in Nayarit. Each pilot would produce an integrated coastal resources management plan which would be publically reviewed prior to the submission to the state and federal authorities. The plans would also evaluate the impact of upstream agricultural, urban and industrial uses on coastal zone ecosystems and aquaculture activities. The pilots would also develop: ecological histories for the coastal lagoon ecosystems; specific site and activity actions plans; and hydraulic lagoon models. The pilots would be managed jointly by SEPESCA and SEDESOL which will form a small interagency working group to oversee the implementation of the pilots and to managed the institutional strengthening program for coastal zone management (see below).

(b) Institutional Strengthening in Coastal Zone Management. SEDESOL together with SEPESCA would also improve the national framework for coastal zone management. In particular, they would prepare a handbook on preparing integrated coastal resource management tools for Mexico based on the three pilot state experiences; expand short- and long-term training on integrated coastal management; and give seminars to bring together various participants in coastal zone research and policy making in Mexico.

(c) Land Use Capability Program. The project would provide technical assistance to implement the resource mapping program in the states of Veracruz and Baja California Sur. The existing format for preparation of land maps would be used as a departure point, which includes
phases for: (i) definition of the technical scope and study area; (ii) acquisition and analysis of field data; (iii) formulation of recommendations; (iv) preparation of an OE workplan; (v) and workplan execution. Additional technical assistance is proposed to assure increased local participation in OE preparation and greater local access to OE products.

(d) Administration and Methodology for Environmental Assessments. The project would improve the environmental assessment process by: (i) providing technical assistance, equipment and training to develop a computer network to improve access to and the flow of information through the single window system; (ii) clearing the backlog of aquaculture EA documents submitted to SEDESOL-National Environment Institute (INE) by contracting expertise; (iii) improving the environmental assessment methodology by contracting technical assistance to revise Mexican EA guidelines for aquaculture projects.

(e) Monitoring of Critical Coastal Communities and Ecosystems. A comprehensive inventory of the principal coastal terrestrial ecosystem types (e.g., mangroves, salt marshes) would be supported. The inventory is proposed for Sinaloa, Nayarit, Oaxaca and Chiapas, as these states have significant mangrove and marisma areas, as well as a high potential for shrimp farm development. In particular, this component would finance technical assistance and equipment to: (i) define the study areas; (ii) acquire remote imagery (LANDAT-TM); (iii) prepare the ground truthing and interpretation, and; produce the final maps in GIS format.

(f) Coastal Water Quality Monitoring Program. The project would support the development and implementation of a coastal water quality monitoring program in the states of Oaxaca, Sinaloa and Tamaulipas. Periodic assessments of coastal water quality, focusing on areas where suspected contamination is highest as well as the areas with potential for future aquaculture development. Major inputs would include technical assistance to: (i) execute an initial diagnostic study in each state to determine the appropriate location, periodicity and type of analyses; (ii) identify equipment and personnel needs; (iii) design data processing, storage and retrieval systems; (iv) evaluate first-year results and recommend modifications; and, (v) design public access features for the program. Equipment needs will include vehicles and boats, basic laboratory equipment, computers and possibly GIS software.

(g) Compensatory Protected Areas for Wildlands. The project would support the creation of protected wildlands on the Pacific coast to compensate for the conversion of wildlands in the PROYAN 94 industrial aquaculture subproject into shrimp ponds. The issue of habitat degradation is not raised with the Nayarit project, since the park site is located on marginal agricultural lands approximately 1.3 meters above the level of highest tides. The Oaxaca site will be examined during the project appraisal mission to determine if there is a need for compensatory protected area mitigation. The project would support a protected areas plan submitted to SEDESOL by Ducks Unlimited (DUMAC). The protected area would be constituted under Mexican law and would involve interested government agencies and private groups. The proposal recommends adaptation of management strategies that (such as those adopted by the 1971 treaty on the "Convention on Wetlands of International Importance" and the NGO, Western Hemisphere Shorebird Refugee Network) that allow economic activities consistent with the core function as a wildlife management area.
May 4, 1994

Ms. Louise Cord
The World Bank
LA2AG, Rm. I-7099
1818 H St., N.W.
Washington, D.C. 20433

Dear Louise,

KBN is pleased to submit the enclosed copies of the sectoral environmental assessment for the Mexico Aquaculture Project, which includes corrections to the draft document as discussed in our previous communications. As we agreed in our phone conversation, I also forwarded copies of the document to Ing. Ocaña in SEPESCA, as well as disk and hard copies to your field office in Costa Rica for translation.

I have greatly enjoyed this opportunity to work with you and other Bank staff on a project that holds such deep personal interest, and look forward to the remaining tasks leading to appraisal.

With best regards,

Mark Hardin,
Senior Scientist
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<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>BCS</td>
<td>Baja California Sur</td>
</tr>
<tr>
<td>D.F.</td>
<td>Distrito Federal</td>
</tr>
<tr>
<td>DGPE</td>
<td>General Office for Ecological Planning (of the INE)</td>
</tr>
<tr>
<td>DUMAC</td>
<td>Ducks Unlimited of Mexico</td>
</tr>
<tr>
<td>EA</td>
<td>Environmental Assessment</td>
</tr>
<tr>
<td>GOM</td>
<td>Government of Mexico</td>
</tr>
<tr>
<td>ha</td>
<td>hectares</td>
</tr>
<tr>
<td>IBRD</td>
<td>International Bank for Reconstruction and Development</td>
</tr>
<tr>
<td>ICZM</td>
<td>Integrated Coastal Zone Management</td>
</tr>
<tr>
<td>INE</td>
<td>National Ecology Institute (of SEDESOL)</td>
</tr>
<tr>
<td>km</td>
<td>kilometers</td>
</tr>
<tr>
<td>LGEEPA</td>
<td>General Law on Ecological Equilibrium and Environmental Protection</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>OD 4:01</td>
<td>World Bank Operational Directive 4:01</td>
</tr>
<tr>
<td>OE</td>
<td>Land Use Planning (Ordenamiento Ecologico)</td>
</tr>
<tr>
<td>OLFPA</td>
<td>Organic Law of Federal Public Administration</td>
</tr>
<tr>
<td>PAM</td>
<td>Mexico Environmental Program</td>
</tr>
<tr>
<td>PROFEPA</td>
<td>Attorney General’s Office for Environmental Protection</td>
</tr>
<tr>
<td>SARH/CNA</td>
<td>Secretariat for Agriculture and Water Resources/National Water Commission</td>
</tr>
<tr>
<td>SEA</td>
<td>Sectoral Environmental Assessment</td>
</tr>
<tr>
<td>SEDESOL</td>
<td>Secretariat for Social Development</td>
</tr>
<tr>
<td>SEPESCA</td>
<td>Secretariat of Fisheries</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>SRA</td>
<td>Secretariat of Agricultural Reform</td>
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<tr>
<td>SRE</td>
<td>Secretariat of Foreign Relations</td>
</tr>
<tr>
<td>STPS</td>
<td>Secretariat of Labor</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>VU</td>
<td>Ventanilla Unica</td>
</tr>
</tbody>
</table>
# Glossary of Spanish Terminology

<table>
<thead>
<tr>
<th>Spanish Word</th>
<th>English Description</th>
</tr>
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<tbody>
<tr>
<td>centro acuicolas</td>
<td>government-owned and operated stations that produce fingerling fish for stocking local ponds</td>
</tr>
<tr>
<td>Concurrencia</td>
<td>Concurrent jurisdiction</td>
</tr>
<tr>
<td>delegaciones</td>
<td>state offices of federal agencies</td>
</tr>
<tr>
<td>dependencias</td>
<td>Secretariat (i.e., ministry) level agencies within the federal government</td>
</tr>
<tr>
<td>desconcentrado</td>
<td>a decentralized federal agency</td>
</tr>
<tr>
<td>ejido</td>
<td>communal land holding</td>
</tr>
<tr>
<td>manifestacion de impacto ambiental</td>
<td>Mexican Environmental Assessment Procedure</td>
</tr>
<tr>
<td>ordenamiento ecologico (OE)</td>
<td>ecological land use planning</td>
</tr>
<tr>
<td>procuraduria</td>
<td>Office of the Attorney General for a given branch of government</td>
</tr>
<tr>
<td>ventanilla unica</td>
<td>one-stop window for permitting</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

The Mexico Aquaculture Development Project seeks to promote sustainable aquaculture and the rational management of coastal resources in the seven states of Tamaulipas, Veracruz, Baja California Sur, Sinaloa, Nayarit, Oaxaca, and Chiapas. Project activities are subdivided into six themes that promote: 1) the generation and adaptation of new aquaculture technologies; 2) the construction or rehabilitation of support infrastructure such as navigation channels, roads, and aquaculture parks; 3) the development of new markets for aquaculture products; 4) the building of institutional capacity to manage environmental issues associated with aquaculture; 5) the strengthening of key Mexican institutions to promote aquaculture development; and 6) the pilot testing of integrated coastal zone management.

This sectoral environmental assessment (SEA) of the Mexico Aquaculture Development Project was prepared to consider environmental issues early in the project planning process, before discrete subproject activities are fully designed or even identified with certainty. The purpose of such early treatment of environmental concerns is that the sector-wide policies and practices at their origin, as well as legal and institutional issues that may exacerbate problems or constrain resolution, can be examined and modified before major project energies and funds have been committed.

At the time of SEA preparation, state task force groups were in the process of preparing specific subproject activities. It is anticipated that the project will be ready for World Bank appraisal in June 1994; will be funded by contributions of $70 to $100 million from each the Government of Mexico and the International Bank for Reconstruction and Development (IBRD); and will initiate project operations in early 1995.

This project is an integral extension of the Mexican government’s Aquaculture Development Program, which seeks to capitalize on recent changes to both the Fisheries Law and the Constitution allowing greater private participation in aquaculture ventures. Though it is hoped that aquaculture will thus be transformed into an instrument in the service of the country’s growth-oriented economic policies, there is also concern that serious environmental impacts may arise in association with such a large-scale development of commercial aquaculture.
As determined by review of the project, principal negative environmental impacts that may arise from implementation include:

- The alteration of local estuarine hydrology due to improperly sited dredging, farm, or road construction operations;
- The eutrophication caused by pond effluent or waste feeds from cage-culture operations;
- The reduction of nearshore fisheries stocks due to uncontrolled collection of wild shrimp seedstock; and
- The loss of habitat for migratory bird populations caused by shrimp pond construction.

The Mexican government has invested considerable time and resources into the development of a comprehensive legal and regulatory framework relative to environmental issues. The landmark 1988 General Law on Ecological Equilibrium and Environmental Protection (LGEEPA) is the parent legislation, providing legal basis for the environmental protection responsibilities of both the Secretariat of Fisheries (SEPESCA), the nodal implementing agency for this project, and the Secretariat for Social Development (SEDESOL), the Mexican environmental protection agency. These laws and regulations obligate the former to the sustainable management of aquatic flora and fauna, and SEDESOL to a powerful oversight role in the evaluation of environmental impacts of SEPESCA activities.

Two principal instruments in the management of environmental issues are environmental assessment (EA) and land-use planning (Spanish acronym OE). The EA methodology required by SEDESOL, though comprehensive and consistently required of all new projects, is not entirely effective as an environmental management tool. Principal constraints to effectiveness include a serious backlog in the evaluation of EA reports by SEDESOL’s office in Mexico City, a lack of personnel qualified to provide useful review of EA reports, a lack of field review of projects by SEDESOL reviewers, and unfocused requirements for data in the EA format, often resulting in expensive collection of information of marginal utility while issues of genuine relevance may be overlooked.

It is believed that this situation could be considerably improved with the completion of land use plans (OE), though funding is present to do so only in five of the seven project states. Existence
of land use plans would restrict aquaculture development to areas at least risk environmentally, as well as streamline the EA process, increasing the likelihood of its genuine utility.

A powerful agency, the SEDESOL Attorney General's Office for Environmental Protection, has been created within the past 2 years to assure compliance with EA conditions and federal government regulations. This agency has offices in all of the project states, has jurisdiction over most aquaculture operations, and is backed by fairly powerful legal powers. Nonetheless, the agency has been preoccupied with monitoring the most serious environmental problems in the country and has been able to give aquaculture development relatively little attention.

Mitigations for negative environmental impacts that are recommended for the Aquaculture Development Project include

- Building an institutional capacity to model and predict coastal estuarine hydrology under varying scenarios of dredging and other infrastructure development,
- Improving the EA process by training additional personnel and revising methodology,
- Completion of land use plans in all project states,
- Designing and initiating environmental monitoring activities focusing on mangrove ecosystems, and
- Supporting the protection of priority wetlands of importance to migratory waterfowl.

Other mitigations have already been incorporated into the project's design—such as the concentration of coastal aquaculture into "parks", the implementation of watershed management to reduce erosion and the need for dredging of estuaries, and the introduction of Integrated Coastal Zone Management strategies.

Three alternatives, accepting the project as-is, accepting the project with recommended mitigations, and rejecting the project, were examined. This exercise indicates that accepting the modified project is the least risky alternative with regards to negative environmental impact.

Despite mitigating measures such as the environmental and coastal zone management components, the project proposes extensive development and land use changes in coastal zones and in close proximity to wetlands. A Category "A" environmental assessment is, therefore, appropriate, a requirement fulfilled by the present SEA. Subproject activities that will always require specific
environmental assessment include dredging, pond and aquaculture farm construction in coastal areas, and construction of main roads. With incorporation of certain changes to environmental assessment methodology, the Mexican EA process could serve in lieu of Bank EA methodologies. Environmental assessment reports should be reviewed by the World Bank for no objection on all Category "A" subactivities.
1.0 INTRODUCTION

This report constitutes the sectoral environmental assessment (SEA) of the Mexico Aquaculture Development Project. The SEA was prepared according to guidelines presented in the World Bank Operational Directive 4:01; the Environmental Assessment Sourcebook Update #4 of October 1993; and project-specific Terms of Reference (TORs) prepared by the consultant and approved by the World Bank, Secretariat for Social Development (SEDESOL), and Secretariat of Fisheries (SEPESCA) (Annex A). The SEA was based on findings from two missions to Mexico, covering the periods November 29 to December 11, 1993, and January 23 to February 13, 1994.

The purpose of the SEA is to allow the consideration of environmental issues very early in the project planning process, before discrete sub-project activities are fully designed or even identified with certainty. The advantage of such early treatment of environmental concerns is that the sector-wide policies and practices at their origin, as well as legal and institutional issues that may exacerbate problems or constrain resolution, can be examined and modified before major project energies and funds have been committed.

If successful, an SEA will:

- Prevent sectoral investments from causing serious environmental problems by identifying broad-based weaknesses in sufficient time to allow change;
- Sharpen environmental issues by comparing alternative sector-investment strategies;
- Reduce the time needed to perform subsequent project-specific environmental assessments by providing background on legal, institutional, and regulatory frameworks.

The assessment was conducted via extensive interviews with representatives from key federal agencies, as well as federal and state government offices in all seven project states.

The Mexico Aquaculture Development Project will provide financial assistance to the Mexican Government in the implementation of their national aquaculture development program. Generally speaking, this program seeks to both take advantage of recent government policy changes favoring aquaculture development (see Section 2.0), and reduce other constraints to sustainable aquaculture.
development through investments in critical infrastructure and technical capabilities. The project is decidedly oriented towards support of the Mexican social sector, which includes the cooperative and ejidal farming and fishing communities. It is anticipated that the project will be ready for World Bank appraisal in June 1994; will be funded by contributions of $70 to $100 million from each the Government of Mexico and the International Bank for Reconstruction and Development (IBRD); and will be implemented in early 1995.
2.0 POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

This section seeks to:

- Describe the legal, regulatory, and policy setting for aquaculture development in Mexico, with particular reference to environmental protection;
- Describe the Mexican government’s process for determining environmental impact and assuring compliance with measures that mitigate or reduce impacts;
- Evaluate the Mexican government’s environmental impact assessment process as compared to the World Bank’s procedures for the same; and
- Describe and evaluate the particular role played by Land Use Plans (ordenamiento ecológico) in promoting aquaculture and providing environmental protection.

Such analyses are vital to the practical utility of SEAs from the standpoint of:

- Ensuring that environmental impacts of government policies promoting sectoral growth have been considered and are addressed as an integral component of the general body of laws and regulations governing the sector (e.g., that fisheries law not only promotes activity in that sector, but also accommodates the environmental impacts of those activities);
- Illuminating any contradictions or overlap in mandate between laws and regulations of the target sector and those environmental policies, law, and regulation of related sectors; and
- Setting the stage for environmental assessments of specific subprojects arising from the sectoral program by answering such fundamental EA-related questions as adequacy of laws, regulations, human, and institutional resources.

National laws and policy instruments, such as the Organic Law of Federal Public Administration (OLFPA), the National Law on Ecological Equilibrium and Environmental Protection of 1988 (spanish acronym LGEEPA), the National Agreement for the Modernization of Aquaculture in Mexico, and the Fisheries Law of 1992 were examined in the course of performing these analyses.
2.1 GENERAL LEGAL AND REGULATORY FRAMEWORK FOR AQUACULTURE DEVELOPMENT IN MEXICO

2.1.1 GOVERNMENT OF MEXICO POLICY AND LEGAL CHANGES ENABLING AQUACULTURE DEVELOPMENT

The Government of Mexico, guided by the free-market economic policies of the present administration, has shifted away from fisheries policies oriented towards the social sector in favor of strategies that reflect aquaculture's potential as an important new force for national economic growth. These changes began with 1989-1991 modifications to the 1986 Fisheries Law (Ley Federal de Pesca), and even more significant modifications to that law in 1992 as a result of the landmark revisions to Article 27 of the Mexican Constitution. Most important were changes to those Article 27 provisions that had previously mandated the reservation of eight high-value aquatic organisms—most importantly shrimp, lobster, and abalone—for exclusive exploitation by fishing cooperatives or other entities in the social sector.

This provision has long been regarded as a particularly serious constraint to aquaculture investment in Mexico since, in effect, a fishing cooperative would be an obligate partner in any venture seeking to harvest, grow, or otherwise exploit the highest value species.

Specific policy objectives of the 1992 changes to the fisheries law include:

- Increasing private investment in fisheries and aquaculture from national sources,
- Promoting the participation of foreign capital in aquaculture projects,
- Increasing foreign currency income to the country via fishery exports,
- Permanently ending the harvest of sea turtles, and
- Increasing the availability of commercial aquaculture feeds.

Legal reforms most critical to the achievement of these policy objectives include the de-reserving of the eight high-value species, the extension of the duration of aquaculture concessions from 10 to 50 years, removal of restrictions to foreign investment, and the transferability of fisheries aquaculture concessions.

In summary, these policy and legal changes have set the stage for the rapid development of an export-oriented, commercial aquaculture industry in which private, even foreign, investment is expected to play a major role.
These changes were effected with some original consideration for conservation issues, principally with regards to transferability of concessions. Enabling the transfer and sale of natural resource concessions is a widely used management strategy, because it provides some avenue for reducing harvest pressure. In theory, if too many fishermen are depending on a given population of organisms, declining per capita harvests will economically marginalize most individuals. Faced with this situation, fishermen may elect either to intensify effort and technology or, if permitted by law, sell their concession quota to other fishermen and get out of the business, thereby reducing overall pressure on the resource. Although the efficacy of this theory has been demonstrated on pelagic capture fisheries in developed countries, its applicability to the aquaculture sector of a developing country such as Mexico cannot be ascertained at present. Concern does exist regarding the possibility that smaller producers will be squeezed out in favor of better capitalized interests in any such consolidation.

Other criticisms of the newly revised Fisheries Law are related to the absence of certain key elements to assure an equitable transition from a policy emphasizing social welfare to one that promotes commercial opportunity. As described by Villemar, these elements would include:

- A decentralized regulatory system with clearly defined roles for local fisheries agencies, counterbalanced by a means by which the general public can hold government accountable,
- A well-supported research agency that would provide data and information on which to base policy decisions, and
- Highly participatory public-interest groups on the local level, comprised of producers, NGOs, consumers, and others with a manifest interest in the general public good (1992).

Villemar characterized the present, post-reform fisheries sector as markedly deficient in all of these aspects. Personal observation of the rapid development of aquaculture sectors elsewhere in the world strongly validates the above model, with particular reference to the Gulf of Fonseca, Honduras. In that country, government mismanagement of an aquaculture concession process occurred due to a total lack of information on the prevailing land use and value to local populations. The result was complete estrangement between local fishermen, shrimp farmers, and government policy makers, and a situation characterized by escalating virulence in the dialogue over issues, violence, and environmental degradation.
Further personal observations made during the course of the Mexico Aquaculture SEA preparation also indicated weak conformance with this model, as indicated by:

- Static or declining budgetary support for the federal fisheries research agency (Instituto Nacional de Pesca), and
- A virtual absence of local interest groups recognized by SEPESCA.

During SEA preparation, it was recommended that SEPESCA involve a number of local NGO groups in the planning process, a suggestion that was met with reluctance, despite those groups having accurately identified a number of problem areas that closely parallel the Honduran situation.

2.1.2 INSTITUTIONAL STRUCTURE

More than eight agencies are involved to a greater or lesser degree in environmental issues related to aquaculture in Mexico (Figure 1). As discussed above, the basic division of responsibility on aquaculture projects is between the Secretariats of Fisheries and of Social Development (i.e., SEPESCA and SEDESOL).

Federal Level

SEDESOL

SEDESOL is responsible for formulation and implementation of development policy throughout Mexico, a mandate that includes social programs such as the National Solidarity Program as well as environmental protection. Responsibility for environmental protection is further divided between the National Institute of Ecology (INE) and the Attorney General for Environmental Protection (PROFEPA) (Figure 2). The INE is responsible for the regulatory side of environmental protection, including policy formulation, development of environmental standards and criteria, and evaluation of environmental impact reports. PROFEPA is responsible for the enforcement aspects of environmental protection, including monitoring of environmental quality, ensuring compliance with environmental regulations and conditions imposed by INE during review of environmental assessments, conducting environmental audits, and responding to public complaints about environmental quality.
Figure 1
"Ventanilla Unica" System (V.U.) of SEPESCA
(Page 1 of 3)
Figure 1
"Ventanilla Unica" System (V.U.) of SEPESCA
(Page 2 of 3)
Figure 1
"Ventanilla Unica" System (V.U.) of SEPESCA
(Page 3 of 3)
Figure 2
Breakdown of Environmental Responsibilities Under SEDESOL
SARH/CNA

The CNA is responsible for managing surface water and groundwater supplies throughout Mexico and has developed a monitoring and enforcement capability of similar size and operational scope as PROFEPA. The CNA is also highly autonomous from the parent agriculture secretariat and has over 8,000 employees and 34 analytical laboratories under its control, of which 6,000 personnel and virtually all laboratories are located in the states [i.e., outside of the Distrito Federal (D.F.)]. The agency operates a national monitoring network for water quality that includes over 800 surface and subsurface sampling stations and a routine program of collections and analysis.

The CNA has jurisdiction over the quality of water that is at least 5 parts per thousand (ppt) salinity or less, implying that an active role will be played in the control of pollution from freshwater aquaculture, as well as in the protection of water quality for the benefit of aquaculture. The agency has an enforcement and compliance unit with a similar scope of authority as SEDESOL's PROFEPA (see Section 2.4).

State Level

Though a variety of state and municipal entities have recently been created to address environmental issues, these agencies generally have operational jurisdiction over small-scale urban or industrial projects and do not directly regulate aquaculture development. Aquaculture project states that have environmental regulatory capacity include:

- Tamaulipas, whose Secretariat of Human Settlements, Works, and Public Services reviews environmental assessments of municipal projects;
- Veracruz, whose Secretariat for Urban Development includes an environmental impacts staff, but whose authority does not cover aquaculture projects;
- Baja California Sur, whose Secretariat for Human Settlements and Public Works evaluates environmental assessment reports according to the state LGEEPA, which, per Article 21, does not have authority to rule on aquaculture projects;
- Sinaloa, whose state environmental law assigns environmental assessment review to the Secretariat of Planning and Development, and provides legal avenue to evaluate aquaculture projects, though the SEDESOL delegation continues to do so;
- Nayarit, whose Social Development Commission is not assigned authority to evaluate environmental impact assessments of aquaculture;
- Oaxaca, whose Secretariat of Urban Development and Ecology, though nominally authorized to environmental assessment, is not empowered to review aquaculture projects; and
- Chiapas, whose state law (i.e., LGEEPA) mandates environmental assessment, does not allow the Secretariat for Development and Ecology to rule on aquaculture projects.

2.1.3 LEGAL AND REGULATORY BASIS FOR ENVIRONMENTAL PROTECTION

The Mexican Constitution and the OLFPA specify the respective functions of the federal secretariats, including responsibility for environmental protection. In keeping with the Mexican custom of assigning concurrent jurisdiction on most aspects of the law (i.e. concurrencia), OLFPA's Article 43 vests the responsibility for environmental protection and natural resource management related to aquaculture development among several government agencies (Table 1).

Though SEDESOL has the overall responsibility for maintaining and improving environmental quality, including the management of biodiversity, it is repeatedly enjoined to collaborate with, and delegate authority to, other agencies with technical competency in a given area. In the case of aquatic environments and their flora and fauna, collaboration would be sought with SEPESCA and SARH/CNA. For its part, SEPESCA's responsibility for the development of aquaculture is clear, though there are also parallel obligations toward environmental protection. In summary, environmental protection is an intrinsic and recurrent theme pervading SEPESCA's mandate for fisheries and aquaculture development as defined by OLFPA.

The National Fisheries Laws and Regulations of 1992, the operational instrument governing the Fisheries Secretariat, also assigns ample responsibility to SEPESCA in the area of environmental protection and natural resource management. The regulations presented in Table 2 are derived from the environmentally related fisheries law also involve shared responsibilities with other branches of the Federal Government (SEPESCA II, 1993).

Again, the responsibilities and powers, as mandated in its governing body of law, are clear with regard to the Fisheries Secretariat's dual role as a: 1) promoter of fisheries/aquaculture extractive and development activities, and 2) collaborating agent with other branches of government for conservation and environmental management.
Table 1. Comparison of Functions between the Secretariats of Fisheries and Social Development with regards to Environmental Concerns as Described in the Federal Organic Law on Public Administration (from SEPESCA I, 1993)

<table>
<thead>
<tr>
<th>Article 32 (Ley Organico Administracion Publica Federal)</th>
<th>Article 43 (Ley Organico Administracion Publica Federal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Responsibility for the Following Issues Resides in the Social Development Secretariat (SEDESOL)</td>
<td>Primary Responsibility for the Following Issues Correspond to the Fisheries Secretariat (SEPESCA)</td>
</tr>
<tr>
<td>XXII. Promote ecologically rational land use planning (<em>ordenamiento ecologico</em>) over the national territory, in coordination with appropriate branches of the federal public administration, state and local government, with the participation of the social and private sectors.</td>
<td>II. Program, promote and advise on fisheries exploitation and production in all its forms.</td>
</tr>
<tr>
<td>XXIV. In coordination with the Secretariats of Health and other related agencies, formulate and implement general policies on environmental security and quality.</td>
<td>V. Establish seasons and location of prohibitions on the capture or exploitation of aquatic biota.</td>
</tr>
<tr>
<td>XXV. With the participation of the branches of government according to the particular case, establish ecological regulations and criteria for the exploitation of natural resources, preserving and restoring environmental quality.</td>
<td>VIII. Authorize and implement all activities related to aquaculture, as well as establish nurseries, farms and reserves for aquatic biota.</td>
</tr>
<tr>
<td>XXVI. With the participation of other branches of government at the federal, state and local levels, according to the particular case, execute actions that assure the conservation or restoration of ecosystems essential to the public welfare.</td>
<td>XV. Technical support to the Secretariat of Commerce and Industrial Promotion in the export and importation of aquatic biota.</td>
</tr>
<tr>
<td>XXVII. In coordination with appropriate federal, state and local governments, assure compliance with standards and programs for the protection, defense and restoration of the environment; establishing mechanisms and administrative procedures via the appropriate jurisdictional agencies.</td>
<td>XVI. Inventory and evaluation of aquatic flora and fauna, as well as conservation and promotion of marine, lotic, and lentic flora and fauna according to regulations set forth by the Secretariat of Social Development.</td>
</tr>
<tr>
<td>XXVIII. With the appropriate participation of the Secretariats of Agriculture and Fisheries, regulate and assure conservation and rational utilization of aquatic and marine flora, wildlife and fisheries.</td>
<td></td>
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</tbody>
</table>
The Fisheries Law exclusively reserves several areas of responsibility related to conservation and environmental management for the Secretariat of Fisheries, including most prominently:

- Establishing fishing seasons (3o.IX),
- Establishing zones for capture and cultivation of aquatic organisms (3o.VII),
- Determining minimum allowable sizes and total catch volumes,
- Issuance of permits for stocking federally controlled bodies of water (Article 15-IV), and
- Granting of permits and concessions for the capture extraction and cultivation of aquatic resources (Regulation, Article 39.III).

2.1.4 PERMITTING RELATED TO AQUACULTURE

The permitting process is the nexus between producers and the regulatory framework for aquaculture development. The process is quite complex, with institutional involvement determined by such basic project attributes as:

- Organizational character, which is a function of private or social sector origination (i.e. corporation or cooperative/ejido);
- Land tenure, which is determined by the land classification as federal or private; and
- Water quality to be used in the culture operation, with the deciding criteria being fresh (i.e., less than 5 ppt salinity) or saline.

The complexity of the permitting system has long been a major issue for aquaculture developers in Mexico. As a mitigation of this complexity, a valuable facilitation role was created for SEPESCA in 1992 that has been christened the Ventanilla Unica (VU), or "One-Stop Window." Under VU, SEPESCA furnishes support and valuable official auspices to private applicants in the acquisition of permits from the above-listed agencies. In operational terms, SEPESCA provides aquaculture developers with comprehensive information regarding the permitting requirements of their individual project, receives required documentation from them, and undertakes its distribution and follow-up among the agencies particular to their case allowing applicants the considerable advantage of dealing with a single bureaucracy. SEPESCA has produced a comprehensive folder of application forms and instructions for distribution to applicants, although these have not been updated since the program's inception and are in short supply in most state delegaciones.
Table 2. Regulations Derived from the 1992 Fisheries Law Related to Environment that Represent Shared Responsibility with other Federal Agencies

Article 1o. The present law...relative to natural resources comprised of flora and fauna whose medium is water...has the objective of guaranteeing the conservation, preservation and rational exploitation of fisheries resources, and establishing a basis for its adequate management...

Article 2o. The law’s resolutions will have application on all waters within Federal Jurisdiction referred to in the fifth and eighth paragraphs of Article 27 of the Constitution.

Article 3o. The application of the present law falls to the Secretariat of Fisheries, without compromising the powers of other branches of federal government, which should establish the necessary coordination with Fisheries in their execution of the following.

I. Draw up, publish and maintain the national fisheries map containing the fisheries resources inventory of federal waters.

IV. Promote aquaculture development in coordination with other federal, state and municipal agencies.

V. Prepare and implement measures that protect sea turtle, marine mammals, and endangered aquatic fauna in need of special protection; collaborating with appropriate agencies in this regard.

VIII. Regulate the introduction of aquatic flora and fauna in bodies of water under federal jurisdiction; and define the technical norms and standards needed to verify – either directly or through accredited laboratories – the basic health of aquatic flora and fauna...in coordination with appropriate federal agencies.
Although the particular mix of agencies is a function of project-specific conditions, most coastal aquaculture projects will involve:

- SEPESCA, who will grant an "Aquaculture Concession" in cases where Federal ownership of land is involved;
- SARH/CNA, who will grant a "Water Use Concession" if culture water falls within their jurisdiction (Figure 3);
- SRA, who, in the case of cooperatives or ejidos, will issue an "Authorization of Agricultural Viability" to assure that the project conforms to Agriculture Reform Policies;
- STPS, who confirms the legal status of social-sector organizations;
- SRE, who confirms the legal status and provides documentation for private-sector investors; and
- SEDESOL, who evaluates and rules on the project's environmental impact assessment and dictates conditions that govern its construction and operation.

The VU is present in both the central and 11 delegation offices of SEPESCA, including all of the seven project states. In simplest terms, the state-level VU is responsible for all permits and review at that level, after which the application is remitted to the VU office in Mexico City for the management of permitting in the D.F. (Figure 1).

Although the VU process has reduced the paperwork burden associated with permitting, complaints and problems continue to exist with the system, virtually all of which relate to the environmental assessment process. Problems originating with the permitting process and not adequately addressed by the VU include: 1) the extended chain of communication between applicant and the agencies located in the D.F., which creates delays of many weeks when SEDESOL requests additional information or data in support of an environmental assessment finding, and 2) the expense of obtaining all permits, which could easily amount to over N $50,000 (approximately $16,000) even for a small project (see Section 7.3).

2.2 ENVIRONMENTAL ASSESSMENT IN MEXICO

Environmental impact assessment is a well established procedure in Mexico, dating in its present form from the 1988 LGEEPA. Two prior laws, the Public Works Law of 1980 and the Federal Law of Environmental Protection of 1982, established the precedent for requiring environmental
impact assessment of development activities. However, this earlier legislation was poorly understood, and an EA was only infrequently performed.

2.2.1 PRESENT LEGAL FRAMEWORK
As mentioned, the legal basis for environmental assessment is the 1988 LGEEPA, which in turn is derived from Article 27 of the Mexican constitution. LGEEPA’s Article 3 defines EA as the "document by which a description is made, based on studies, of the significant and potential environmental impact which a work or activity may generate, as well as how to avoid or mitigate it, should that impact be negative." Article 8 assigns to SEDESOL the responsibility for evaluating environmental impact of activities further defined in Articles 28 and 29.

Article 28 further defines SEDESOL’s mandate as covering "public or private works or activities that may upset ecological balance... or exceed federal norms and standards defining environmental quality." With regard to natural resource based projects, Article 28 also states that impacts to all components of the host ecosystem must be considered in addition to the target resource.

Article 29 defines specific areas of jurisdiction for SEDESOL, including federal public works, hydraulic works, transport, heavy industry, pipelines, mineral exploration and extraction, hazardous waste management facilities, federal tourist development projects, radioactive waste management facilities, and the exploitation of forest resources.

Although jurisdiction for all other activities is assigned by default to the states, aquaculture remains within the federal domain according to Article 95, which states that "SEDESOL may ask the Fisheries Department to conduct environmental assessment studies before granting concessions, permits, or in general, authorizations to carry out fisheries activities, when development of the species jeopardizes its conservation or may cause ecological imbalance." Although this article provides a nominal loophole in being tied to the aquaculture concession process (i.e., a concession is not required for aquaculture on private land), this loophole is effectively closed by the classification in the Fisheries Law of culture water as an area for federal jurisdiction, meaning that SEDESOL will always be required to review environmental assessments of any aquaculture project development.
2.2.2 METHODOLOGY

Figure 4 shows the generic process for an EA in Mexico, and Figures 5 and 6 show the environmental procedure presently in force for general and intermediate modalities, according to environmental impact regulations derived from LGEEPA (Articles 6 through 25). These regulations also establish the maximum periods between steps in the EA process. It should be emphasized that should SEDESOL require additional information or clarification, the decision will not be rendered before an additional 30 days have elapsed.

The standard form for aquaculture projects requires the following sections (Table 3).

I. General data.
II. General description of project and site.
III. General aspects of natural and socioeconomic environment.
IV. Preparation of site and construction.
V. Operation and maintenance.
VI. Identification of environmental impacts.
VII. Preventive measures and mitigation of environmental impacts identified.
VIII. Conclusions.
IX. References.

A full, step-by-step procedure has been prepared by SEPESCA for preparing environmental assessment reports on aquaculture projects and is attached to this SEA report (Annex B).

2.2.3 CRITERIA FOR SELECTION OF EA CATEGORY

The environmental assessment process for aquaculture projects is initiated via the preparation of a "Conceptual Synthesis" document for submission to the state-level SEPESCA officer in charge of Ventanilla Unica (VU). The conceptual synthesis provides basic project information needed for the SEDESOL-National Ecology Institute (INE) ruling on the necessity for a full environmental assessment and to select the appropriate category of EA report. The synthesis has three basic sections, comprised of general project information such as location and organizational character, the general physical and operational characteristics, and possible environmental impacts.
Figure 4
Flow Diagram for Environmental Assessment
Figure 5
Environmental Assessment Methodology for the General Modality

(1) In the case of the United States, the V.U. is accessed through Federal SEPESCA Delegations.
(2) Technical Verdict: Opinion from other public entity: CNA (freshwater), etc.

Note: Eventually SEDESOL will perform inspections to verify information supplied by applicant.
Figure 6
Environmental Assessment Methodology for the Intermediate and Specific Modalities
### Table 3. Comparison of Environmental Assessment Report Features (Page 1 of 2)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Executive Summary</strong></td>
<td><strong>A. General Project Information</strong></td>
<td><strong>A. General Project Information</strong></td>
</tr>
<tr>
<td><strong>B. Policy, Legal, and Administrative Framework</strong></td>
<td><strong>B. Description of Proposed Project or Activity</strong></td>
<td><strong>B. Description and Justification of Project</strong></td>
</tr>
<tr>
<td><strong>C. Project Description</strong></td>
<td><strong>1. Project Description</strong></td>
<td><strong>1. Project Description</strong></td>
</tr>
<tr>
<td>1. Geographic, Ecological, Social, and Economic Context</td>
<td>2. Site Selection</td>
<td>2. Site Selection</td>
</tr>
<tr>
<td><strong>D. Baseline Data</strong></td>
<td><strong>C. General Aspects of the Existing Environment Prior to Project Development</strong></td>
<td><strong>C. Description of the Existing Environment Prior to Project Development</strong></td>
</tr>
<tr>
<td>1. Description of Physical Conditions</td>
<td><strong>1. Physical Aspects</strong></td>
<td><strong>1. Area of Project Influence</strong></td>
</tr>
<tr>
<td>2. Description of Biological Conditions</td>
<td><strong>2. Biological Aspects</strong></td>
<td><strong>2. Physical Aspects</strong></td>
</tr>
<tr>
<td>3. Description of Socio-Economic Conditions</td>
<td><strong>3. Socio-Economic Environment</strong></td>
<td><strong>3. Biological Aspects</strong></td>
</tr>
<tr>
<td><strong>E. Environmental Impacts</strong></td>
<td><strong>D. Identification of Environmental Impacts</strong></td>
<td><strong>D. Analysis and Determination of the Actual and Projected Quality of Environmental Factors</strong></td>
</tr>
<tr>
<td>1. Positive and Negative Impacts</td>
<td><strong>1. Physical Aspects</strong></td>
<td><strong>1. Physical Aspects</strong></td>
</tr>
<tr>
<td></td>
<td><strong>2. Biological Aspects</strong></td>
<td><strong>2. Biological Aspects</strong></td>
</tr>
<tr>
<td></td>
<td><strong>3. Socioeconomic Aspects</strong></td>
<td><strong>3. Socioeconomic Aspects</strong></td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>E. Methods of Prevention and Mitigation of Identified Environmental Impacts</td>
<td>E. Identification and Evaluation of Environmental Impacts</td>
<td>1. General Considerations</td>
</tr>
<tr>
<td>F. Analysis of Alternatives</td>
<td>F. Description of the Modified Environmental Scenario</td>
<td>2. Analysis of Environmental Impacts (including Alternatives)</td>
</tr>
<tr>
<td>G. Mitigation Plan</td>
<td>G. Methods of Prevention and Mitigation of Adverse Environmental Impacts and Cessation of Project Activities</td>
<td></td>
</tr>
<tr>
<td>H. Environmental Management and Training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Environmental Monitoring Plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Appendices</td>
<td>F. References</td>
<td>H. References</td>
</tr>
</tbody>
</table>
Using the synthesis document, INE will select one of five options, presented here in increasing order of detail and scope:

- Exemption (i.e., from environmental assessment);
- Water quality study;
- Informational report,
- General environmental assessment, and
- Intermediate environmental assessment.

An additional EA report format exists, called the "specific environmental assessment" that is used for development projects that have high risk of negative impacts, and is never recommended for aquaculture.

Selection is made from a matrix of criteria related to:

- Project size, which ranges from less than 10 to over 450 hectares;
- Culture infrastructure, ranging from cages to earthen ponds;
- Culture water exchange requirements, ranging from less than 5 to 100 percent total volumes per day; and
- General production strategy, ranging from extensive to intensive.

In case a project's civil construction is more than 30 percent complete, an "Environmental Diagnosis" document is required in lieu of an EA. The objective of a diagnosis document is to provide a plan for achieving regulatory compliance in operations that existed prior to the establishment of EA requirements.

2.2.4 COMPARISON OF MEXICAN EA PROCEDURES WITH OPERATIONAL DIRECTIVE 4.01

A comparative analysis of the World Bank and borrower-country environmental assessment methodologies is consistent with the Sectoral Environmental Assessment concept. In the case of the Aquaculture Development Project, the exercise answers an important question: should the World Bank guidelines for EA preparation be integrated into the preparation process of all subprojects arising from the sectoral investment? . . . or do the Mexican guidelines provide sufficient assurance that, if properly executed, environmental issues will be adequately addressed?
The following section compares Operational Directive 4.01 (OD 4.01) to the SEDESOL EA preparation methodology in the general and intermediate modes.

**Overview of World Bank Environmental Assessment Guidelines**

OD 4.01 from the World Bank Operational Manual provides the policy and procedures of the World Bank (Bank) for the environmental assessment of Bank lending operations. The EA is proposed and regarded as a flexible implement, whose breadth, depth, and analysis are project-dependent.

The specified purpose of the Bank’s EA procedure is to improve decision making and to ensure that the various aspects of the project’s implementation are environmentally sound and sustainable. Recognition of significant environmental impacts to be caused by a project’s development at an early stage can allow for appropriate prevention, minimization, or mitigation of adverse impacts. Consideration of such impacts and response mechanisms at an early stage can avert costly and unbudgeted remediation measures.

Thus, the timing of the EA is critical to these goals. Close and early integration the EA process with economic, financial, institutional, and engineering analyses is intended to ensure consideration of potential environmental impacts prior to finalization of the project site and design. This strategy will also help avoid delays in project implementation arising from unforeseen environmental consequences.

The overall Bank EA procedure includes the preparation by the Bank of terms of reference (TOR) for the EA, EA report preparation by the borrower, and EA review and project approval by the Bank. For major projects, the report itself may require from 6 to 18 months to prepare. It must be submitted to the Bank prior to its appraisal mission, the purpose of which is to review procedural and substantive elements of the EA with the borrower, assess the adequacy of local environmental institutions, determine that the EA’s recommendations are reflected in the project’s engineering design and economic analysis, and ensure that identified mitigation procedures have been properly budgeted. An unsatisfactory EA report may delay the appraisal mission as well as eventual Bank financing.
Comparison of Environmental Evaluation Procedures

The Bank EA report is expected to address, where appropriate, a wide range of potential issues listed in Table 4. While many of these issues are addressed in a generic sense in the Mexican *manifestacion de impacto ambiental* procedure, the regulations do not appear to require the depth of analysis specified in OD 4.01.

Mexican environmental authorities evidently conduct routine site visits for verification of the EA reports. However, limited staffing and travel resources are focused almost exclusively on major polluting activities such as industry rather than the less risky and relatively inaccessible aquaculture developments.

Other observations are as follows.

- Bank enforcement is by Bank Appraisal Mission, versus the Office of the Attorney General for the Protection of the Environment (PROFEPA, see Section 2.4) PROFEPA, with the consequent focus on implementation of mitigation plans (Bank) versus awaiting authorization to construct.
- There are no industrial hazards/occupational safety issues covered in the Mexican EA/MIA procedure.
- The Bank EA requires defined mitigation plans versus the identification of mitigation measures (general EA only). Enforcement of mitigation in MEXICAN MIA must be put forth in a conditional approval and then enforced by the PROFEPA.
- There is no requirement for institutional analysis in the Mexican EA, a situation amounting to *de facto* continual self-evaluation. Requirements for EMP, management and training, and monitoring bolster this supplemental focus of the Bank EA.
- The Bank focus is, to a certain and significant degree, on the protection of the investment (in addition to the environment, of course), with emphasis on cost-benefit analysis. Mexican EA focuses on the environment proper.
- There is no specific reference in Mexican law or regulations that requiring analysis of engineering or economic alternatives to the project until a “specific” EA is requested by SEDESOL, although consideration of the site selection process is covered in the “general” and “intermediate” modalities. The philosophy expressed by Mexican officials is that the EA process is sufficiently expensive and onerous with the analysis of a single scenario, multiple analysis are beyond the abilities of either the
### Table 4. Potential EA Issues

<table>
<thead>
<tr>
<th>Bank EA Potential Issues</th>
<th>Addressed by General MIA?</th>
<th>Addressed by Intermediate or Specific MIA?</th>
<th>Addressed by CI^* Aquacultural MIA?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Agrochemicals</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Biological Diversity</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Coastal and Marine Resource Management</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Cultural Properties</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Dams and Reservoirs</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Hazardous and Toxic Materials</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Indigenous Peoples</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Induced Development and other Sociocultural Aspects</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Industrial Hazards</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>International Treaties and Agreements</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>International Waterways</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Involuntary Resettlement</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Land Settlement</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Natural Hazards</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Occupational Health and Safety</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Ports and Harbors</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Tropical Forests</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Watersheds</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Wetlands</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Wildlands</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 4. Potential EA Issues

<table>
<thead>
<tr>
<th>Project Type</th>
<th>World Bank Category</th>
<th>Addressed in Mexican Legislation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dams and Reservoirs</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Forestry Production</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Industrial Plants</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Irrigation, Drainage, and Flood Control</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Land Clearance and Leveling</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Mineral Development (including oil and gas)</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Port and Harbor Development</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Reclamation and New Land Development</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Resettlement</td>
<td>A</td>
<td>No</td>
</tr>
<tr>
<td>River Basin Development</td>
<td>A</td>
<td>Depends on size</td>
</tr>
<tr>
<td>Thermal and Hydropower Development</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Manufacture, Transportation, and Use of Pesticides or other Hazardous/Toxic Materials</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Agro-Industry (small-scale)</td>
<td>B</td>
<td>No</td>
</tr>
<tr>
<td>Electrical Transmission</td>
<td>B</td>
<td>Yes</td>
</tr>
<tr>
<td>Aquaculture and Mariculture</td>
<td>B</td>
<td>Depends on size</td>
</tr>
<tr>
<td>Irrigation and Drainage (small scale)</td>
<td>B</td>
<td>No (below established criteria)</td>
</tr>
<tr>
<td>Renewable Energy</td>
<td>B</td>
<td>Electrical generation only</td>
</tr>
<tr>
<td>Rural Electrification</td>
<td>B</td>
<td>Yes</td>
</tr>
<tr>
<td>Tourism</td>
<td>B</td>
<td>Federal Projects Only</td>
</tr>
<tr>
<td>Rural Water Supply and Sanitation</td>
<td>B</td>
<td>No</td>
</tr>
<tr>
<td>Watershed Projects</td>
<td>B</td>
<td>Depends on size</td>
</tr>
<tr>
<td>Rehabilitation, Maintenance, and Upgrading (small scale)</td>
<td>B</td>
<td>No</td>
</tr>
</tbody>
</table>

* Bank Category C projects would not require an EA according to Mexican regulations
government or private sector to contemplate. The Bank EA stresses analysis of alternatives, believing that issues cannot be thrown into sufficient contrast without such an exercise. It should be noted that documentation for the aquaculture sector EA procedure (Annex B) does include alternative analysis to an extent similar to that of the Bank, although the legal standing of a SEPESCA-recommended protocol versus the letter of the LGEEPA remains unclear.

Protection of Wildlands
The Bank considers the treatment of wildlands, land and water areas in a state virtually unmodified by human activity, to be an important subset of considerations during environmental assessment. As described in the Bank's Operational Policy Note (OPN) 11.02, wildlands can have either formal status, such as biosphere reserves or national parks, or simply be recognized by the scientific and conservation community as having intrinsic value in terms of biodiversity conservation or the provision of "environmental services" (e.g., erosion control, preservation of water quality, etc). Examples of the latter wildland type provided in OPN 11.02 include estuaries, mangrove areas, and riverine habitats—all prominent features of the Aquaculture Development Project landscape.

Bank policy seeks balance on this question, and is accordingly concerned that project economic development activities which reduce the extent of wildlands be mitigated by additional measures to improve management, and actual extent, of other such areas. A given project's potential to degrade wildlands, the borrowing country's existing policies and programs for wildland management, and the value of native wildlands are considerations that shape treatment of this issue.

Consideration for wildlands management in Mexico, a country thought to have the third or fourth most diverse biota in the world, is the subject of LGEEPA's second chapter, which provides the rationale for preserving wild areas as well as nine protected area designations, including

- Biosphere reserves,
- Special biosphere reserves (of smaller area than above),
- National parks,
- Natural monuments,
- National marine parks.
Natural resource protection areas,
Floral and faunal reserves,
Urban parks, and
Special zones subject to ecological conservation.

With regards to the ecosystem type of greatest concern to the Aquaculture Development Project, Mexico has 44 national parks and 20 biosphere reserves focusing on wetlands protection. No blanket proscription against development exists for these areas, rather each has developed a management plan accommodating varying degrees of economic activity. Though no explicit treatment of wildlands is included in the Mexican EA methodology (except for the "specific" modality, which is never recommended for aquaculture projects), protection of these areas is afforded during through the evaluation of project environmental assessment reports.

Protected areas are under the direct administration of SEDESOL's Department of Natural Resource Utilization, and further protected via direct monitoring by PROFEPA delegations in each state.

With regards to wildlands protection closer to the concept provided in OPN 11.02, natural zones in the larger sense than official parks and protected areas, two additional designations exist of "priority wetlands" and "marine turtle reproductive zones". The former category designates wetlands of sufficient ecological value to merit special concern, though no formal protective status exists. Aquaculture Development Project areas with priority wetlands include:

- The southeastern coast of Chiapas; approximately from Pijijiapan to the Guatemalan border,
- The northern coast of Nayarit, from the latitude of Tepic to the northern state line,
- Sinaloa, from the area further south of Culiacan to the border with Sonora, and
- Baja California Sur, in the area of the Magdalena-Punto Eugenio lagoon complex.

The priority wetlands designation prompts special review by INE during evaluation of environmental assessment reports on projects within those areas, with the result that development activities are under special constraint to avoid compromising wetland function.
"Marine turtle reproductive zones" are strips of beach used for nesting by those animals, and under strict protection against development, with an eye primarily towards preventing mass tourism development. Twenty-three of these zones have been identified to date, including at least one in every project state. The turtle beaches are categorically proscribed from development, and environmental assessment reports for projects near these zones are obligated to demonstrate that their operations will not adversely affect the area's value for turtle nesting.

Finally, the completion of OE will further promote the protection of wildlands by recommending land uses such as Conservation Areas, land uses that do not fundamentally alter or harm the natural resource base; and Integral Protection areas, which involve total preservation against economic exploitation (see Section 2.3).

Conclusion
In conclusion, the environmental assessment protocol per se, though deficient in certain areas deemed important by the Bank, can be readily modified. Principal modifications would include an adequate analysis of alternatives, an appropriately defined scope for baseline data collection (i.e., to that which is truly necessary), and an explicit treatment of wildlands.

In practice, the lack of field verification, consequent lack of knowledge on the part of INE reviewers of local conditions, low INE staff numbers, and other constraints (see Section 4.3) have turned the EA process into a bureaucratic exercise rather than a valid tool for environmental management, a problem of application rather than methodology.
2.3 LAND USE PLANNING AND AQUACULTURE DEVELOPMENT IN MEXICO

Mexico's ambitious, national-level program for land use planning originates with LGEEPA (Title I, Chap. III, Article 8, VI) and the 1989 to 1994 5-year National Development Plan and derivative 1989 to 1994 Environmental Protection Program, both of which establish ecological land use planning (ordenamiento ecológico or OE) as a fundamental tool in the execution of national environmental policy and development programs. A definition of OE is offered within LGEEPA as "the process intended to evaluate and plan land use and natural resource management in the national territory, and zones over which the nation maintains jurisdiction, for the purpose of preserving and restoring ecological equilibrium and protecting the environment" (Title 1*, Chapter I, Article 3*, XX).

By design, the OE planning process introduces consideration of key ecological factors into the implementation of national development schemes, federal environmental policy on land use, and natural resource management approaches, such as:

- Regional ecosystem types and function;
- Predominant regional economic activities, especially as an expression of local natural resource utilization;
- Existing ecosystem dysfunctions caused by human settlement or economic activities;
- The potential sustainable relationship between human economic activities and ecosystem function; and
- Potential future environmental impacts of intensified human use of local resources.

In specific terms, the OE process is to be applied in the regulation of a wide range of economic activities, to include as a minimum:

- Public projects that are fundamentally based on the exploitation of natural resources, or that may result in regional concentration of economic activity based on natural resources;
- The local authorization of land use for agriculture or forestry activities that carry risk of negative environmental impacts;
- The granting of authorizations and concessions for the use of water under national jurisdiction, for forestry activities, and for the exploitation of wildlife and fisheries;
- The financing of agricultural and forestry activities (i.e., in order have influence on siting such activities);
Fiscal incentive programs oriented towards planned location or relocation of economic activities;
- Granting of construction and operating permits for industrial enterprises,
- The founding of new population centers; and
- The determination of urban land use.

2.3.1 IMPLEMENTATION OF THE LAND USE PLANNING PROCESS

LGEEPA authorizes the General Office of Ecological Planning (DGPE) of SEDESOL's INE to implement the ordenamiento ecológico over the entire national territory. This mandate is to be realized concurrently with other federal and local agencies as determined by their respective areas of technical and legal dominion (e.g., SEPESCA has responsibility for fisheries and coastal OE development). The LGEEPA ensures such broad participation by further authorizing and obligating all state and local governments to take over and complete the planning phase of OE at correspondingly greater levels of detail and local relevance. The state and municipal plans would then serve as the basis for local land use plans, Declaratorios de Usos, Distinos, y Reservas del Suelo, that would be promulgated into law at the municipal level.

In practice, this development strategy is being realized in phases, with the INE taking the lead in the preparation of the Phase I component known as the National Land Use Plan (Ordenamiento Ecológico General del Territorio). Although no products of the National Plan have been released (they were available for cursory review in the INE offices at the time of SEA preparation), this first phase was declared essentially complete by mid-1992. As ably summarized by Webb (1993), the technical approach for the development of the National Plan featured the use of satellite imagery to develop a GIS database at the scale of 1:1,000,000. This database featured a basic division of Mexico's territory into:

- Humid, Dry Tropic, Wet Tropic, and Temperate Hydrographic zones; further divided into,
- 88 ecological provinces; further resolved into,
- 1,813 individual landscape mosaics comprised of 51 physical and socio-economic characteristics.
Four basic policy designations were imposed upon these units, comprised of:

1. **Sustainable use areas**, to entail intensive but managed use;
2. **Conservation areas**, to allow land uses that do not fundamentally alter or harm the natural resource base;
3. **Restoration areas**, which would entail the recovery of highly degraded areas; and
4. **Integral Protection areas**, which involve total preservation against economic exploitation.

With completion of the National Plan, state and local versions will be prepared that feature increasingly greater resolution and relevance to local conditions. These will fall into scales that range from 1:100,000 to 1:250,000 for state and 1:5,000 to 1:50,000 for local plans, which are generally considered to be the second and third phases, respectively, of OE development. It is expected that the entire process will be complete within 5 years’ time.

The role of the SEDESOL in this phased approach will be formalized via contracts between the DGPE and local governments or involved delegaciones, obligating SEDESOL to provide funds and technical assistance during local OE preparation. This provision of technical assistance, in addition to lending vital experience to the local agencies as they embark on the planning process, will also ensure uniform technical methodology and consistency of the plan’s objectives with basic national policies.

Though conveying responsibility for OE preparation upon state governments represents a fundamental step towards decentralizing the whole process, federal sectoral interest in the OE process is still manifest via the Program of Priority Activities for Regional Productivity (Programa de las Actividades Prioritarias de Productividad Economica Regional en el Pais). This INE initiative commissions each of the federal government dependencias to enter into the OE land use planning process in close collaboration with the DGPE and local government at the outset of each major, national-scale sectoral development initiative. Though the federal agencies and state/municipal governments have sufficient latitude to design local land use plans in accordance with their sectoral and local interests, they must conform with the criteria and broad objectives of the national (i.e., federal) environmental policy.
A sectoral plan prepared at the municipal level must be returned to the national SEDESOL/INE office, where, in addition to technical review, resolution of conflict arising from incompatible sectoral interests in a given area will be resolved (i.e., watershed protection versus timber harvesting).

There is low probability of serious intersectoral conflict of this type according to officials of both SEDESOL and SEPESCA. Criteria and methodologies for arriving at preferred land use designations are clearly defined, and reflect scientific evaluation of physical, biological, and social factors. Of greatest importance, SEDESOL-INE is the final decisionmaker and arbiter of any such interpretive differences arising from the land use capability process, and treatment of the issue is rooted in their legal mandate. If a given sectoral agency still has dispute with land capability classification following INE arbitration, they may file a complaint with the Office of the Attorney General for environmental protection. Following SEDESOL approval, the plan is then presented publicly for comment, revised accordingly, and promulgated into law.

2.3.2 THE ROLE OF LAND USE PLANS IN ENVIRONMENTAL PROTECTION AND AQUACULTURE DEVELOPMENT

As the national agency in charge of aquaculture promotion and development and as directed by the aforementioned Program of Priority Activities for Regional Productivity, SEPESCA has direct responsibility for OE planning in that sector, as well as general responsibility for coastal-zone planning. SEPESCA has acted upon this responsibility by initiating OE planning activities, in close collaboration with the INE-DGPE and local governments, in seven priority states of Tamaulipas, Campeche, Chiapas, Oaxaca, Sinaloa, and Nayarit. These activities have been significantly advanced in Chiapas and Oaxaca, where expectations of rapid shrimp-farm development have stimulated the preparation of detailed baseline studies upon which a coastal-area OE at the 1:200,000 scale can be established for those states. Similar considerations for the potential of shrimp farm development in Nayarit and Sinaloa have motivated the development of OE plans at the 1:250,000 scale for the coastal areas of those two states.

The pilot Coastal Zone Management component of the Aquaculture Development project will be accompanied by small scale OE development, and will represent a local culmination of SEPESCA’s general mandate for coastal and fisheries OE preparation. As presently conceived, OE plans in the pilot areas will be scaled at the 1:4,000 level or smaller, will use local
municipalities and fishing groups as the organizational and legal framework, and will promote aquaculture as the local resource-use strategy of preference in the resolution of other competing and environmentally harmful economic activities.

As evidenced by these activities, and the presence of a full-time OE officer in the Aquaculture Office, SEPESCA strongly supports *ordenamiento ecológico* as a management tool in the promotion of aquaculture development. Principal reasons for such support include the fact that:

1) OE would allow SEPESCA the prerogative of early designation of priority areas for aquaculture development, imparting legal status to promotional efforts at sector development; and

2) present requirements for environmental assessment of aquaculture projects would be greatly streamlined.

Improved efficiency of the EA process was seen as a major benefit of the OE process from the beginning. According to the joint opinion of SEDESOL and SEPESCA, *ordenamiento ecológico* and environmental assessment were conceived as complementary tools serving the same policy. The local land use plan establishes an environmental frame of reference, within which the impacts of particular development options can be easily characterized (Anonymous, 1993). In one sense, EA can be viewed as the imperfect, cumbersome tool that nonetheless safeguards environmental quality pending the arrival of the longer-term measure represented by *ordenamiento ecológico*.

This is a significant advantage given the considerable EA requirements that encumber new aquaculture projects. Present EA methodology for the "general modality" will typically require that up to 15 environmental parameters be described in detail, require 6 months of preparation, 4 months of evaluation, and will cost the small-scale investor from NP $30,000 to $120,000 (U.S. $10,000 to $40,000). Once OE plans are completed however, it is anticipated that environmental assessment of aquaculture development projects within an OE plan's purview will require description of only two or three environmental parameters. This will result in a proportionate (i.e., five- to seven-fold) reduction in preparation time, evaluation time, and overall cost. Since EA preparation is regarded as a principal constraint to aquaculture development, SEPESCA is appropriately aggressive in their promotion of OE as key to growth in this sector.
2.3.3 PRESENT STATUS OF THE LAND USE PLANNING PROCESS
As previously stated, the national plan was declared complete and available to the public in June of 1993, though no products have yet been released. State governments must now implement the next stage, via the execution of the aforementioned contracts with the DGPE, the groundwork for which has been laid by the passage of state environmental laws requiring OE in 29 of the nation's 31 states.

Various state and regional development priorities and initiatives have had sufficient prior momentum to advance the above schedule. The acute and immediate problems caused by environmental degradation related to tourism development have, for example, propelled the preparation of plans by the municipalities of Cancun and Los Cabos, in Quintano Roo and Baja California Sur, respectively.

Despite this wealth of activity, only the Benito Juarez-Cozumel (Cancun-Tulum) municipalities have completed the entire process of preparation, INE/DGPE approval, public review, and adaptation into law.

At the time of SEA preparation, funding was in place for the completion of OEs at the local level in Tamaulipas, Sinaloa, Nayarit, Oaxaca, and Sinaloa; and studies were being conducted leading to completion of proposed plans.

2.4 ENVIRONMENTAL COMPLIANCE: THE ATTORNEY GENERAL'S OFFICE FOR ENVIRONMENTAL PROTECTION
The Office of the Attorney General for Protection of the Environment (Spanish acronym PROFEPA) is the compliance arm of SEDESOL's environmental regulatory efforts. Highly autonomous in terms of budget, administrative structure, and operation (i.e., desconcentrado in the terminology of the current decentralization initiatives underway in Mexico), PROFEPA complements the analytical, programmatic, and research activities of the INE.

2.4.1 AUTHORITY
The PROFEPA is charged with assuring compliance with legislation, regulatory standards/criteria, and programs formulated by the federal government with regard to environmental protection.

Direct areas of PROFEPA authority include:
Government industries,
Any activity carried out on land under federal jurisdiction,
Large-scale industry,
Atmospheric emissions,
Hazardous wastes, and
Parks and protected area management.

In addition to these exclusive areas of authority, PROFEPA is also concurrently charged with supporting the enforcement of sectoral environmental regulations that are the primary responsibility of other government agencies; such as freshwater quality (SARH/CNA) and marine water quality (SEPESCA).

2.4.2 INSTITUTIONAL STRUCTURE AND STRENGTH
Though PROFEPA was created in May of 1992, the institution’s organizational growth and scope of activities has progressed rapidly. Each state minimally has a PROFEPA delegation in the capital city, with local offices in areas of locally intensive industrial development. The agency presently has over 1,800 employees nationwide, of which approximately 1,400 are professional or technical specialists.

PROFEPA is divided into three main areas, or "Assistant Attorney General's Offices" for public participation and complaints, environmental auditing, and regulatory compliance (Figure 2).

The Office for Regulatory Compliance (Sub-Dirección de Verificación) has 42 professional field inspectors assigned to the Mexico City office, with 10 or more additional inspectors posted to each of the state delegation offices. Inspectors are recruited from a variety of disciplinary backgrounds, dominated by specialties such as chemical, industrial engineering, and the life sciences.

Funding has been sought through the World Bank-sponsored Mexico Environmental Program for the construction of analytical laboratories, though analytical work is presently contracted.
2.4.3 OPERATIONAL PROCEDURES

PROFEPA operates via:

- Random inspection and audit of industrial sites to assess compliance with atmospheric emission, noise, and hazardous waste criteria established by INE;
- Responding to public complaints related to environmental quality;
- Supporting other government agencies in the enforcement of environmental standards outside the direct jurisdiction of the PROFEPA; and
- Scheduled site inspections of facilities in both the construction and operational phases to ensure compliance with terms set forth by INE during an environmental assessment review.

The latter activity is especially relevant to the present SEA, since this is the point at which the monitoring system becomes operational. Once the SEDESOL-INE has evaluated and ruled on environmental assessment reports, the document is sent with accompanying conditions to the PROFEPA state level delegation office. The project development timeline and milestones for achieving mitigation measures are then integrated into the PROFEPA staff’s routine of scheduled field visits. Staffing of field visits is multidisciplinary, with composition of field teams depending on the technical nature of the individual project.

The PROFEPA office is also responsible for management of protected areas and assuring integrity of national parks.

2.4.4 INSPECTION/COMPLIANCE PROCEDURES AND PENALTIES

A field inspection report (Acta de Inspeccion) prepared by PROFEPA staff is the basis for any legal action in the event of infractions. In case of infractions, the other party then has 10 working days to respond to the inspection report, after which a resolution is emitted by PROFEPA’s legal department.

Several legal instruments then become available to support PROFEPA’s enforcement activities, which can be applied in any of the combinations or degree described below depending whether on the degree of violation falls within “administrative” (i.e., civil) or criminal bounds.
"Administrative Sanctions" carry the following penalties (LGEEPA Title 6, IV, 171-175).

- Fines can be levied at a rate varying from 20 to 20,000 multiples of the minimum daily wage (presently around U.S. $8.00 per day in the D.F.), with the option of daily assessment pending full compliance or rectification;
- Partial or complete closure may be imposed temporarily or indefinitely;
- "Administrative arrest" can be imposed on individuals for up to 36 hours; and
- Operating permits, concessions, and licenses can be revoked.

Environmental violations of the most serious type, those which pose very serious threats to public health and safety, are considered criminal violations and punishable by:

- 3 months to 6 years' imprisonment (in cases involving population centers, up to 9 years' imprisonment), and
- Fines ranging from 1,000 to 20,000 multiples of the minimum daily wage (LGEEPA Title 6, VI, 182-188).

In addition to the above penalties, "Immediate Application Measures" are emergency responses to situations where environmental damage is so acute or is occurring at such an alarming rate that immediate closure or cessation of activities is required. This procedure can be applied at the discretion of PROFEPA officers, prior to any judicial review or other procedures described above, making it one of the most powerful regulatory enforcement tools in the environmental field anywhere in the world.

2.4.5 ENFORCEMENT RECORD

Statistics kept by the D.F. office of PROFEPA show that over 19,000 monitoring visits were performed in Mexico in the 17 months ending December 1993, which resulted in a total of NP 45,000,000 in levied fines (approximately U.S. $15 million). None of these irregularities were found against aquaculture operations in any of the seven states included in the aquaculture development project.

Despite this record, PROFEPA continues to get mixed reviews from the conservation NGO community. Despite some high-profile partial and complete closures of major industrial concerns, the perception is that other vested interests violate regulations with relative impunity. This problem may be in some manner due to the practice of assigning concurrent responsibility for
compliance among multiple agencies, which allows jurisdictional squabbles to cover for reluctance to confront powerful interests. A considerable vacuum also reportedly forms during the transfer of responsibility from the INE to PROFEPA, that is when EA documents and accompanying conditions are sent to the latter agency for monitoring and enforcement. Coordination and communication between the two agencies in the activation of compliance measures is one problem, although the rapid increase in the flow of EA documents exacerbates this problem as well.

2.4.6 RELEVANCE OF PROFEPA TO AQUACULTURE DEVELOPMENT

The agency is mandated to play an important role in regulating environmental impacts of aquaculture development because:

- All construction projects or other proposed changes in land use must prepare an EA, and PROFEPA will review construction progress to assure compliance with EA conditions, and
- Most aquaculture projects in coastal areas utilize land under federal government and thus under PROFEPA jurisdiction.

PROFEPA will also be critical to the resolution of environmental degradation affecting aquaculture, with particular regard to water quality. Although nearshore marine water quality is nominally the jurisdiction of SEPESCA, the agency is weak on enforcement capability and legal instruments, and will work closely with PROFEPA in management of marine water quality issues. Degradation of freshwater quality affecting aquaculture will fall to the SARH/CNA.
3.0 DESCRIPTION OF PROPOSED PROJECT

As described in the introduction, an SEA typically occurs before specific project investments are defined. Accordingly, and in lieu of the baseline environmental information (e.g., water and air quality, flora, and fauna) that is characteristic of a site-specific environmental assessment, a description is provided of the broad geographic scope and the types of projects anticipated within each area. This exercise should allow reviewers to make reasonable assumptions regarding the nature and scope of environmental risk that the sectoral investment represents.

3.1 PROJECT OBJECTIVES

The two principal objectives of the World-Bank-financed aquaculture development project are to:

1. Promote the sustainable development of coastal and inland aquaculture, emphasizing the expansion and diversification of income-generating and dietary options for lower income families; and

2. Maintain the sustainable development of Mexican natural resources through the rational management of critical coastal zones.

These objectives reflect an initial intent by project designers, in recognition of the intrinsic link between effective coastal zone management and successful aquaculture development, to develop two parallel project subcomponents comprised of ICZM and aquaculture promotion. To avoid overlap between two activities of such similar scope, these two subcomponents were eventually collapsed into a single project with the major emphasis of aquaculture development. The project is proposed for implementation in seven coastal states of Tamaulipas, Veracruz, Baja California Sur, Sinaloa, Nayarit, Oaxaca, and Chiapas.

3.2 PROJECT ACTIVITIES

State Task Force groups were meeting in each of the seven project states throughout the time of SEA preparation. These groups, comprised of state representatives from SEPESCA, SEDESOL, the Secretariat for Agriculture and Water Resources/National Water Commission (SARH/CNA), and other government agencies implicated in aquaculture development, plus representatives from producers groups, are responsible for generating a detailed list of subproject investments for their respective states using six project categories as organizing themes.
A rapid project preparation schedule kept the State Task Force groups focused on the identification of projects rather than preparing specific details of their final design. The definitive SEPESCA-approved list of projects will be prepared by mid-March, and exact dimensions and location will not be known for some months. Nonetheless, visits to state capitals and interviews with State Task Force members provides a reasonably accurate description of the proposed range of project activities. These activities and their potential negative environmental impacts are summarized in order of priority in the following summary descriptions and attached Tables 5 and 6.

The six organizing themes that comprise the World-Bank-supported project are as follows.

1. **Generation, Adaptation and Transfer of Technology**—The purpose of this theme is to generate aquaculture technologies appropriate for conditions in Mexico, and transfer these technologies via on-farm demonstration units. Typical requests for funding under this component include feasibility studies and pilot projects for:
   - The cultivation of Malaysian prawn (*Macrobrachium rosenbergii*), bullfrogs, and other non-typical species;
   - The management of coastal lagoons for the extensive production of shrimp;
   - The production of bivalves for stocking lagoons;
   - The demonstration of integrated watershed management techniques; and
   - Production of hybrid tilapia.

2. **Physical Infrastructure**—This theme undertakes the renovation and construction of critical support infrastructure to the aquaculture sector, such as fingerling stations (*centros acuicolas*), roads, dredging, water control structures, electrification, ice plants, potable water, and aquaculture parks. Typical requests for funding under this component include:
   - Rehabilitation of hatcheries (*centros acuicolas*) for the production of fish fingerlings, principally tilapia, carp, and channel catfish;
   - Dredging and re-dredging of channels in coastal lagoons for the purpose of improving hydrology and navigation;
Table 5. Summary by State of Project Activities (Page 1 of 3)

<table>
<thead>
<tr>
<th>State</th>
<th>Proposed Project Interventions</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamaulipas</td>
<td>Aquaculture Parks</td>
<td>1) Tamaulipas has the strongest regulatory institutions for environmental management as a result of border (i.e.) environmental issues.</td>
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<td></td>
<td>Shrimp</td>
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<td>Oyster</td>
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<td></td>
<td>Rehabilitate Hatcheries</td>
<td>2) Is too far north for major mangrove estuaries.</td>
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<td></td>
<td>Channel Dredging</td>
<td>3) Planned construction of intercoastal canal is an infrastructure project with major environment impacts for the state.</td>
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<td>Road Renovation</td>
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<td></td>
<td>Construction</td>
<td>4) Gulf/Atlantic states such as Tamaulipas are unlikely candidates for explosive growth in the shrimp aquaculture, due to absence of major commercial species of interest (i.e. <em>P. vannamei</em>).</td>
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<td></td>
<td>water treatment plants</td>
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<td></td>
<td>landing/loading docks</td>
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<td></td>
<td>penaeid shrimp hatchery</td>
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<td></td>
<td>ice plant</td>
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<td></td>
<td>Rehab. sea turtle nesting area</td>
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<td></td>
<td>Studies</td>
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<td></td>
<td>Lagoon behavior</td>
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<td></td>
<td>Utility of Dredge Spoil for Aquaculture</td>
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<td></td>
<td>Health Certification of Shellfish areas</td>
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<td></td>
<td>Env. Imp. studies</td>
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<td></td>
<td>Marketing studies</td>
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<tr>
<td>Veracruz</td>
<td>Aquaculture Parks (oyster)</td>
<td>1) OE preparation is not underway for Veracruz.</td>
</tr>
<tr>
<td></td>
<td>Rehabilitate Hatcheries</td>
<td>2) Due to juxtaposition of petroleum, fishing, agriculture, and urban areas, Veracruz has many sectoral conflicts and is an excellent candidate for pilot coastal zone activities.</td>
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<tr>
<td></td>
<td>Channel Dredging</td>
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<td></td>
<td>Road Renovation</td>
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<tr>
<td></td>
<td>Construction</td>
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<td></td>
<td>water treatment plants</td>
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<td></td>
<td>landing/loading docks</td>
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<td></td>
<td>ice plant</td>
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<tr>
<td></td>
<td>Coastal Zone Pilot Project</td>
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</tbody>
</table>

3-3
Table 5. Summary by State of Project Activities (Page 2 of 3)

<table>
<thead>
<tr>
<th>State</th>
<th>Proposed Project Interventions</th>
<th>Comment</th>
</tr>
</thead>
</table>
| Baja California Sur | Major aquaculture parks planned for the Magdalena-Punto Eugenio Lagoon Complex, Bahia Tortugas and Bahia Sta. Domingo, focusing on managed natural production of oysters, scallops, mussels, and abalone, to include:  
- Access roads  
- Electrification  
- Hatcheries  
- Ice plants  
- Depuration plants  

Stock enhancement for shellfish populations  
Feasibility studies for production of marine finfish, algae, crustacea (lobsters, brown shrimp)  
OE preparation for above areas  
| Sinaloa | Hatchery for stock enhancement of Callo de Hacha (*Pinna rugosa*)  
Dredging of access canals and lagoon mouths (36.25 km total length)  
Rehabilitate fingerling centers  
Develop capacity to produce hybrid tilapia  
| Nayarit | Dredging of lagoon mouths  
Stock enhancement and infrastructure to improve fisheries on hydroelectric reservoirs  
Aquaculture Parks  
- Shrimp  
- Oyster  
Access road renovation  

1) OE preparation is not underway for Baja California Sur.  
2) Instituto de Investigaciones Biologicos (IIB) is a strong research resource providing input on project designs and environmental impacts. IIB has submitted a proposal to prepare OE focused on aquaculture to SEPESCA.  

| Stock enhancement for shellfish populations  
Feasibility studies for production of marine finfish, algae, crustacea (lobsters, brown shrimp)  
OE preparation for above areas |

1) Sinaloa is poised for major commercial shrimp aquaculture development, with 7,459 hectares of ponds currently in operation.  
2) Major agriculture development juxtaposed with shrimp, with over 1 million ha of irrigated agriculture  

1) Nayarit will be the site of one of the pilot coastal zone management projects.  
2) Nayarit is also poised for major commercial shrimp aquaculture development, with 1,600 ha of ponds currently in operation and capacity for 35,000 total.  
3) SEDESOL Delegation has a newly formed "Aquaculture Unit" that will be exclusively dedicated to the evaluation of environmental impact studies for aquaculture projects.  
4) Serious problems between shrimp farms in the Laguna El Valle have occurred with regards to eutrophication of local waters.
### Table 5. Summary by State of Project Activities (Page 3 of 3)

<table>
<thead>
<tr>
<th>State</th>
<th>Proposed Project Interventions</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oaxaca</td>
<td>Feasibility studies for bullfrog, catfish fingerling station construction (4) for &quot;mini-farm&quot; integrated watershed management string culture of oysters/mussels semi-intensive culture of penaeid shrimp production of brine shrimp freshwater shrimp production establishing special reserve zones for coastal lagoon species</td>
<td>1) Oaxaca has a very active conservation NGO community, whose representative council has been elevated to parastatal status. 2) Drought and increased sedimentation rates have left many relict coastal lagoons, isolated from tidal exchange and recruitment of new fisheries stock. Extensive cultivation, by pumping seawater into lagoon beds, is a means of mitigating effects of drought and deforestation and restoring lagoon productivity. 3) Link between deforestation and lagoon sedimentation is as evident and strongly established in Oaxaca as in any other state. Proposed integrated watershed management project is a major initiative to address this problem.</td>
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<td></td>
<td>Other studies for identifying irrigation canals suitable for aquaculture agricultural chemical use social infrastructure needs market improvements</td>
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<td></td>
<td>Lagoon monitoring study (seven major lagoon systems)</td>
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<td></td>
<td>Design and implementation of an integrated watershed management project around the city of Oaxaca covering 4,800 hectares</td>
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<td></td>
<td>Experimental Extensive Shrimp Culture in Lagoons</td>
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<td></td>
<td>Cage culture of tilapia</td>
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<td></td>
<td>Road Renovation 93 km</td>
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<tr>
<td>Chiapas</td>
<td>Road renovation</td>
<td>1) Chiapas will be the site of one of the pilot coastal zone management (ICZM) projects.</td>
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<tr>
<td></td>
<td>Dredging of coastal lagoons</td>
<td>2) Intensive agriculture, protected area management, upstream deforestation and aquaculture development all occurring in close proximity in the southeastern coast (i.e., near Tapachula)</td>
</tr>
<tr>
<td></td>
<td>Stock enhancement/cage culture on inland reservoirs</td>
<td>3) New World Bank project is contemplating a study of the hydrological resources of the coastal zone of Chiapas that may integrate with the ICZM project.</td>
</tr>
</tbody>
</table>
Table 6. Environmental Impacts of Principal Aquaculture Project Development Activities (Page 1 of 2)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Potential (-) Impact</th>
<th>Intended (+) Impact</th>
<th>Mitigation of (-) Impacts</th>
<th>States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dredging</td>
<td>Unpredictable possibility of reduced estuarine productivity and loss of mangrove species due to salinization</td>
<td>Improve estuarine productivity by restoring hydrological regimes affected by siltation of tidal channels</td>
<td>Improved capacity for modeling lagoon behavior, allowing better siting of channels</td>
<td>Tamaulipas, Veracruz</td>
</tr>
<tr>
<td></td>
<td>Reduced estuarine productivity of mesohaline species (e.g. oysters, shrimp juveniles)</td>
<td></td>
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<td>Sinaloa, Nayarit, Oaxaca</td>
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<tr>
<td></td>
<td>Salinization of agricultural land</td>
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<td></td>
<td>Salinization of groundwater</td>
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<td></td>
<td>Disturbance and siltation of benthic organisms</td>
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<tr>
<td>Pond Construction</td>
<td>Displacement of wetland ecosystems such as mangroves and vernal lagoons</td>
<td>Conversion of marginal, salinized coastal land into high-value production</td>
<td>Land use regulations governing siting of aquaculture ponds</td>
<td>Sinaloa, Nayarit</td>
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<tr>
<td></td>
<td>Isolation and degradation of wetland ecosystems by dike and access road construction</td>
<td>Poverty alleviation</td>
<td>Natural resource inventory to monitor ecosystem health</td>
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<td></td>
<td>Soil erosion during construction of earthworks</td>
<td>Reduction of unsustainable natural resource extraction by provision of alternative income</td>
<td>Use of culverts and other water control structures to maintain local hydrology</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Potential (-) Impact</td>
<td>Intended (+) Impact</td>
<td>Mitigation of (-) Impacts</td>
<td>States</td>
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<tr>
<td>Pond Operation</td>
<td>Eutrophication of local water by pond effluent</td>
<td>Same as pond construction</td>
<td>Appropriate siting of ponds in areas with high natural exchange/flushing capacity to dilute organics</td>
<td>Same states</td>
</tr>
<tr>
<td></td>
<td>Overharvest of shrimp seed and by-catch</td>
<td>Vested interest in environmental quality</td>
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<td></td>
<td>Bird losses from predator control</td>
<td>Establishment of seasons and harvest volumes for the capture of wild seedstock</td>
<td>Promotion of semi-intensive (i.e. vs. intensive) production strategies</td>
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<td></td>
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<td>Promotion of hatcheries for production of seedstock</td>
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<td></td>
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<td>Education programs for producers regarding non-lethal bird control</td>
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<tr>
<td>Road Renovation</td>
<td>Blocking of tidal and/or continental runoff access to wetland areas by roadbeds</td>
<td>Facilitate access to coastal fishing villages</td>
<td>Use of water control structures to preserve local hydrology</td>
<td>All states</td>
</tr>
<tr>
<td></td>
<td>Improved access to undisturbed natural areas resulting in unintended development</td>
<td>Provide access to aquaculture parks</td>
<td>Use of anti-erosion measures during construction (e.g. haybales, geo-textile)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mining of riverbeds to obtain aggregate/fill material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock Enhancement</td>
<td>Introduction of exotic species that displace native biota</td>
<td>Enhance fisheries production, especially in relatively sterile and new reservoirs</td>
<td>Restriction on introduction of new non-native species</td>
<td>Tamaulipas, Veracruz, Sinaloa, Nayarit, Oaxaca, Chiapas</td>
</tr>
</tbody>
</table>

* Aquaculture pond construction and operation in the context of this table refers to marine shrimp.

* Refers to finfish stock enhancement only (i.e., not bivalve mollusk).
• Construction and rehabilitation of roads to link rural fishing populations with major highways; and
• Construction of "aquaculture parks" that will provide necessary infrastructure for the local aquaculture development.

3. **Markets and Commercial Channels**—This theme is directed to the development of processing and commercialization infrastructure, improvements in post-harvest handling, and expansion of national and international markets. Typical investment requests include:
   • Studies to identify new national and international markets for traditional aquaculture products;
   • Ice plants, processing plants, and other quality improvement/post-harvest handling infrastructure; and
   • Studies to identify possibilities for adding value to existing aquaculture products.

4. **Environment**—This theme seeks to strengthen the national capacity for planning, management, and control of intensive aquaculture activities via such tools as land use planning, environmental impact assessment, and the development of ecological criteria. Typical requests for funding under this component include:
   • Integrated watershed management pilot projects,
   • Lagoon hydrological and bathymetric studies,
   • Environmental impact assessments of other project components,
   • Endangered species management, and
   • Stock enhancement of threatened species (e.g. the scallop *Pinna spp.*).

5. **Institutional Strengthening**—This theme is directed toward improving the capacity of SEPESCA, SEDESOL, SARH/CNA, and other federal, state, and local government agencies for the promotion of sustainable aquaculture and environmental protection.

6. **Integrated Coastal Zone Management**—This theme seeks to establish on a pilot scale coastal zone management programs in three areas characterized by resource use-conflicts between fishermen and other economic sectors. As of the time of SEA
report preparation, three pilot zones are located in Veracruz, Nayarit, and Chiapas, though exact locations are as-yet undefined.
4.0 DESCRIPTION OF ENVIRONMENT

4.1 AQUACULTURE IN MEXICO

As has long been recognized by potential investors and government policymakers alike, Mexico is well suited to make aquaculture a key activity in its economic development portfolio. The Mexican coastline has an aggregate length of 11,500 kilometers (km) between Pacific, Gulf of Mexico, and Caribbean shores, and contains over 1.5 million hectares (ha) of highly productive coastal estuarine systems. These estuaries (lagunas) include the full range of hydrological, biotic, and physical regimes characteristic of North America and are populated with human communities that have a long tradition of exploiting their local fisheries. Continental resources are equally impressive, with 1.6 million ha of freshwater, littoral-zone lagoons included among the 2.9 million ha aggregate total freshwater surface area. The size, natural productivity, and diversity of these aquatic systems provide Mexican policymakers, investors, and producers with a wide variety of species and culture strategies from which to choose.

However, despite the long presence of significant industrial and artesanal capture fisheries (e.g., until the 1980s, Mexico was the leading supplier of imported seafood to the United States market), there is only a minimal tradition of aquatic husbandry. Recognizing this situation, and the aforementioned significant development potential, the Mexican government, with personal interest and participation of President Salinas Gortari, proposed in 1990 a goal-oriented agenda for aquaculture development that would guide their promotional efforts over the coming 4 years. The 1990-1994 Aquaculture Integral Development Program seeks a 20 percent annual growth rate in the production of aquaculture products, to reach a 1994 goal of 500,000 tons of production with an estimated a value of $500 million. The program features three basic strategies for increasing aquaculture development.

1. **Stock enhancement** (*aquacultura de repoblamiento*) has been the most important single strategy employed in Mexico to increase fishery yields in recent decades. Supplied by government-supported fingerling stations (*centros acuícolas*), thousands of inland lakes, lagoons, and reservoirs have received annual stockings of finfish fingerlings, of exotics such as tilapia and common carp, that have increased annual artesanal capture fishery yields. An extensive strategy meeting the definition of aquaculture only in the most nominal sense, the enhancement programs nonetheless account for over 40
percent of the national aquaculture production and are responsible for tilapia’s rank as the country’s largest-volume cultured product.

2. **Rural aquaculture** includes small-scale extensive inland aquaculture of finfish, again with the exotics tilapia and common carp predominating, in private ponds and farms as a supplemental activity. Rural aquaculture production is almost entirely destined for local consumption.

3. **High-yield aquaculture** (*aquicultura de alto rendimiento*) as defined in Mexico can include any production system specifically designed for aquaculture, and which requires inputs of feed, skilled labor, and significant capital. Semi-intensive production of penaeid shrimp in earthen ponds is the typical high-yield strategy in Mexico.

Despite the government’s intervention, aquaculture production remains small-scale—with a total crop weight of 175,000 metric tons (mt) and a value of $122 million, or less than 1 percent of agricultural gross domestic product (GDP)—in 1992 (Table 7). The vast majority of production is from small-scale systems that are integrated into agricultural production schemes, such as the reservoir stock enhancement programs, or culture strategies such as management of oyster beds that are little-evolved from a traditional capture fishery.

In summary, aquaculture in Mexico of the last two decades can be characterized by:

- Widespread reliance on extensive technologies, often consisting of enhancement and capture strategies applied to what are essentially wild stocks of non-native finfish and mollusks, and
- a decided emphasis on assisting the social sector to increase income and quality of nutrition in lieu of promoting capital-intensive, export-oriented industrial production of high-value species such as shrimp.

**4.2 ENVIRONMENTAL CONCERNS OF AQUACULTURISTS**

Because of its dependence on good water quality, sustainable aquaculture development is inherently linked to effective management of environmental issues. Coastal aquaculture is in fact regarded in some parts of the world as an effective way to vest major economic interest in maintaining coastal environmental quality and can be viewed as an “indicator industry” for the
Table 7. 1992 Aquaculture Production by Species

<table>
<thead>
<tr>
<th></th>
<th>Tilapia</th>
<th>Oyster</th>
<th>Carp</th>
<th>Shrimp</th>
<th>Catfish</th>
<th>Trout</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production in 1992 (mt)</td>
<td>76,964</td>
<td>37,376</td>
<td>28,393</td>
<td>8,326</td>
<td>4,219</td>
<td>1,601</td>
<td>174,626</td>
</tr>
<tr>
<td>Percent Increase in Production since 1982</td>
<td>34</td>
<td>2</td>
<td>392</td>
<td>320</td>
<td>1,650</td>
<td>143</td>
<td></td>
</tr>
</tbody>
</table>

mt = metric tons.
general health of coastal waters. The Italians have reached such a conclusion about their coastal aquaculture and fisheries sectors as evidenced from the following published assessment. "Experience teaches that where the various components of the lagoon reality are not accounted for, fisheries and aquaculture have been the most penalized sector, just because they are directly dependent upon environmental quality. Fisheries and aquaculture are even instruments of environmental conservation: the fishermen are in fact supervisors and permanent witnesses of the environmental status, because their income depends upon it" (Ardizzone et al., 1988).

Environmental quality issues affecting aquaculture success and sustainability in Mexico were derived from workshop sessions with fishermen's groups and are presented in the Section 8.0, Public Participation.

4.3 COASTAL ZONE MANAGEMENT AND PLANNING IN MEXICO

Integrated Coastal Zone Management (ICZM) encompasses a broad array of planning initiatives that integrate treatment of the impacts of economic activities within the coastal zone, usually defined as the area between the landward-most extent of tidal influence and the edges of the continental shelf. Though specific objectives can vary, the fundamental purpose served by ICZM is the resolution of resource-use conflicts among economic sectors and the promotion of environmental quality.

Considerable academic research has taken place on the extensive coastal ecosystems of Mexico, including recent work by Contreras (1993) that provides a summary of the classification, biology, and physical characteristics of each of the country’s 130 coastal lagoons. Despite this inventory of coastal ecosystems, a widespread recognition of the value of coastal zones to Mexico’s economic development and numerous, high-profile cases of resource-use conflict involving coastal zones (e.g., petroleum versus fisheries in the state of Tabasco), no formal coastal resource management exercises (except ordenamiento ecologico, see Section 2.4) have been attempted or are planned.
5.0 ANTICIPATED ENVIRONMENTAL IMPACTS

5.1 GENERAL ENVIRONMENTAL IMPACTS OF AQUACULTURE
Several environmental issues are commonly identified with commercial aquaculture, particularly with regards to large-scale shrimp farming, including:

- **Displacement of coastal mangrove estuaries** by shrimp ponds with consequent loss of ecosystem production was a serious problem in many countries during the 1960s to 1970s. Discovery of the poor suitability of mangrove soil for aquaculture, in addition to stricter land use regulation, has greatly lessened this problem since the 1980s.

- **Restricting the access of local populations to resources** (e.g. fishery and forest products) through the exclusive concession of formerly common areas has occurred in some countries. In Honduras, where areas suitable for aquaculture had no perceived value to government policymakers and which had never been included in any land use planning process, this problem has resulted in extreme social tension.

- **Alteration of local hydrology** due to construction of pond dikes, access roads, and the dredging of water supply channels has produced severe local and regional impacts in some cases. In coastal areas in particular, mangrove forests and other important biota are vulnerable to destruction by alterations in tidal regime and salinity. In continental areas, the diversion of fresh water can severely affect downstream ecosystem function as well as groundwater hydrology.

- **Eutrophication caused by pond effluent** discharged during drainage or routine exchange can enrich receiving waters, resulting in local degradation in water quality, eutrophication, and loss of ecosystem function and diversity.

- **Eutrophication caused by waste feeds** is a related problem occurring near large cage-culture and net-pen culture operations that are sited in areas of hydrologically restricted water exchange.

- **Overharvest of wild seedstock** for stocking shrimp ponds has been implicated the decline of other local fisheries due to the very high percentage of by-catch organisms that are discarded destroyed.

- **Introduction of exotic species** such as tilapia, carp, and penaeid shrimp may displace native organisms by direct competition or the introduction of new pathogens.
5.2 POTENTIAL ENVIRONMENTAL IMPACTS OF THE MEXICO AQUACULTURE DEVELOPMENT PROJECT

Potential negative environmental impacts resulting from the activities proposed under the Aquaculture Development Project in Mexico are summarized in Table 8.
### Table 8. Summary of Negative Environmental Impacts of Alternatives A, B, and C

<table>
<thead>
<tr>
<th>Potential (-) Environmental Impacts</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Unpredictable risk of dredge-induced salinization and consequence: reduced estuarine productivity, loss of mangrove species and associated diversity, reduced estuarine productivity of meso-haline species (e.g. oysters, shrimp juveniles), salinization of agricultural land and groundwater, and disturbance and suffocation of benthic organisms</td>
<td>X</td>
<td>X*</td>
<td>x</td>
</tr>
<tr>
<td>• <em>Continued, rapid sedimentation of the majority of Mexican coastal lagoons, with hyper/hyposalinity, reduced productivity and access</em></td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>• Risk of all (-) impacts associated with coastal aquaculture pond construction and operation, including deforestation, eutrophication, overfishing, and resource access (see 2.4.1).</td>
<td>X</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>• <em>Dominance of aquaculture characterized by capital-intensive, absentee-ownership over which the regulatory structure has significantly less control than social-sector aquaculture projects</em></td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>• Risk to local hydrology as a result of improper road siting and construction</td>
<td>X</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>• <em>Continued isolation of coastal village populations, restricting local economic development and resulting in continued social problems such as outmigration</em></td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>• Risk to native flora and fauna posed by exotic species introduction</td>
<td>X</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>• Low fishery yields from relatively sterile, new reservoirs</td>
<td>x</td>
<td>X</td>
<td>x</td>
</tr>
</tbody>
</table>

* Dredging is an ongoing activity of SEPESCA and will continue with or without World Bank funding.
6.0 ANALYSIS OF ALTERNATIVES

The objective of this section is to sharpen discussion of issues raised in the EA report by comparing the results of alternate project design scenarios. In a project-specific investment, such analysis might involve alternate siting of project infrastructure or production processes. While these specific types of analyses may also prove useful for sectoral environmental assessment, it is also useful to consider exclusion, inclusion, or modification of entire components.

In the case of the Aquaculture Development Project, significant environmental risks were associated with:

- The dredging of coastal lagoons in the absence of hydrological models for lagoon behavior;
- The promotion of commercial penaeid shrimp aquaculture in sensitive coastal areas without strong land use, environmental assessment, and environmental monitoring capabilities in place;
- The introduction of rural road construction and renovation without strong environmental capabilities; and
- The introduction of exotic fish species.

Three alternatives are considered:

Alternative A: The project as-proposed, and without mitigating actions for environmental risk

Alternative B: Rejection of the project components for which environmental risk has been identified

Alternative C: The project as-proposed, though modified by mitigating actions.

For the purposes of this analysis, the “proposed action” (Alternative A) is considered to be those activities submitted for consideration for funding by the state task forces. Although a definitive roster of subactivities will not be forthcoming for some time yet, the final project list will be derived from those activities presently under consideration.

The no-action scenario (Alternative B) consists of omitting dredging, coastal aquaculture development, road construction, and exotic stock enhancement schemes from further consideration for project funding.
The modified proposed-action scenario (Alternative C) consists of accepting the risky components for project funding, but only as mitigated by the actions discussed in Section 4.0.

The negative impacts of each alternative are summarized in the attached Table 8. The italicized text represents the negative impacts of the "no-action" scenario. Because most project components have been proposed to ameliorate undesirable conditions (e.g., dredging is proposed to ameliorate sediment-induced loss of estuarine productivity) the consequence of "no-action" means that those conditions will only continue to degrade. In the case of coastal aquaculture development, one risk of not supporting social-sector involvement is continued dominance by large-capital aquaculture interests.

Because no alternative is entirely without risk of negative environmental impact, the use of upper- and lower-case symbols indicates greater and lesser degree. Because the greatest risk of negative environmental action is posed by either Alternative A and B, it is the recommendation of this report that the project be accepted in all components for funding, if mitigated by actions described in Section 4.0.
7.0 MITIGATIONS OF NEGATIVE ENVIRONMENTAL IMPACTS

Some risks of negative environmental impacts arising from the Aquaculture Development Project will be mitigated by the activities already proposed for the Environmental and Pilot Coastal Zone Management Components.

7.1 AQUACULTURE PARKS

This new concept, proposed by every state task force, calls for the delineation of coastal areas in which local aquaculture development will be concentrated. Nonexistent in the country at present, aquaculture parks as envisioned in Mexico will each contain from a few hundred to several thousand total area and, with financial support from the Aquaculture Development project, will provide all of the major infrastructure that is necessary for production operations. Major infrastructure will minimally include water intake, distribution and drainage canals, electric power, access roads, common storage areas, and processing-related facilities such as ice plants. Clear title will be held to individual parcels of land. Investor participation in the aquaculture parks will be fostered by the aquaculture permitting process, as further supported by local OEs and the environmental impact process, OE may classify aquaculture as an undesirable activity in all areas other than the designated parks).

From a producers standpoint, a considerable advantage is offered by the "Aquaculture Concession" permit and the security represented by the 50-year duration of this instrument. Disadvantages are few, and are principally derived from an increased risk for transferring pathogens from one operation to another as a result of their proximity.

Negative environmental impacts extend no further than those already described for aquaculture development. In summary, aquaculture parks can be considered as mitigation for the negative environmental impacts associated with individual farms, the only major disadvantage being their status as a novel and untested development approach.

7.2 ORDENAMIENTO ECOLOGICO

7.2.1 BACKGROUND

As the national agency in charge of aquaculture promotion and development, SEPESCA has direct responsibility for land use planning in that sector under the national Ordenamiento Ecologico (OE)
program. SEPESCA has acted upon this responsibility by initiating, in close collaboration with the INE-DGPE and local governments, OE planning activities in six priority states of Tamaulipas, Campeche, Chiapas, Oaxaca, Sinaloa, and Nayarit. A completed and operational OE of coastal areas suitable for aquaculture will, by providing a priori indication of preferred land use and possible environmental issues, greatly streamline environmental assessment of aquaculture projects and reduce the collection and analysis of extraneous information. Environmental degradation originating with other sectors and threatening aquaculture will also be mitigated, because the preferred alternate land uses in aquaculture zones will not include polluting industries.

7.2.2 ISSUE
With PAM funding, preparation of studies leading to state and municipal-level OE (i.e., at the 1:10,000 to 1:250,000 scales) is planned for five of the seven project states. The two remaining states of Baja California Sur and Veracruz will not receive the considerable environmental management benefits of OE in terms of improved siting of aquaculture or other development projects, and shortened time and expense of EA preparation.

7.2.3 OBJECTIVES
To optimize the efficiency and utility of the EA process and minimize environmental impacts of other sector development, financial and technical support should be provided to develop coastal-zone OE for the states of Veracruz and Baja California Sur.

7.2.4 INPUTS
To be determined during project preparation.

7.3 IMPROVEMENT OF "VENTANILLA UNICA" AND THE ENVIRONMENTAL ASSESSMENT PROCESS
7.3.1 BACKGROUND
The permitting process for aquaculture projects in Mexico is lengthy and complicated, requiring as many as 20 separate reviews, approvals, or permits from as many agencies. In an attempt to make the system more efficient the VU was created in 1990. Under the VU concept, which has existed in other federal agencies for some time, SEPESCA serves as the single point of government contact with private applicants in the acquisition of permits from the required
agencies, furnishes advice in the preparation of permit applications, and is the official representative of the applicant before these agencies.

7.3.2 ISSUE
Despite improvements for individual permit applicants, the VU process is still lengthy and cumbersome, reportedly requiring up to 30 months from initiation to completion. Delays are principally linked to SEDESOL's review and judgment on the environmental assessment (EA) report, in turn due to:

- The fact that many state-level SEDESOL delegations are not authorized to review and judge EA reports, obligating the Mexico City office to the performance of this function;
- A shortage of qualified personnel within the SEDESOL-D.F. offices, where there is a reported backlog of 1,500 reports to be reviewed;
- Unfamiliarity by SEDESOL-D.F. personnel with the field conditions in each state, resulting in numerous call-ins for data of dubious relevance; and
- An environmental assessment methodology in either the "general" or "intermediate" modalities that is inflexible in its format and overly complex in scope for aquaculture projects, requiring collection and subsequent evaluation by SEDESOL of data on many parameters of marginal relevance.

Further permitting delays are caused by coordination difficulties between other state and federal agencies and the state VU officer who is in direct contact with the applicant.

7.3.3 OBJECTIVES
Objectives of this component are to accelerate the VU process in general, and the environment review process in particular, greatly shortening aquaculture project development time and increasing the actual utility of EA as a decision-making tool for aquaculture project managers. Specific objectives include:

- Contracting and training additional staff for both state and federal SEDESOL environmental impact offices,
- Revising environmental assessment methodologies to attain a format better suited for aquaculture development, and
• Improving communication between state-level VU personnel and other agencies in the permitting chain-of-process.

7.3.4 INPUTS
To be determined during project preparation.

7.3.5 TO BE RESOLVED
• Capacity of SEDESOL to receive additional personnel at delegation and D.F. offices,
• SEDESOL perspective on modified EA methodology (note: a consultant was hired under the Mexico Environmental Program for this purpose, but has not produced results in well over 1 year), and
• Full understanding of the limitations on state-level SEDESOL delegations with regard to authorization to review EAs.

7.4 DEVELOPING A CAPACITY FOR MODELING COASTAL LAGOON SYSTEM BEHAVIOR

7.4.1 BACKGROUND
Dredging of coastal lagoon systems is proposed under the Aquaculture Development Project for the states of Tamaulipas, Veracruz, Sinaloa, Nayarit, and Chiapas. As conceived by the state SEPESCA delegations and project beneficiaries, dredging would ameliorate the consequences of drought and watershed deforestation that have prevailed in Mexico in recent years. Anticipated positive results include improved access to upper reaches of lagoon systems, now blocked by sediments that would be scoured from channels by continental runoff during rainy years, and improved ecological function of lagoons via the restoration of tidal connections to the open ocean. The latter effect is expected to restore shellfish, crustacean, and finfish productivity that is presently depressed by hyper- or hyposaline conditions caused by sediment-constrained circulatory and water exchange patterns.

7.4.2 ISSUE
The hydrology of coastal lagoons is determined by parameters such as tidal amplitude, location, and dimensions of internal channels and channel openings to the sea, continental runoff, and the complex shape of the lagoon basin. Predictions of lagoon behavior as a result of dredging are inherently difficult to make, and past dredging operations by SEPESCA have occasionally produced unexpected negative results in several states, most notably, in Nayarit's canal de Cuatla.
which connects the Agua Brava Lagoon with the Pacific Ocean. Though environmental assessments are performed on proposed dredging activities, their utility is limited by the lack of reliable models for lagoon behavior.

7.4.3 OBJECTIVES
Design monitoring and bathymetric studies of lagoons targeted for dredging operations. Studies would include basin morphology, water quality, water circulation, and tidal behavior. With proper baseline information, computer hardware, and hydrological monitoring, software would be procured and training provided to allow prediction of impacts to lagoon function under alternate dredging scenarios.

7.4.4 INPUTS
To be determined during project preparation.

7.4.5 TO BE RESOLVED
Institutional arrangements for housing the lagoon monitoring and modeling functions. Candidate organizations within SEPESCA include:

- The Infrastructure and Fleet Office, which is responsible for preparation and financing of dredging projects;
- The Aquaculture Office;
- The National Fisheries Institute, which prepares environmental assessments of SEPESCA infrastructure projects; and
- The state-level SEPESCA delegations or state government fisheries agencies, which have operational control of dredging as well as the greatest familiarity with the lagoons.

During the SEA preparation, all of the above agencies expressed a need for, and interest in, developing and housing this capacity within their own offices.

7.5 MONITORING
7.5.1 BACKGROUND
The activities of the Aquaculture Development Project entail considerable natural resource consumption or alteration, including changes of land use as a result of pond construction.
consumption from wild fishery populations, contributions to wild fishery populations, and alteration in present patterns of water quality and usage.

Monitoring of baseline and ongoing conditions of the several natural resource parameters implicated above will allow project managers and regulatory agencies to determine the success of and unanticipated impacts resulting from project activities. Monitoring will also provide the considerable advantage of solid, scientific information in the event of public controversy over one or another project activity. As a minimum environmental monitoring is needed for:

- Alterations in vegetative function in critical coastal ecosystems such as mangroves,
- Populations of target species and those species taken as by-catch during capture, and
- Coastal water quality.
- Threatened species in Project’s sphere of influence.

7.5.2 ISSUES

There is at present no inventory of mangrove cover and quality for Mexico. Should coastal aquaculture develop rapidly (i.e., if this project is successful), the issue of large-scale deforestation will inevitably arise in the public dialogue, as it has in every other country with significant development of this type of activity. Despite the presumptive safety of mangroves afforded by their strict protection status and the environmental assessment process, Mexico should nonetheless anticipate some impact to these ecosystems and perform a baseline inventory.

The present OE methodology, though distinguishing mangrove species, does not differentiate between various qualities of the ecosystems in which they occur. Likewise, neither OE nor the National Water Quality Network of the CNA include any consideration of coastal water quality as part of their programs.

With regard to capture of wild postlarvae, the SEPESCA-INP is passively collecting information through their capture permitting system. However, no field research is actively examining such issues as the degree and composition of by-catch organisms, or attempting to project patterns of wild postlarvae capture against future growth of the industry.
7.5.3 OBJECTIVES
To provide sufficient baseline and ongoing information on those environmental parameters and natural resources at risk from aquaculture development to quantifiably measure and manage impacts, by undertaking:

- A baseline inventory of mangrove zones, including vegetative cover differentiated by species composition and ecosystem function, to be prepared from the ample stock of aerial and satellite imagery already existing for the Mexican coastline,
- Recurrent mangrove inventories at 5-year intervals using updated imagery, and
- Studies of postlarval harvest focusing on volumes, seasonality, and by-catch organisms.

These data should be integrated into existing natural resource and environmental monitoring schemes, such as OE in the case of mangrove and water quality, or the ongoing fisheries monitoring programs of the INP.

7.5.4 INPUTS
To be identified during project preparation.

7.6 WETLANDS PROTECTION

7.6.1 BACKGROUND
Aquaculture parks proposed under the project include marine shrimp farms in six of the seven states. Proposals from state task forces in Chiapas, Oaxaca, Nayarit, and Sinaloa call for an aggregate of 3,500 hectares of ponds to be constructed. Tamaulipas and Baja California Sur also mention marine shrimp culture in earthen ponds as a component activity of aquaculture parks in those states, but do not specify the surface area of the proposed facilities.

Marine shrimp ponds in Mexico and elsewhere in Latin America typically occupy barren mudflats on the continental fringes of lagoon mangrove estuaries, on land covered only by the highest spring tides. Although Sinaloa and Nayarit already have significant shrimp farm development in their coastal zones, the state fisheries delegaciones of Oaxaca and Chiapas regard the project-financed aquaculture parks as "detonator projects" that will promote the activity in the as-yet undeveloped margins of their extensive lagoon systems.
7.6.2 ISSUES

Estuarine mudflats — or marismas — on both coasts are regarded as critical habitats for hundreds of thousands of migratory waterfowl and shorebirds that winter in Mexico each year. These areas flood with seasonal rains and spring tides, resulting in temporary, shallow lagoons that quickly bloom with short-lived populations of fish and crustaceans. The lagoons serve as resting and feeding places for at least 25 taxonomic families of migratory aquatic birds, for which wholesale conversion to shrimp ponds represents a serious degradation in habitat quality.

Migratory waterfowl are the subjects of international treaties between Canada, Mexico, and the United States, and are the topic of an ongoing public dialogue between these countries. International and national groups active in waterfowl conservation have made wetlands preservation the focal element of their strategy. These groups manifest considerable concern over the widespread conversion of vernal lagoons and mudflats into shrimp farms in the states of Sinaloa and Sonora, as well as in other neo-tropical areas of importance to migratory fowl such as the Gulf of Fonseca region of Honduras.

Under auspices of the IUCN, and with the collaboration of numerous Mexican conservation organizations, an inventory of "internationally important" wetlands for waterfowl was compiled for neo-tropical America in 1987. "Internationally important" was defined by several criteria that include numbers and diversity of annual, seasonal waterfowl populations, plus special factors such as utility as breeding area. Though this inventory the basis for SEDESOL-INE's "priority wetlands" program mentioned in 2.24, none of the areas yet enjoy formal protected status.

Several of the mariculture parks will be located within these priority areas, and will conceivably affect their quality as habitat for migratory birds (Table 9).

7.6.3 OBJECTIVES

Support the creation of protected status for some portion of mudflat area in the project state wetland, assuring the continued existence of adequate resting and feeding habitat for migratory waterfowl represented by these areas.

---

Table 9. Proposed Shrimp Farms Located Near Wetlands

<table>
<thead>
<tr>
<th>State</th>
<th>Project</th>
<th>Area</th>
<th>Internationally Important Wetland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nayarit</td>
<td>Parque Camaronicolas in Rosamorada, Tuxpan and Ixcuintla</td>
<td>1,500 ha</td>
<td>Marismas Nacionales</td>
</tr>
<tr>
<td>Oaxaca</td>
<td>Parq. Maricult. Mar Muerto</td>
<td>100 ha</td>
<td>Mar Muerto</td>
</tr>
<tr>
<td>Chiapas</td>
<td>Parq. Maricult. Joya-Buenavista</td>
<td>100 ha</td>
<td>Laguna de la Joya</td>
</tr>
<tr>
<td>Chiapas</td>
<td>Parq. Maricult. Patos-Solo Dios</td>
<td>100 ha</td>
<td>Lagunas del area &quot;Sesecapa&quot;</td>
</tr>
</tbody>
</table>
7.6.4 INPUTS
To be determined during project preparation.

7.7 SUMMARY OF OBJECTIVES
The preceding sections describe activities that will mitigate the negative impacts of implementing the Mexico Aquaculture Development Project. The status of the component activities ranges from those that are already well conceived and supported by the project sponsors (i.e., the aquaculture parks), to those for which considerable planning and negotiation remain. Further distinction is needed between activities that are obligatory for project approval, and those that will strengthen SEPESCA's ability to manage environmental issues and, though not obligatory, are highly recommendable for this reason.

7.7.1 REQUIRED MITIGATORY ACTIONS
The following actions must be incorporated into the project design prior to appraisal.

- Adapt Mexican EA guidelines to comply with World Bank OD 4:01 requirements, and agree upon a process whereby the World Bank can review all EA reports on Category A subprojects prior to the initiation of construction. The hybrid EA methodology and a list of category A projects must be finalized prior to appraisal.
- Agree to institutional strengthening investments that will provide state-of-the-art technology for predicting lagoon behavior as a result of dredging actions. Scope of investment as well as basic component design must be defined before appraisal.
- Agree to some form of investment that will provide protection to coastal mudflats, a class of wetlands at risk from coastal shrimp farm development. Scope of investment must be defined, in some level of detail (yet to be negotiated), prior to appraisal.
- Prepare a monitoring program that will provide additional focus (i.e., over and above the existing OE program) on natural resources at risk from, and that pose risk to, coastal aquaculture development. Examples would be mangrove cover, fisheries stocks, and coastal water quality. Basic component design must be finalized prior to appraisal (level of detail to be negotiated).
7.7.2 RECOMMENDED ENVIRONMENTAL MANAGEMENT ACTIONS

- Invest in completion of OE process in the two states presently not included in the SEDESOL/World Bank Mexico Environmental Project, which are Baja California Sur, and Veracruz.
- Study the existing EA/permitting (i.e. ventanilla unica) process to improve utility as to well as lower cost and preparation time. Suggested actions for implementation during the project would include contracting additional personnel in INE for evaluating EA reports, and contracting of studies to rework the EA format and application methodology. Basic component design must be fleshed out prior to appraisal (level of detail to be negotiated).

7.8 RELATIONSHIP OF PILOT PROGRAMS FOR INTEGRATED COASTAL ZONE MANAGEMENT TO ENVIRONMENTAL COMPONENTS

The purpose of Activities 7.1 through 7.5 is to improve the efficiency, accelerate the development, or otherwise enhance the utility of environmental management tools presently at the disposition of existing sectoral institutions. The purpose of the ICZM component is the pilot introduction of an entirely new strategy for resolving intersectoral conflict over natural resources.

Although the ICZM projects are clearly "environmental," they are focused on a highly defined geographic area and will not overlap operationally with the program-wide initiatives described above. Activities that will occur under the ICZM component include:

- The demarcation of the pilot areas,
- The description of principal resource uses (which will perforce include aquaculture),
- The identification of existing institutional auspices for those resource users (e.g., fishing cooperatives, cattle growers associations, sectoral governmental agencies),
- The identification of priority environmental issues and areas of conflict, and
- The proposal of collaborative mechanisms between those institutions to facilitate conflict resolution.
The success of this strategy is predicated on the presence of the aforementioned tools and the framework in which they operate, an accurate and timely EA process to identify environmental impacts of the disparate economic development activities, rational land use classifications to lend credibility to reserving areas for special activities, and accurate baseline information about ecosystem behavior.
8.0 PUBLIC PARTICIPATION

World Bank operational directives emphasize the need to involve affected populations or other non-governmental organizations in the environmental assessment process, and require that some measure of public consultation take place.

During SEA preparation for the Mexico Aquaculture Project, communication with such groups was greatly expedited by state-level workshops conducted by SEFESCA and the project preparation team. One objective of the workshops was to identify areas and issues appropriate for the ICZM component of the project, and sessions were held with coastal fishermen’s groups for this purpose. In practice, these sessions also allowed considerable dialogue on the environmental concerns of coastal fishing groups both in the general sense and in the context of the various proposed project activities. Conducted in Veracruz, Chiapas, and Nayarit, this exercise produced an inventory of the environmental concerns of aquaculturists and fishermen, most of which are intersectoral in nature. These concerns include:

- Contamination by agricultural chemicals, which is a particular concern in Chiapas and Sinaloa;
- Deforestation and erosion of watersheds, resulting in the sedimentation of river and estuarine channels and connections to open water, which is a concern in all project states save La Paz and Tamaulipas;
- Reduction in freshwater inflow to estuaries as a result of damming, which has greatly degraded coastal water quality and coastal morphology (e.g., the closing of lagoon mouths) in most coastal states of Mexico;
- Sewage contamination of coastal waters, which has severely degraded bivalve shellfish quality, particularly in Veracruz and Tamaulipas through bio-accumulation of human microbial pathogens;
- Toxic effects on fisheries of fugitive oil contamination from petroleum extraction and transportation in coastal areas, particularly in Veracruz, leading to reduced populations and degraded quality of shellfish and shrimp; and
- Entrainment and destruction of large numbers of juvenile aquatic forms at thermal power plant cooling intakes.
No direct concerns were voiced regarding possible environmental impacts of the project itself. Rather the sessions were apparently viewed as an venue for heightening SEPESCA’s awareness of producer concerns for general environmental degradation and its impacts on their livelihoods.

In addition to the producers groups, informal meetings were also held with the "Jose Luis Valdovinos Shoreline Fishermen’s Network," an NGO that receives support from various national and international organizations, principally the Friedrich Ebert Foundation. This group represents nearshore artisanal fishermen’s organizations in nine states, and has prepared a set of substantial proposals for assisting this troubled sector. Their concerns regarding the environment were mainly directed at perceived weak enforcement of environmental regulation by PROFEPA, as evidenced by situations such as the continued degradation of nearshore waters around the Port of Lázaro Cárdenas in Michoacan originating with the heavy industry and petroleum sectors. Concern was also voiced that grass roots organizations such as theirs would be left out of the project preparation process, such that the real needs and issues of the social sector fishing populations would not be adequately addressed.

Interviews were also held with the Mexico offices of Greenpeace and Ducks Unlimited of Mexico (DUMAC). Greenpeace is by common opinion the most aggressive critic of the environmental record of the Mexican government, focusing public activism and media attention on the issue of SEDESOL’s commitment to enforcement of regulations governing air and water quality. This stance was reflected in the opinions expressed during interviews, which was that PROFEPA’s record to date cannot be counted on to assure compliance with any regulatory or mitigation measures that arise from an active coastal aquaculture sector. No direct environmental concerns related to the project activities were voiced.

DUMAC and it’s parent organization Ducks Unlimited are active in wetlands protection issues in North America and have supported the development of multilateral treaties governing migratory waterfowl protection. As further described in 7.6, DUMAC expressed deep concern that development of commercial shrimp farms in coastal Mexico would degrade the quality of tidal mudflats — or marismas — a habitat type deemed critical to migratory waterfowl. Already concerned over such habitat degradation in coastal Sonora and Sinaloa, DUMAC believes that similar development of the shrimp farming sector in Chiapas and Oaxaca would constitute a serious impact on migratory waterfowl, and is a situation that bears close attention.
9.0 RECOMMENDATION OF A OR B CLASSIFICATION

The World Bank's 1991 guidelines on project screening, as provided in the *Environmental Assessment Sourcebook* and OD 4:01, provide three categories of project according to magnitude and risk of associated environmental issues:

- **Category A** projects are those that will always require environmental assessment due to diversity and depth of environmental impacts;
- **Category B** projects have some components with limited environmental impacts, as well as others for which little impact is anticipated, and are thus candidates for environmental review; and
- **Category C** projects do not require environmental assessment, since initial review indicates very low probability for negative environmental impact.

The purpose of screening is to determine the type of environmental assessment to be performed during project preparation. The OD 4:01 guidelines facilitate this process by providing examples of activities for each category A through C, though these illustrative cases are no substitute for a comprehensive examination of actual impacts from each project. In this context, it is worth noting that aquaculture and mariculture (i.e., coastal aquaculture) were categorically rated by the Bank as "A" activities in OD 4:00, and yet serve as "B" examples in OD 4:01.

As a sectoral investment, the Aquaculture Development Project has diverse project activities that range across all three categories. The dredging, pond construction/operation, road construction, and other activities located in coastal zones, or that have the potential to affect wetlands, deserve an "A" rating. Other project components, such as the preservation of marine turtle reserves or development of EA methodologies, clearly would bring a "C" rating.

Despite growing awareness of environmental issues in Mexico in recent years, the strength of the legal and regulatory framework that has resulted, and the strong emphasis given to environmental considerations in the development of this project, a Category A environmental assessment is recommended in light of potential impacts to wetlands and coastal zones. At the preparation stage, the present SEA report is the appropriate EA methodology because subprojects are not defined and the primary concern is with Mexico's ability to mitigate negative environmental impacts.
At the implementation state, applying the World Bank classification scheme to project subactivities will provide guidance to project managers, as illustrated below.

**Category A** subprojects will always require an EA, and would include:
- Coastal development such as large ponds or aquaculture parks,
- Road construction,
- Dredging or hydrological management strategies,
- Docks or harbor facilities construction, and
- Any coastal fisheries stock enhancement.

**Category B** subprojects may require an EA, depending on location and depth of potential environmental impacts and would include:
- Processing plant construction or renovation,
- Small-scale, freshwater aquaculture development,
- Shellfish depuration plants,
- Fingerling station rehabilitation or construction,
- Watershed management projects, and
- Market promotion initiatives.

**Category C** subprojects, which will not require an EA, include:
- Studies.
- All training and capacity-building,
- Coastal zone management and planning, and
- Monitoring and natural resource inventories.

With incorporation of mitigations recommended in Section 7.0, the Mexican EA procedures can be used to evaluate the impacts of these subactivities.
REFERENCES


REF-1
APPENDIX A

TERMS OF REFERENCE FOR ENVIRONMENTAL ASSESSMENT
DATE: November 19, 1993

TO: Mark Hardin, Environmental Consultant

FROM: Mark Cackler, Acting Division Chief, LA2AG

EXTENSION: 38999

SUBJECT: Mexico: Aquaculture Project - Terms of Reference for Environmental Assessment

1. You will be responsible for the implementation of the sectoral environmental assessment which will involve:

   (a) A detailed description and evaluation of the relevant legal and regulatory framework for aquaculture and coastal areas development in Mexico at the federal, state (for the 4-7 states) and municipal (for the 3 coastal pilots) levels. This includes identifying and describing the key laws and regulations that affect aquaculture and coastal areas development and evaluating how they protect the environment and simultaneously promote the development of aquaculture and coastal areas.

   (b) An assessment of how thoroughly the relevant federal, state and local authorities implement the legal and regulatory framework; the financial and staff resources they have to implement the framework; available sanctions to ensure that the requirements are met; the average number and kinds of violations; and typical fall-out when the regulations are not satisfied.

   (c) Identifying strategies and investments to improve the legal and regulatory framework and/or its implementation.

   (d) A review of the Mexican environmental assessment process for aquaculture projects to: (i) concisely describe the specific procedures and evaluate the thoroughness of the process; (ii) assess the complexity (documentation required, processing time, institutions involved, etc.) and cost of the process (for a specific sample of typical projects); (iii) evaluate the extent to which their complexity and cost creates distortions for investment in the sector; (iv) assess the implementation of the EA process and subsequent recommendations by federal and local authorities; (v) compare with the Bank EA requirements and Operational Directives 4.04 on wild lands; (v) evaluate the linkages between the Mexican EA process and the aquaculture land use plans (ordenamientos ecológicos); and (vi) identify specific strategies/investments to strengthen the Mexican EA process.
(e) Describing the objectives, institutional framework, content and processes of the different types of Mexican land use plans (ordenamientos ecológicos) and the resources required to prepare them; detailing the relationship between sectoral OEs and spatial (national, state and municipal) OEs and how conflicts in land use priorities are resolved at the federal, state and local levels; detailing the relationship between the different sectoral OEs (e.g. aquaculture, tourism, petroleum, etc.) and how conflicts are resolved among the different OEs and involved actors (governmental and non-governmental); assessing the overall usefulness of the plans for aquaculture land use planning.

(f) Prioritizing principal environmental issues associated with aquaculture in Mexico (identified in the Webb and Aim reports) and providing specific guidelines as to how project design should avoid aggravating, and/or could address these environmental issues.

(g) Identifying specific types of sensitive areas where the project should not get involved or should intervene with special precautions.

2. This work will be carried-out during two missions. During the first mission (November 29 through December 10), Mr. Hardin will assess: (i) beneficiary concerns with the EA process; (ii) the federal, state (and if possible the municipal) legal and regulatory framework for the EA process; and (iii) the general institutional framework and available resources to implement the framework and the extent to which it is actually implemented. Mr. Hardin will also use the mission to arrange for the follow-up mission in January, this will involve: (i) preparing detailed terms of reference for the environmental assessment (objectives, issues, methodology, timetable, budget, staff); (ii) obtaining the full agreement of SEPESCA and SEDESOL on the draft EA terms of reference; (iii) identifying counterparts from SEPESCA and SEDESOL to assist carry-out the study; (iii) identifying a Mexican environmental lawyer (as well as any other necessary resource persons). Upon the conclusion of the December mission, Mr. Hardin will submit: (i) an interim report describing the mission's progress in achieving points (a) through (g) above; (ii) detailed terms of reference (including the workplan for the environmental lawyer) and outline for the study; and (iii) a work program for the January mission.

3. The second part of the environmental assessment will be carried-out in Mexico for three weeks during January 1994. The full report will be submitted to the Bank by February 11. You should keep at least three days at the end of the contract to incorporate comments on the report. The entire length of the contract should not exceed 50 days. The contract would commence on November 29, the EA terms of reference and interim report should be received by the Bank by December 18, the draft EA report should
be submitted by February 11 and the final revised report should be submitted by March 15. Mr. Hardin will be responsible for the quality of the report prepared by the Mexican lawyer and the preparation of a single document.

cc: Knotter (LA2DR); Baxter o/r, Bronkhorst, Koberle, Keynan, Cord (LA2AG); Mahar, Webb, Ledec, Partridge (LATEN); Zweig (ASTEN); Alm, Post (ENVLW); van Santen (EMTAG)

cord
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November 19, 1993
EVALUACIÓN DE IMPACTOS AMBIENTAL A NIVEL SECTORAL
PROYECTO DE DESARROLLO DE ACUACULTURA
TÉRMINOS DE REFERENCIA

Este documento representa los términos de referencia concisos del Banco Mundial para la preparación de la Evaluación del Impacto Ambiental (EIA) del Proyecto de Desarrollo de Acuicultura. La EIA se llevará a cabo entre 29 Noviembre de 1993, y 15 Marzo de 1994; tendrá los objetivos, metodología, y alcance de trabajo detallado aquí abajo; y satisfacerá los requisitos del Banco Mundial para una manifestación de impacto ambiental a nivel sectoral como presentado en su Directivo Operacional 4.01 (OD 4.01 de Octubre 1991).

1.0 Antecedentes

El proyecto sería realizado en 5 a 7 estados escogido de Tamaulipas, Veracruz, Chiapas, Oaxaca, Sinaloa, Baja California Sur, y Nayarit; y tendrá los objetivos principales siguientes:

(i) promover el desarrollo sostenible de la acuicultura en las regiones internas y costeras, con énfasis en aumentar y diversificar los ingresos y las fuentes nutritivas de familias de bajos recursos; y

(ii) manejar el desarrollo sostenible de los recursos naturales mexicanos por medio de ordenamiento y manejo de las zonas costeras que protezcan el medio ambiente.

El proyecto comprende los siguientes componentes:

- **Generación, Adaptación y Transferencia de Tecnología**, con el propósito de generar, consolidar, incorporar y adaptar tecnología acuícola adecuada a México, dado sus condiciones de acuicultura y sus recursos naturales.

- **Infraestructura Física**, que contempla la renovación y construcción de infraestructura de apoyo al sector de acuicultura, tales como caminos, dragados, estructuras para el control de agua, electrificación y agua potable.

- **Mercados y Comercialización**, dirigido al desarrollo de infraestructura de tratamiento y comercialización de productos acuícolas, mejoramiento del manejo post-cosecha de productos acuícolas, y ampliación de los mercados nacionales e internacionales para productos acuícolas.

- **Medio Ambiente**, dirigido al fortalecimiento de la capacidad nacional para planificar, manejar, y controlar las actividades intensivas acuícolas en zonas costeras, represas de agua dulce, sistemas de irrigación, y otros recursos acuáticos; a través de los procesos del ordenamiento ecológico, asesoría de impacto ecológico, y desarrollo de criterios ecológicos.

- **Fortalecimiento Institucional**, dirigido a aumentar la capacidad de SEPESCA, SEDESOL,
CNA y SARH además de otras delegaciones federales, estatales y municipales; para promover el desarrollo de la acuacultura, preparar planes para el ordenamiento de zonas costeras, regular la industria, y proteger el medio ambiente.

Además de estos cinco componentes principales, el proyecto contempla un sub-componente de Ordenamiento y Manejo de Zonas Costeras en tres estados escogidos de Chiapas, Oaxaca, Nayarit, Baja California Sur y Veracruz. Este iniciativa contempla organizar a nivel piloto el desarrollo y implementación de planes de manejo para zonas costeras fundados sobre la estructura actual de Ordenamiento Ecológico.

2.0 Requisitos del Banco Mundial para Manifestación de Impacto Ambiental

Como presentado en su Directivo Operacional 4.01 (OD 4.01 de Octubre 1991), la política del Banco Mundial es de asegurar que las programas financiados en sus países clientes toman en consideración — lo más temprano posible en la fase de identificación y diseño — todos los impactos ambiental directo y indirecto que puede surgir debido a las actividades del proyecto.

El instrumento operacional para realizar esta política es la preparación de una manifestación del impacto ambiental (MIA) describiendo todos los impactos anticipados, alternativas para el diseño del proyecto que puede reducir impactos negativos, y acciones o inversiones que se deben incorporar en el proyecto para compensar a los impactos negativos inevitables.

Aunque esta política existe en el Banco Mundial desde 1989 con la publicación del primero Directivo Operacional (4.00), el procedimiento operacional para la preparación de un MIA ha sido lo más apropiada para proyectos específicos cuyos aspectos físicos — tales como localidad preciso, construcción civil, requisitos para material, flujo de descargas etc — están definidos.

Afin de mejor servir la política de anticipar los impactos ambiental temprano en la preparación de un proyecto, el Banco ha adaptado un procedimiento nuevo llamado "Evaluación de Impactos Ambiental a Nivel Sectoral". Este clase de MIA examine el contexto legal y regulatorio — o marco de referencia — en lo cual se va a desarrollar un futuro proyecto, calificándolo ese mismo en términos de su capacidad para proteger el medio ambiente y asegurar el uso sostenible de recursos naturales. Debido a su introducción durante de los primeros fases de identificación y diseño del proyecto, el MIA sectoral ofrezca amplia oportunidad de prevenir y evitar o mitigar los impactos negativos al medio ambiente.

3.0 Objetivos

La Evaluación de Impacto Ambiental del Proyecto de Desarrollo de Acuacultura a nivel sectoral tendrá los objetivos siguientes:

3.1 Preparación de una descripción detallada del marco legal y regulatorio relacionado al desarrollo de zonas costeras en general, y al desarrollo de proyectos de acuacultura en
particular. Esta descripción debe enlazar el marco con las metas políticas general del gobierno — tales como la aliviaci6n de la pobreza y protección del medio ambiente — y resumir los principales leyes y regulaciones a nivel federal, estatal (para los estados que se incluye en el proyecto) y — en el caso de las zonas pilotos — a nivel municipal.

La descripción debe incluir una presentación gráfica, en forma de diagrama o árbol de decisiones, del proceso de trámite de los permisos necesarios para tramitar proyectos de acuacultura — refiriendo a leyes, regulaciones y instituciones en cada sección del diagrama.

La descripción debe utilizar el sistema de "ventanilla única" de la Dirección de Acuacultura como punto de entrada para organización, dado que este sistema comprende todo que es ley y regulación para el desarrollo de acuacultura.

3.2 Evaluación del marco legal/regulatorio y su implementación en cuanto la promoción de acuacultura y protección del medio ambiente.

3.3 Preparación de una descripción detallado del proceso de evaluación de impacto ambiental de proyectos de acuacultura, incluyendo:

* los grados y clasificaciones de proyectos y el clase de MIA correspondiente,
* los procedimientos específicas para cada clase de MIA;
* un flujograma del procedimiento de preparación, sumisión, evaluación y aprobación de una MIA, incluyendo el tiempo necesario para cada paso y los instituciones implicados en cada etapa.

3.4 Evaluar el éxito general en la implementación del sistema Mexicano de evaluación de impacto ambiental, con especial referencia al desarrollo de proyectos acuacolas.

3.5 Relacionado al 3.4, preparar una descripción de los recursos institucional en términos financieros, legal y humanos que son disponible al Gobierno de México — principalmente en las Secretarias de Pesca y Desarrollo Social/Procuraduría Federal de Protección al Ambiente — a nivel nacional, estatal y local para hacer monitoreo, contestar a quejas, y aplicar sanciones correspondiente en la implementación del marco legal y regulatorio referido en 3.1.

3.6 Identificar estrategias para mejorar el funcionamiento del los sistemas regulatorios descrito en 3.1 y 3.2; con especial referencia a la preparación y revisión de estudios del impacto ambiental, y el cumplimiento con las normas legales establecidas.

3.7 Comparar el procedimiento Mexicano para evaluación de impactos ambientales con el equivalente del Banco Mundial — con el objetivo de reemplazar ese último con el método nacional durante el fase de planeación de obras específicas.
3.8 Preparar una descripción de los objetivos, marco institucional, sustancia técnica y procedimientos para la implementación del sistema de Ordenamiento Ecológico (OE), con especial referencia a:

- la relación entre los OE's de varias clases distintas, tales como los OE's sectorales y los OE's geográfico;
- el mecanismo para solucionar conflictos en los OE's de sectores y unidades geográfico/gubernamental (ej. agrícola y municipal), y;
- la utilidad de los OE's para el proceso de ordenamiento ecológico.

3.8 Preparar una descripción detallada de los inversiones y infraestructura propuesta por el proyecto en cada estado, utilizando como punto de entrada los informes de las comités estatales de trabajo encargado con la preparación del proyecto.

3.9 Preparar una descripción de las problemas asociadas con el desarrollo de acuacultura en México en términos de los principales impactos ambientales negativos anticipados a del proyecto; y clasificarlos en orden de prioridad.

3.10 En caso de necesidad, identificar inversiones alternativas a los propuesta afin de minimalizar impactos negativos al medio ambiente.

3.12 Identificar áreas de especial sensibilidad, los cuales se deben evitar de desarrollar; tales como reservas biológicas y habitaciones crítica.

4.0 Metodología

La evaluación se implementará a través de entrevistas, investigación y visitas de campo en los estados; dividido entre dos misiones consistiendo de preparación (1º misión) y implementación.

4.1 Primera Misión

El primer fase se llevara a cabo en Diciembre, con los objetivos de

- reclutar el personal idóneo,
- identificar los contactos y citas necesarios para entrevistas,
- recoger literatura y otra documentación necesario para la ejecución del las tareas ya mencionados, y
- finalizar los términos de referencia para la implementación de la segunda misión.
4.2 Segunda Misión

La segunda misión tendrá una duración de tres semanas comenzando el 16 Enero de 1993, y contemplará los objetivos siguientes.

- Completar entrevistas del personal del gobierno federal, estatal y municipal, con especial referencia a la Dirección de Acuacultura, Secretaría de Pesca; y el Instituto Nacional de Ecología y Procuraduría Federal de Protección al Ambiente, ambos de SEDESOL.

- Completar entrevistas del personal de las instituciones privados y los ONG’s implicados en sector ambiental de México.

- Entrevistar beneficiarios del proyectos en los 5-7 estados contemplados para el proyecto (cabe mencionar que el estado de Vera Cruz se ha visitado durante la primera misión, y a consecuencia no tiene que entrar en el programa para la segunda misión).

Los datos recolectados en ambos misiones serán integrados en el documento operativo del evaluación de impacto sectoral, según el formato presentado en el Directivo Operacional 4.01 (Apéndice A).

5.0 Programa de Implementación

1-12 Diciembre 1993 - Primera misión
17 Enero - 5 Febrero 1994 - Segunda misión
11 Febrero - Borrador del informe
15 Marzo - Informe final
7.0 Presupuesto

El presupuesto siguiente representa un cálculo del costo de implementar los términos de referencia ya presentado.

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En visto de la cantidad y calidad de información relacionado al tema de este estudio disponible en Mexico, se propone que las descripciones del marco legal/regulatorio y procedimientos para evaluación de impacto ambiental (osea la parte descriptiva de secciones 3.1 a 3.3) serfa realizado por una compañía de consultoría privada contratados directamente por KBN Engineering.

8.0 Apoyo Requerido

Para asegurar que la segunda misión sea productiva, los arreglos siguientes tienen que estar hecho antes del 15 Enero.

- Coordinación para arreglar las citas presentadas en el apéndice B.
- Un horario para los talleres de preparación estatal, afin de asegurar que las visitas a los estados por la misión ambiental toman lugar después de que las comités de preparación hayan

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1 Ofertas estan solicitados para la preparacion de los elementos 3.1 a 3.3

2 El consultor internacional seria reembolsado para costos efectivos de hospedaje, comunicación y otros gastos incidentales, calculado a $200 diario.

3 fotocopias, producción del informe final, correo express, etc.
preparado un borrador del diseño.

- Coordinación logística en cada estado permitiendo visitas a las zonas pilotos escogido para el componente Manejo Integrado de Zonas Costeras, además de zonas que tendrán mayor inversión de infraestructura como dragados y caminos.

- Copias de documentos críticas, tales como los informes borradores de la descripción del proyecto en cada estado, producido por las comités estatal de preparación.

- Copias ejemplares de manifestaciones de impacto ambiental de proyectos de dragado dirigido al mejoramiento ecológico de lagunas costeras.
APÉNDICE A:

GUÍA PARA LA PREPARACIÓN DEL MANIFESTACIÓN DE IMPACTO AMBIENTAL

RESUMEN EJECUTIVO

1.0 MARCO POLÍTICO, LEGAL Y ADMINISTRATIVO

1.1 Marco Legal y Regulatorio Gobernando el Desarrollo de Proyectos Acuícolas

1.2 Capacidad y Procedimientos para la Evaluación de Impactos Ambiental en los Estados Unidos de Mexico

2.0 DESCRIPCIÓN DEL PROYECTO

3.0 DATOS DE BASE

4.0 IMPACTOS AMBIENTAL ANTICIPIADO

5.0 ANÁLISIS DE ALTERNATIVAS

6.0 PROGRAMA DE MITIGACION

7.0 ADMINISTRACIÓN AMBIENTAL Y CAPACITACIÓN
APÉNDICE B

Listas de Citas y Contactos Críticas para la 2° Misión

(1) Distrito Federal (el 17-18 de Enero)

- **SEPESCA**
  - El responsable del programa de mejormiento ecológico de lagunas costeras

- **SEDESOL**
  - Director, Ordenamiento Ecológico, Arq. Jorge Velez (sería la segunda entrevista con el Arq. Velez)
  - Dirección de Impactos - Ing. Adriana Pineda/INE
  - Procuraduría Federal para Protección al Ambiente (relacionado al 3.4)

- Greenpeace, Rafael Gonzalez Franco

(2) Estatal

- Dependencias de SEDESOL/INE
- Director Estatal de SEPESCA/Dirección de Acuacultura
- Agencia estatal encargado de asuntos ambientales (el equivalente al SEDUVER de Vera Cruz)
- grupos de productores
- Centros de Investigación Pesquera
- cualquier otro grupo implicado en asuntos ambientales (ONGs, Universidades etc.).
APPENDIX B

SEPESCA ENVIRONMENTAL ASSESSMENT PREPARATION GUIDELINES
II) MANIFESTACION DE IMPACTO AMBIENTAL

La manifestación de impacto ambiental es el documento que se analiza durante el proceso de evaluación de impacto ambiental, la realización completa y analítica de este documento facilita la toma de decisiones en relación a la implementación del proyecto.

-Síntesis Conceptual:

La EIA generalmente comienza con un informe preventivo o síntesis conceptual de la acción propuesta. El nivel de detalle de estos debe ser el suficiente para poder determinar: 1) no se esperan impactos ambientales significativos o 2) se esperan impactos significativos, si esto último ocurriera se deberá desarrollar una EIA completa, así como la elaboración de una MIA.

-Circunstancias en las que se requiere una MIA:

Cuando se detecta que la implementación del proyecto causa impactos significativos se debe realizar una manifestación de impacto ambiental. Dependiendo de la localización, tipo y dimensiones del proyecto, serán los impactos que se puedan originar, sin embargo, algunos de los criterios útiles para la identificación de impactos significativos son:

* Cambios en el uso de suelo, según lo establecido en el ordenamiento ecológico.

* Que pudiese impactar en la calidad del aire, suelo y agua del sitio del proyecto o de zonas adyacentes.

* Si existe la posibilidad de que no se cumpla con la normatividad vigente, se excedan las normas o que se produzca en la calidad del medio una degradación considerable.
* Cambios hidrodinámicos en los cuerpos de agua de abastecimiento y descarga, así como cambios en el volumen de los mismos que pueden repercutir en las comunidades ribereñas.

* Que produzcan modificaciones en las cadenas alimenticias, o bien en los nichos y habitats ecológicos.

* Que pudiese afectar adversamente a los recursos naturales protegidos, tales como parques nacionales, corredores de aves migratorias o especies en peligro de extinción.

* Que pudiese causar, en combinación con otras actividades o proyectos, efectos acumulativos adversos.

* Que pudiese crear controversia pública significativa.

* Que se propicie la generación de desechos, que pongan en peligro la calidad del medio.

El procedimiento de EIA exige que los impactos potenciales a los recursos ambientales se evalúen detalladamente y se manejen varias alternativas factibles, de las que se pueda seleccionar la más viable basándose en los méritos de los objetivos, antes de la implementación final del proyecto.

Se deben evitar las decisiones unilaterales, esto es, por individuos u organizaciones que tienen intereses creados, que pudieran repercutir en detrimento de la calidad ambiental, por ello se debe involucrar a los interesados y a un grupo de profesionistas y especialistas en varias áreas que analicen las posibles alternativas, hasta tomar una decisión equilibrada.

Se requiere que la MIA evalúe la acción propuesta, explore un espectro de alternativas factibles, evalúe esas alternativas e identifique las medidas que evitarán o disminuirán la severidad de los impactos indeseables. La información revelada durante el proceso de EIA puede formar la base para la decisión de aprobar o denegar una propuesta, o para poner condiciones para su implementación.

Si se determina la elaboración de una EIA completa, se debe identificar a su vez la profundidad de análisis (general, intermedia o específica) que se debe desarrollar durante la investigación.
Para determinar la modalidad de MIA que se debe presentar se considera:

1) El Alcance del Efecto:

Se refiere a la extensión de los impactos potenciales generados por la acción propuesta, principalmente en el área geográfica potencialmente afectada y al lapso de tiempo durante el cual ocurrirá el impacto. El área incluye cuencas fluviales, corrientes de aire y ecosistemas. 

El área dentro de la cual ocurrirán todos los efectos potenciales, impactos, características y esfuerzos compensatorios relacionados con una propuesta y sus alternativas puede denominarse área de estudio.

2) Significado del Efecto en el Medio Ambiente:

Existen acciones que tienen el potencial de ejercer efectos significativos en el medio ambiente. Estos efectos potenciales pueden ser relacionados a la alta sensibilidad de los recursos a transitorarse, a la naturaleza específica de los impactos, a la duración potencial de dichos impactos, o a los impactos secundarios o acumulativos potenciales. En este tipo de acciones los efectos ambientales podrían causar pérdidas irrevocables de recursos naturales importantes o efectos irreversibles a la salud humana.

La naturaleza de los efectos potenciales afectará el nivel de EIA, por lo que se deberá analizar entonces, el tipo, tiempo de exposición y frecuencia de los mismos, lo que puede aumentar la posibilidad de impactos adversos. Algunos de los recursos naturales altamente sensibles pueden ser ambientes naturales tales como, pantanos (costeros <manglares, humedales> o internos), cuencas de inundación de ríos, grandes extensiones de tierras de cultivo, de bosques, habitats de especies amenazadas, o regiones culturales. Pudiendo ser además receptores sensibles los recursos humanos (escuelas, agua potable, áreas de recreación, etc.).

- Principales contenidos de una MIA:

1) Descripción del proyecto y ubicación.-

La magnitud y tipo de alteraciones que se produzcan en el ambiente depende directamente de las características medioambientales existentes y las del proyecto que se pretende desarrollar.

La descripción detallada de todas las obras, permite analizar las alternativas posibles, así como las alteraciones que cada una de estas pueda producir.
2) Propósito y necesidad.-

El propósito y la necesidad son la justificación para llevar a cabo la acción propuesta, una descripción clara de estos puntos presenta la perspectiva de evaluar el razonamiento de varias alternativas. Sin un propósito y una necesidad justificados claramente, el proyecto no debería seguir adelante.

3) Descripción del medio ambiente (natural y socioeconómico).-

La descripción del medio ambiente detalla las características del área de estudio, los detalles deben ser suficientes para identificar los recursos naturales y humanos que podrían resultar afectados debido a la acción y alternativas propuestas.

Dentro de los aspectos generales del medio natural y socioeconómico se encuentran los siguientes:

- geología.
- topografía
- calidad del aire
- ordenamiento ecológico
- suelos
- hidrología (subterránea y superficial)
- clima, temperatura, precipitación, intemperismos severos
- comunidades terrestres (flora y fauna)
- especies de interés comercial, endémicas y/o en peligro de extinción
- comunidades acuáticas
- áreas de sensitividad ambiental
- áreas naturales protegidas
- recursos culturales.- sitios arqueológicos, de interés histórico, de atractivo turístico o de cualidades estéticas únicas
- centros de población
- vías de acceso
- servicios de infraestructura
- actividades predominantes en el área del proyecto y sus alrededores
- riesgo de carácter epidemiológico.

Es importante en este punto basarse en datos bibliográficos y cartográficos, análisis de agua y suelo así como en la realización de visitas de campo y entrevistas, todo esto debe ser reciente.

El alcance de la mayoría de las EIA es lo suficientemente amplio para necesitar de expertos técnicos y científicos, por lo
cual, un enfoque interdisciplinario suministrará claramente la información más valiosa para el proceso decisivo, ya que una MIA considera comúnmente las condiciones ambientales y los impactos potenciales sobre la calidad de las aguas y comunidades acuáticas, calidad de aguas subterráneas y su abastecimiento, vegetación y fauna terrestre, calidad de aire y salud humana, geología, topografía y análisis de suelos, infraestructura (transportación, demografía, socioeconomía) y recursos culturales.

4) Preparación del sitio y construcción.-

Se deben especificar todas las acciones que se realizarán durante la preparación del sitio y la construcción de las obras del proyecto, esto incluye desmontes, nivelaciones, rellenos, dragados, desviación de corrientes, obras y servicios de apoyo, necesidad de personal, requerimientos de energía y agua, así como los residuos generados.

5) Operación y mantenimiento.-

En este punto, se deben describir detalladamente los recursos naturales que se aprovecharán, las materias primas e insumos, las medidas de seguridad, requerimientos de energía, métodos de control de la fauna de acompañamiento, residuos generados, tipo y frecuencia de mantenimiento, producción de biomasa esperada, así como la vida útil del proyecto y las medidas de restitución al finalizar la vida útil.

6) Alternativas.-

Son los medios diferentes para llegar a la acción propuesta, dentro de las cuales se incluye la no acción, esta última presenta la base contra la cual se comparan los impactos de las alternativas a la acción.

La identificación, descripción, evaluación y comparación de vías alternas para llegar al propósito y necesidad básicos para una acción, son cruciales para la objetividad del proceso de EIA.

La descripción cuidadosa de las alternativas de un proceso de EIA facilita su comparación en cuanto a riesgos y beneficios técnicos, ambientales y económicos. Dentro de las alternativas, que deben ser legítimas y sustantivas, se incluyen cambios de tamaño, localización, tecnología o planificación, deben compararse con respecto a los costos de capital y de operación; impactos ambientales directos, indirectos y acumulativos.
impedimentos físicos, legales o institucionales, y políticas de desarrollo.

En general para la selección de las alternativas preferidas se deben considerar 3 perspectivas generales:

I) Factibilidad de ingeniería y requisitos
II) Viabilidad económica y
III) Entereza ambiental

se deben considerar a su vez los permisos de otras Instituciones tales como CNA, SEPESCA, etc.

7) Identificación y descripción de Impactos Ambientales.-

Métodos para la identificación de impactos:

Para la identificación y análisis de impactos ambientales se debe utilizar alguna metodología que permita en cualquier momento verificar las conclusiones presentadas en la manifestación ambiental. Existen una gran gama de técnicas que se pueden utilizar, entre ellas se encuentran:

* listas de chequeo
* matrices
* diagrama de flujo y redes
* sobreposición
* modelos de simulación
* modelos de dispersión
* jerarquización de alternativas dentro de categorías de impacto

Impactos primarios y secundarios.-

Los impactos primarios de una acción son aquellos que generalmente ocurren al mismo tiempo y en el mismo lugar de la acción. Se asocian con la construcción, operación y mantenimiento de una instalación o actividad y generalmente son obvios y cuantificables.

Pueden incluir efectos como:

a) la remoción de suelo.
b) el comprometimiento o destrucción de ecosistemas sensítivos, incluyendo humedales, bosques, zonas costeras, llanos aluviales y habitats naturales (siendo de singular importancia los de especies amenazadas o en peligro de extinción).
c) la degradación de los cuerpos de agua superficial debido a la erosión o a la descarga de elementos no propios a los naturales.
d) la alteración de las características de las aguas subterráneas.

e) la alteración o destrucción de áreas históricas, arqueológicas, geológicas, culturales o recreativas.

f) el desplazamiento de población.

g) el aumento en la generación de concentraciones de contaminantes aéreos, aumento en los niveles de olores y ruidos ambientales.

h) la creación o agravamiento de problemas de salud pública.

i) la violación directa durante la construcción y operación de las Leyes o Reglamentos Federales, Regionales o locales.

Los impactos secundarios son los cambios indirectos o inducidos en el medio ambiente, la población, el crecimiento económico, cubren todos los efectos potenciales que pudiesen ocurrir más adelante o en lugares diferentes como resultado de la acción.

El análisis de este tipo de impactos debe cubrir la extensión geográfica probable del desarrollo inducido, debiendo identificar los cambios en las características del medio, algunos ejemplos serían:

a) eutroficación de cuerpos de agua.

b) cambios en la hidrodinámica lagunar.

c) creación de nuevos centros de población.

d) salinización de tierras.

e) intrusión salina.

f) cambios de clima.

g) creación de plagas.

h) cambios en las comunidades acuáticas.

Impactos a corto y largo plazo.-

Dependiendo de su duración los impactos pueden ser a corto o largo plazo. La pérdida de pasto u otro tipo de vegetación herbácea puede considerarse a corto plazo, ya que el área podría regenerarse, sin embargo la tala de un bosque maduro o humedal puede considerarse un impacto a largo plazo.

Impactos positivos y negativos.-

Todos los efectos ambientales significativos, tanto negativos como positivos deben recibir atención, los primeros para minimizarlos y los segundos para acentuarlos. Generalmente los impactos positivos son socioeconómicos, dentro de los que se encuentran:

* generación de empleos

* construcción y mejoramiento de vías de comunicación
La creación de laboratorios de producción de larvas pueden a su vez contribuir a la disminución de captura de crías del medio ambiente.

Impactos acumulativos.-

Son aquellos impactos ambientales resultantes del impacto incrementado de la acción propuesta sobre un recurso común cuando se añade a acciones pasadas, presentes y razonablemente esperadas en el futuro.

Estos impactos ambientales pueden ocurrir debido a los efectos colectivos de acciones individualmente menores a través de un periodo de tiempo. Las circunstancias que generan impactos acumulativos podrían incluir:

a) impactos en la calidad del agua debidos a una emanación que se combina con otras fuentes de descarga o con desagües no provenientes de un solo punto.

b) impactos en la calidad del aire que resulten de las emisiones industriales o comerciales operadas en la misma región geográfica.

c) pérdida o fragmentación de habitats ambientalmente sensitivos (bosques, humedales, tierras agrícolas), resultante de la construcción de desarrollos.

La evaluación de éstos impactos es difícil, podrían ser simplemente agregables en sus efectos, pero potencialmente podrían interactuar de manera sinérgica o antagonista. Los modelos de calidad de agua y aire dan medidas para estudiar el resultado de los efectos acumulativos.

8) Prevención, mitigación y compensación de impactos ambientales.-

Mitigación es la implementación intencional de decisiones o actividades diseñadas para reducir en el medio ambiente los impactos indeseables de una acción propuesta. Este concepto puede incluir:

a) evitar completamente los impactos al no tomar una acción en particular.

b) disminuir los impactos al limitar la magnitud de la acción, o bien establecer cambios en la misma.
c) rectificar los impactos al reparar o restaurar características particulares del medio ambiente afectado.

d) reducir los impactos poco a poco al llevar a cabo actividades de mantenimiento durante toda la duración de la acción.

e) compensar al medio ambiente por los impactos ocasionados, al suministrar adiciones y sustitutos (creación de ambientes similares a aquellos afectados por la acción).

Es más deseable evitar impactos que tener que rectificarlos o compensarlos. Una reducción significativa de los impactos puede lograrse con el uso cuidadoso de las opciones de análisis de alternativas y mitigación, ya que es a través de estos medios que el proceso de EIA funciona para prevenir los impactos ambientales significativos.

Decisiones Equilibradas:

Es evidente que cualquier acción de desarrollo, re-desarrollo, o correctiva alterará los atributos ambientales existentes, sin embargo, es necesario que los efectos indeseables se mantengan al mínimo, una vez identificadas las medidas de mitigación. Para lograr el equilibrio, se deben tomar en cuenta todos los impactos originados, por ejemplo, que los efectos ambientales, tanto positivos como negativos de una acción, se pongan en una balanza contra los resultados socioeconómicos de la misma. Para poder determinar esto, los resultados de la investigación de EIA deben organizarse y presentarse de tal forma que facilite el equilibrio de los factores positivos y negativos. Debiendo comparar varias alternativas razonables que pudieran llenar el propósito y la necesidad de la acción propuesta.