homeoffice@gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

One of GAA's primary efforts is to establish standards of good practice for responsible aquaculture. To that end, the Alliance published **"Codes of Practice for Responsible Shrimp Farming."** This technical guide, available in sections below or as a complete printed manual, is a significant part of GAA's Responsible Aquaculture Program. NEW! **New Code:** Food Safety.

[ORDER CODES ONLINE]
(Credit card payment only.)
[PRINTABLE ORDER FORM]

[PART I. CODES OF PRACTICE]
[PART II. REVIEW OF RESPONSIBLE SHRIMP FARMING]

Prepared by Dr. Claude Boyd and other members of the GAA Technical Committee, the 10 codes contained in Part I of the guide (see below) are intended to assist in the development of national or regional codes, as well as to provide direction for individual shrimp farm operators. In its Review of Responsible Shrimp Farming, Part II of "Codes of Practice for Responsible Shrimp Farming" reviews shrimp production technology and farming techniques that address both sustainability and efficiency. Visit these pages for a general overview of the industry and its relationship to the environment.

Part I: Individual Codes of Practice

- NEW! Food Safety
- Mangroves
- Site Evaluation
- Design and Construction
- Feeds and Feed Use
- Shrimp Health Management
- Therapeutic Agents and Other Chemicals
- General Pond Operations
- Effluents and Solid Wastes
- Community and Employee Relations

The Codes of Practice were created as flexible guidelines for the formulation of site-specific systems of responsible shrimp production. Implementation methods will vary based on individual farm methods, goals and local conditions. As technology advances, some management practices will likely require revision.

Global Aquaculture Alliance -- http://www.gaalliance.org
Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: homeoffice@gaalliance.org

homeoffice@gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

FOOD SAFETY

[CODES INDEX]

PURPOSE

The purpose of this Code is to address food safety concerns that can arise from the presence of pathogenic bacteria, chemical contaminants (herbicides, pesticides, heavy metals), and aquaculture drugs (chloramphenicol, nitrofurans) in aquaculture products. The focus is on preventing these contaminants in preference to treating for them. Adherence to the other Codes of Practice helps to minimize the incidence of contamination, yet additional steps should be taken.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" and specifically asserts that:

- Shrimp farmers who adhere to the Code will rely on good management and responsible pond operations to prevent, eliminate, or reduce contamination by chemicals, drugs, and pathogens that pose human health concerns.
- Monitoring, controlling, and record keeping for these contaminants should conform to acceptable protocols.

MANAGEMENT PRACTICES

Adherents to the Code should strive to produce contaminant-free products for consumers through responsible pond operations and Best Aquaculture Practices that prevent, eliminate, or appropriately reduce levels of chemicals, drugs, and pathogens that pose human health concerns. The following practices should be used to achieve this goal:

1. All waste materials should be disposed of in a sanitary way.
2. In evaluating the suitability of a site for aquaculture, include testing for any chemicals, drugs, and pathogens that might pose a human health risk and are likely to occur at the site.
3. Avoid the potential for septic runoff from humans or other animals, as well as any indication of frequent use of pesticides, herbicides, and drugs; and past contamination with fuel oil or any other chemical contaminants.
4. Feed should not contain chemical or microbial contaminants. Feeding of uncooked organisms or any nutrient source derived from uncooked organisms is discouraged.
5. The shrimp industry and individual producers should work with regional governments to prepare lists of pathogens, drugs, and chemical contaminants that pose existing or potential human health concerns and take effective measures to control these risks.
6. When using any chemical products at or near shrimp-farming sites, shrimp farmers should be attentive to the information on product labels that regards human health concerns.
7. Managers should routinely evaluate procedures for feeding, fertilizing, and the use of chemicals and drugs to continually minimize human health concerns that may result from consumption of their aquaculture products.
8. Approved antibiotics, drugs, or other chemicals (such as sodium meta-bisulfite) should be used only when necessary to control identified disease problems.
9. Shrimp producers should frequently communicate with shrimp processors to obtain current information about antibiotics, drugs, and other chemicals that are regulated in shrimp-importing nations.
10. Records should be generated and maintained to demonstrate adherence to the practices mentioned above and control the hazards involved.

Global Aquaculture Alliance -- http://www.gaalliance.org
Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**

homeoffice@gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

MANGROVES

[CODES INDEX]

PURPOSE

The Code is designed to foster greater environmental awareness within the shrimp farming industry to assure continued protection of mangrove forests from potentially adverse impacts of coastal aquaculture. Recognizing the multitude of different conditions impacting mangroves in different countries and regional locations, this Code is to be interpreted as a flexible set of criteria to be used to assist any and all interested parties in formulating codes, regulations, and principles for protecting mangrove forests.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" by encouraging the following:

- The shrimp aquaculture industry will promote responsible and sustainable development and management practices ensuring the preservation of mangroves and the sustainability of shrimp aquaculture.
- The shrimp aquaculture industry will promote alternative development programs aimed at protecting mangroves while benefiting local communities in mangrove areas.
- Producers shall adhere to national and local regulations applicable to mangroves and to shrimp farming.

MANAGEMENT PRACTICES

It shall be the objective of all adherents to this Code to not harm mangrove ecosystems, and whenever possible, to preserve and even enhance the biodiversity of these ecosystems. The following practices will ensure the protection of mangrove ecosystems:

1. New shrimp farms should not be developed within mangrove ecosystems.
2. Realizing that some mangrove must be removed for canals when new shrimp farms are sited behind mangroves, a reforestation commitment of no net loss of mangroves shall be initiated.
3. Farms already in operation will continue ongoing environmental assessments to recognize and mitigate any possible negative impacts on mangrove ecosystems.
4. All non-organic and solid waste materials should be disposed of in an environmentally responsible manner, and waste water and sediments shall be discharged in manners not detrimental to mangroves.
5. The shrimp aquaculture industry pledges to work in concert with governments to develop sound regulations to enhance the conservation of mangroves including regulations regarding restoration of mangrove areas when old farms located in former mangroves are decommissioned.
6. The shrimp aquaculture industry will promote measures to ensure the continued livelihood of local communities that depend upon mangrove resources.

Global Aquaculture Alliance -- http://www.gaalliance.org
Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: homeoffice@gaalliance.org

homeoffice@gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

SITE EVALUATION

[CODES INDEX]

PURPOSE

The Code is designed to promote site evaluation as a means to ensure that new shrimp-farming projects are harmoniously integrated into local environmental and social settings. Site evaluation can identify limitations that influence the suitability of a site for farm construction and operation, reveal the possibilities of negative environmental and social impacts, and allow estimates of technical and financial requirements for mitigation of unfavorable conditions. Recognizing that enormous variation in environmental and social conditions exists from site to site, this Code presents adaptable guidelines to assist any and all parties interested in making site evaluations for shrimp farms.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" and promotes the following:

- Use of site evaluation to avoid siting farms where significant technical, environmental, and social problems are likely.
- Prevention of significant negative enviromental and social impacts through use of site evaluation findings in planning mitigation methods. A proper site evaluation will provide most of the information required to produce an environmental impact assessment (EIA).

MANAGEMENT PRACTICES

All adherents to the Code shall thoroughly evaluate potential sites for shrimp farms to assure that local ecological and social conditions are protected and even enhanced. The following practices will ensure that appropriate sites are selected for shrimp farms:

1. Evaluate hydrologic features including tidal patterns, freshwater influences and flood levels, offshore currents, and existing water uses.
2. Determine water quality characteristics of coastal waters in the vicinity of the site.
3. Ascertain the suitability of topography, soil, and ecosystem for siting and construction of ponds.
4. Make sure that previous site use has not resulted in contamination of water or soils.
5. Acquire long-term climatological records to determine the likelihood of drastic events such as flood, droughts, or severe storms that could negatively impact the project.
6. Survey the existing flora and fauna with particular concern for effects of the project on ecologically sensitive areas such as migration routes and nesting grounds or protected areas such as parks and refuges.
7. Document regulatory requirements for the site, and consider alternatives for compliance with regulations.
8. Consider alternatives to mitigate potential negative environmental impacts and to alleviate conditions not conducive to shrimp farm construction and operations.
9. Survey local communities to determine demography, resource use patterns, availability of work force, and compatibility with project goals.
10. Consider alternatives to mitigate potential negative social impacts.
11. Determine if any areas within the site are of significant archeological or historical importance and consider methods for their preservation.

5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**

homeoffice@gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

DESIGN AND CONSTRUCTION

[CODES INDEX]

PURPOSE

The Code is intended to promote environmental protection through proper shrimp farm design and good construction methods. Good site selection and incorporation of mitigative features in the farm design are the best ways to avoid problems related to flood levels, storms, erosion, seepage, water intake and discharge points, and encroachment on mangroves and wetlands. Planning of clearing and earth moving activities can prevent or greatly limit ecological damage during farm construction. Recognizing that a site-specific approach to design and construction is necessary, the Code provides basic design and construction criteria for environmentally responsible shrimp farms.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" and it promotes:

- Use of design features and good construction methods to overcome site limitations and to prevent or mitigate potential negative environmental and social impacts.
- Adoption of successfully proven and accepted design and construction procedures.

MANAGEMENT PRACTICES

Adherents to the Code shall strive to design and construct shrimp farms in a responsible manner to protect the environment and coastal communities. The following practices can afford this protection:

1. Farms should not be built on ecologically sensitive mangrove areas or other wetlands and in places where it is impractical to correct site-related problems such as highly-acidic, organic, or permeable soils.
2. Comply with all environmental impact assessment (EIA) procedures before initiating construction and abide by EIA restriction during construction.
3. Embankments should be designed to prevent erosion, and where practical, methods for reducing seepage through pond bottoms should be included.
4. Ponds should have separate intake and outlet structures to permit control of filling and draining.
5. Inlet and discharge canals should be separate so that water supply and effluent are not mixed.
6. Storms and flood levels should be considered in earthwork design.
7. Infrastructure and access roads should not necessarily alter natural water flows, cause salinization of adjacent land or water, or impound flood water.
8. Canals should be designed to prevent excessive water velocity and scouring.
9. Water intake point(s) should provide a sufficient volume of high quality water available.
10. Pump intakes should be screened, vegetative buffers provided around pump stations, and containments installed to prevent fuel spills.
11. Where possible, vegetative buffer zones, riparian vegetation, and habitat corridors should be maintained, and vegetative cover provided on exposed earthwork.
12. Sediment traps and basins should be incorporated in the design where suspended solid concentrations are expected to be high in effluents.
13. Outfalls should be designed to prevent erosion and avoid discharge of effluents into stagnant water.
14. Disturb as little area as possible during construction.
15. Erosion should be controlled during construction.
16. Cut and fill construction techniques are preferable, and earthwork should be compacted.

17. Degraded areas such as unused soil piles, barrow pits, and uncontrolled refuse dumps should not be created.

Global Aquaculture Alliance -- http://www.gaalliance.org
Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**

homeoffice@gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

FEEDS AND FEED USE

[CODES INDEX]

PURPOSE

The Code is designed to improve the efficiency of supplemental feeds and feed management in shrimp farming and to minimize the waste load in ponds. Feeding is a standard practice in shrimp production, because it permits higher production than can be achieved from natural pond productivity. Recognizing that feed is expensive, it should be used wisely to reduce production costs. However, using good feeds and feeding practices also are important steps towards reducing waste loads in pond effluents. Guidelines presented in this Code can be used by feed manufacturers and shrimp producers to improve feeds and feeding practices.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" and promotes awareness of two major issues:

- Shrimp feed should be made from high quality ingredients by good manufacturing techniques and stored properly.
- Feed should be used conservatively to ensure efficient conversion to shrimp flesh and minimize waste and expense.

MANAGEMENT PRACTICES

Those supporting the Code shall strive to improve feed quality and feeding with the goal of optimizing the conversion of feed to shrimp and reducing the amount of waste entering ponds. This goal can be achieved through the following practices:

1. Feed ingredients should not contain excessive pesticides, chemical contaminants, microbial toxins, or other adulterating substances.
2. Pellet binders and suitable manufacturing techniques should be used to provide a water-stable pellet.
3. Manufacturing processes should provide adequate vitamin and nutrient concentrations in feed.
4. Feed should be purchased fresh and not stored for more than a few months.
5. Feed should be stored in cool, dry areas to prevent mold and other contamination. Do not use contaminated feed.
6. Feed management practices should be implemented to assure the shrimp consume the maximum amount of supplemental feed and not leave excess amounts decomposing in the pond attributing to poor water quality.
7. Feeding rates should be determined from standard feed curves and adjusted for shrimp biomass, appetite, and pond conditions. Feed trays can be used to monitor feeding and prevent under- or overfeeding.
8. The most efficient supplemental feeding can be obtained by distributing the feed several times through the day and night, widely distributing it throughout the pond, either by manual or mechanical dispersement or use of feed trays.
9. Appropriate feed curves commensurate with shrimp biomass and appetite should be utilized on a site specific, species specific basis and with the recommendation of shrimp feed specialists.
10. Medicated feed should be used only if necessary for the control of a specific diagnosis of disease.
11. Feeding of uncooked organisms such as fish and invertebrates should be discouraged, because they can carry disease and foul pond waters.
12. Research to reduce the level of fish and other marine meals in shrimp feed should be encouraged.
13. Pond managers should keep careful records of daily feed application rates so that

feed conversion ratio (FCR) can be assessed. Reductions in FCR through careful feeding will improve production efficiency and reduce waste loads.

Global Aquaculture Alliance -- http://www.gaalliance.org
Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**

homeoffice@gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

SHRIMP HEALTH MANAGEMENT

[CODES INDEX]

PURPOSE

The purpose of this Code is to promote shrimp health management as a holistic activity in which the focus is on disease prevention instead of disease treatment. Authorities on shrimp health management recognize that stress reduction through better handling, reasonable stocking densities, good nutrition, and optimal environmental conditions in ponds can prevent most infectious and non-infectious diseases. Treatment should be undertaken only when a specific disease has been diagnosed. Also, effective measures must be taken to minimize the spread of diseases between farm stocks and from farm stocks to natural stocks. This Code provides adaptable guidelines that should provide effective management of shrimp health.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" and advances three basic premises as follows:

- Many disease problems can be prevented through stress management.
- Disease treatments should be made only after a clear diagnosis of the causative factors.
- Spread of disease should be minimized by reasonable regulation of importations of broodstock and larvae and by isolation and disinfection of affected ponds.

MANAGEMENT PRACTICES

Adherents to the Code shall adopt the principles of good shrimp health management to reduce the incidence of diseases and to protect natural fisheries. The following practices should be used to achieve these goals:

1. Shrimp farming associations should work with governments to formulate and enforce regulations to include quarantine procedures for importations and exportations of broodstock, nauplii, and postlarvae.
2. Healthy postlarvae should be used for stocking ponds. Survival of postlarvae should then be optimized by preparing the pond to ensure adequate availability of natural food, by properly acclimating postlarvae before stocking, and by avoiding stress by using appropriate handling and transportation techniques.
3. Good water quality and bottom soil management should be used. Stocking rates should not be excessive and high quality feed and good feeding practices should be used.
4. Strong chemical treatments that can stress shrimp should not be employed.
5. Shrimp should be routinely monitored for disease, and a definite diagnosis obtained for any observed shrimp health problem.
6. For non-infectious diseases related to pond conditions, carry out the best option for disease treatment or for correcting pond conditions.
7. For mild infectious diseases with potential to spread within a farm, quarantine the pond and carry out the best option for disease treatment.
8. For serious infectious diseases that may spread widely, isolate the pond, net harvest remaining shrimp, and disinfect the pond without discharging any water.
9. Dispose of dead, diseased shrimp in a sanitary manner that will discourage the spread of disease.
10. When disease occurs in a pond, avoid transfer of shrimp, equipment, or water to other ponds.
11. Drug, antibiotic, and other chemical treatments should be done in accordance with recommended practices and comply with all national and international regulations.

12. The shrimp industry should work with governments to develop certification programs for disease diagnosis laboratories and pathologists.
13. Each country or geographical area should develop its own pond dry-out, and biosecurity strategy.

Global Aquaculture Alliance -- http://www.gaalliance.org
Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**

homeoffice@gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

THERAPEUTIC AGENTS AND OTHER CHEMICALS

[CODES INDEX]

PURPOSE

The Code is intended to foster greater awareness within the shrimp industry of the proper use of certain potentially toxic or bioaccumulative compounds in shrimp production. Careful control over the use of therapeutants and other chemicals in production will assure that farm-reared shrimp are less likely than wild-caught shrimp to contain residues of pollutants or contaminants. Environmental benefits also will accrue from responsible chemical use. This Code contains flexible criteria that will allow prudent use of certain drugs, antibiotics, and other chemicals in production without endangering food safety or threatening the environment.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" and promotes three basic objectives:

- The shrimp farming industry in each nation should work with governmental and international agencies to develop lists of approved feed additives, pesticides, drugs, antibiotics, and other chemicals and to specify approved uses for each compound.
- Shrimp farmers who adhere to the Code will rely on good management to prevent water quality and disease problems and chemicals should be used only when necessary.
- Chemical should be used in ponds only after an accurate diagnosis of the situation, and treatments should conform to acceptable protocol.

MANAGEMENT PRACTICES

Adherents to the Code should strive to produce a wholesome product for consumers through responsible use of drugs, antibiotics, and other chemicals. Use of the following practices will assure this goal:

1. Shrimp health management at hatcheries and farms should focus on disease prevention through good nutrition, sound pond management, and overall stress reduction rather than disease treatment.
2. Where countries have approved lists of chemicals and chemical uses, only approved chemicals should be used in ponds and only for the use approved. Where such lists are not available, the shrimp industry and individual producers should work with governments to prepare such lists.
3. Shrimp farmers should follow information on product labels regarding dosage, withdrawal period, proper use, storage, disposal, and other constraints on the use of a chemical including environmental and human safety precautions.
4. When practical, antibiograms should be used to select the best antibiotic for use in a particular case, and the minimum inhibitory concentration (MIC) should be used.
5. When potentially toxic or bioaccumulative chemicals are used in hatcheries and ponds, waters should not be discharged until compounds have naturally decomposed to non-toxic form.
6. Careful records should be maintained regarding use of chemicals in ponds as suggested by the Hazard Analysis and Critical Control Point (HACCP) method.
7. Store therapeutants in a cool place and in a secure manner where they will be inaccessible to unauthorized personnel, children, and animals, and dispose of unused compounds by methods that prevent environmental contamination.
8. The shrimp-farming industry should work with governments to develop regulations for labelling the content and percentage of active ingredients in all chemicals including liming materials and fertilizers.

Global Aquaculture Alliance -- http://www.gaalliance.org
Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**

homeoffice@gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

GENERAL POND OPERATIONS

[CODES INDEX]

PURPOSE

The purpose of the Code is to prevent eutrophication, salinization, reductions in biodiversity, and other environmental perturbations by using responsible pond management practices. Experience demonstrates that it is possible to optimize efficiency of shrimp production and be good stewards of the environment at the same time. This Code contains broad guidelines on pond management that can be used to standardize and improve operations for sustainable shrimp farming.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" and asserts that:

- Responsible pond operations can protect or even improve environmental quality and enhance sustainability.
- Both profitability and environmental sustainability can be achieved at the same time.

MANAGEMENT PRACTICES

It shall be the objective of adherents to the Code to use pond operation methods that are environmentally responsible while allowing profitable shrimp production. The following practices should be used to promote profitable, yet sustainable shrimp farming:

1. Farms should be encouraged to use hatchery larvae rather than wild-caught larvae.
2. Where wild-caught postlarvae are used, a screening method should be used to separate by-catch and return it to the estuary.
3. Native species should be cultured whenever feasible; however, if non-native species are used, all applicable regulations should be obeyed regarding importation and inspection.
4. Only healthy postlarvae should be used.
5. Good water quality should be maintained by using stocking and feeding rates that do not exceed the assimilative capacity of the culture system and by using high quality feeds and good feeding practices.
6. Water exchange should be reduced as much as possible.
7. Fertilizers, liming materials, and all other chemicals should be used in a responsible manner and only as needed.
8. Good shrimp health management should be used.
9. Aerators should be positioned and operated to minimize erosion and creation of sediment mounds in pond bottoms.
10. Freshwater from wells should not be used in ponds to dilute salinity.
11. Effluents, sediment, and other wastes should be disposed responsibly.
12. Bottom soils should be evaluated periodically between crops and necessary treatments applied to remediate deterioration in soil conditions that occur during culture.
13. Water inlets and outlets to ponds should be screened to prevent entrance of competitors and release of culture species.
14. Predator control methods that do not require destruction of ecologically important species should be used.

Global Aquaculture Alliance -- http://www.gaalliance.org
Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA

Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**

homeoffice@
gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

EFFLUENTS AND SOLID WASTES

[CODES INDEX]

PURPOSE

The Code is designed to increase the awareness of proper waste management within the shrimp farming industry and enhance protection of coastal land and water resources. Recognizing that a number of production activities produce wastes, shrimp producers and processors should formulate systems of waste management for protecting lands and waters in the vicinity of their activities. This Code provides a set of guidelines that can form the framework for responsible waste management that will benefit all coastal resource users including shrimp farming.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" and specifically recognizes that:

- The shrimp aquaculture industry should promote responsible methods of effluent and solid waste management to protect environment quality and public health.
- Effluent and solid waste management is a continuous activity, and each member farm should strive to improve waste management procedures and reduce amounts of waste released to the environment.
- In countries where quality and volumes of effluent are not regulated by permits from governmental agencies, adherence to the Code is an alternative way of protecting the environment.

MANAGEMENT PRACTICES

Adherents to the Code should continuously strive to improve waste management. Particular attention should be given to the following practices:

1. Canals and embankments should be maintained to reduce erosion of above water portions.
2. Minimize water exchange to the extent feasible.
3. Use efficient fertilization and feeding practices to promote natural primary productivity while minimizing nutrient inputs.
4. Store and use fuels, feeds, and other products in a responsible manner to avoid accidental spills that could contaminate water. An emergency plan should be made for containing accidental spills.
5. Ponds should be drained in a manner to minimize resuspension of sediment and prevent excessive water velocities in canals and at effluent outfalls.
6. Where feasible, pond effluents should be discharged through a settling basin or mangrove forest.
7. Outfalls should be designed so that no significant impact of effluents on natural waters occurs beyond the mixing zone.
8. Shrimp pond effluents should not be discharged into freshwater areas or onto agricultural land.
9. Sediment from ponds, canals, or settling basins should be put back into areas from which it was eroded, used as earthfill, or disposed in some other environmentally responsible way.
10. Sanitary facilities for disposal of human wastes should be provided at hatcheries, farms, and processing plants.
11. Garbage and other farm wastes should be burned, put in a land fill, or disposed of by other acceptable methods.
12. Shrimp farms, hatcheries, and processing plants should comply with existing

governmental regulations related to effluents and other wastes.

13. Processing plants, and where necessary, shrimp hatcheries should install effluent treatment systems of appropriate type and capacity.
14. Managers should routinely evaluate waste management procedures and continually attempt to improve them.

Global Aquaculture Alliance -- http://www.gaalliance.org
Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**

homeoffice@
gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Codes Of Practice

Individual Codes of Practice

COMMUNITY AND EMPLOYEE RELATIONS

[CODES INDEX]

PURPOSE

The purpose of the Code is to foster good relationships among shrimp farm officials, workers, and local communities. Aquaculture can be a powerful stimulus to improving the standard of living in coastal communities by providing jobs and services, contributing to the tax base, improving the physical and social infrastructure, and creating a larger and more diverse and dynamic economy. Recognizing that public relations and employee welfare are complex issues, this Code is intended to provide some general guidelines for enhancing the prospects for harmonious interactions with workers and the local community. Conditions and expectations are highly variable from place to place, so considerable flexibility will be necessary in applying these guidelines.

The Code helps to achieve several of the "Guiding Principles for Responsible Aquaculture" and specifically promotes the following:

- Shrimp farms should employ local workers to the extent possible, provide good working conditions, and wages commensurate with local pay scales.
- Shrimp farms should abide by local laws and regulations regarding the rights of local people to use coastal resources.
- Shrimp farms should be supportive of local communities and engage in community activities.

MANAGEMENT PRACTICES

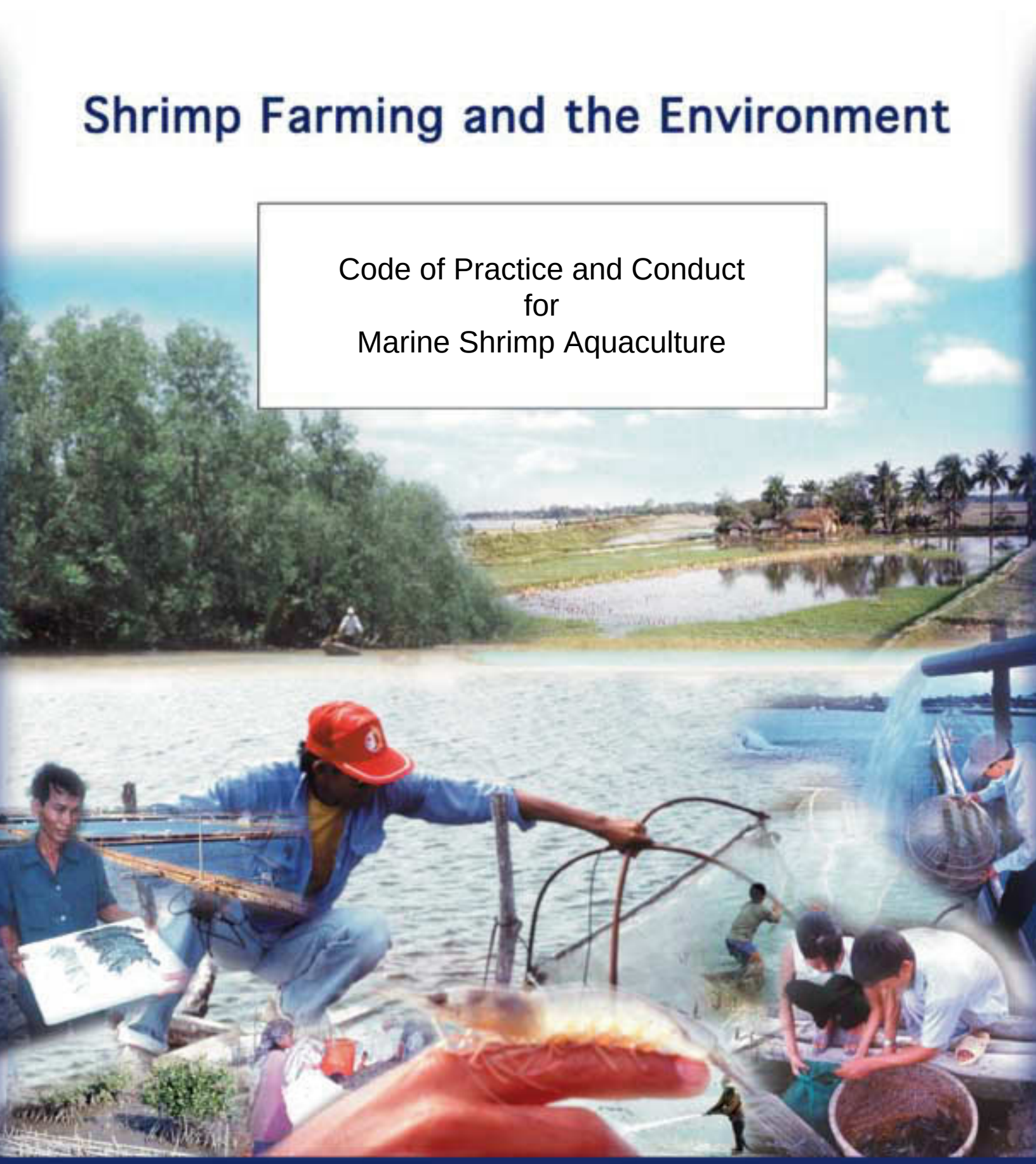
Shrimp farms range in size from small, family operations to large corporate enterprises. Most of the guidelines given below apply primarily to large shrimp farms:

1. Shrimp farm owners should have clear title or right to their property or other current, legal land concession agreements.
2. Shrimp farm management should schedule meetings with local communities to exchange information. This is particularly important in the planning stages for new farms or expansions.
3. Shrimp farm management should attempt to accommodate traditional uses of coastal resources through a cooperative attitude towards established local interests and environmental stewardship.
4. Shrimp farm management should contribute to community efforts to improve local environmental conditions, public health and safety, and education.
5. Local workers should be employed to the extent possible, and all practical means made to prevent conflicts between local people and workers from outside.
6. Workers should be fairly compensated with respect to local wage scales.
7. Healthy and safe living and working conditions should be provided. Procedures should be established for dealing with illness and accidents, and employers must be responsible for making sure that workers are fully aware of these procedures.
8. Shrimp farm management should have clearly defined and posted security policies.
9. Employees should have a clear understanding of their duties and of company expectations regarding their performance.

5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**

Shrimp Farming and the Environment

Code of Practice and Conduct
for
Marine Shrimp Aquaculture



A Consortium Program of:

WORLD BANK

NACA

WWF

FAO
FIAT PANIS

CODES OF PRACTICE AND CONDUCT FOR MARINE SHRIMP AQUACULTURE

Claude E. Boyd
Department of Fisheries and Allied Aquacultures
Auburn University, Auburn, Alabama 36849 USA

John A. Hargreaves
Department of Wildlife and Fisheries
Mississippi State University
Mississippi State, Mississippi 39762, USA

and

Jason W. Clay
World Wildlife Fund-US
1250 24th Street, NW
Washington DC 20037-1132, USA

A Report Prepared for the

World Bank, Network of Aquaculture Centres in Asia-Pacific,
World Wildlife Fund and Food and Agriculture Organization of the United Nations
Consortium Program on Shrimp Farming and the Environment

Preparation of this document

The research reported in this paper was prepared under the World Bank/NACA/WWF/FAO Consortium Program on Shrimp Farming and the Environment. Due to the strong interest globally in shrimp farming and issues that have arisen from its development, the consortium program was initiated to analyze and share experiences on the better management of shrimp aquaculture in coastal areas. It is based on the recommendations of the FAO Bangkok Technical Consultation on Policies for Sustainable Shrimp Culture[1], a World Bank review on Shrimp Farmingand the Environment[2], and an April 1999 meeting on shrimp management practices hosted by NACA and WWF in Bangkok, Thailand. The objectives to the consortium program are: (a) Generate a better understanding of key issues involved in sustainable shrimp aquaculture; (b) Encourage a debate and discussion around these issues that leads to consensus among stakeholders regarding key issues; (c) Identify better management strategies for sustainable shrimp aquaculture; (d) Evaluate the cost for adoption of such strategies as well as other potential barriers to their adoption; (e) Create a framework to review and evaluate successes and failures in sustainable shrimp aquaculture which can inform policy debate on management strategies for sustainable shrimp aquaculture; and (f) Identify future development activities and assistance required for the implementation of better management strategies that would support the development of a more sustainable shrimp culture industry. This paper represents one of the case studies from the Consortium Program.

The program was initiated in August 1999 and comprises complementary case studies on different aspects of shrimp aquaculture. The case studies provide wide geographical coverage of major shrimp producing countries in Asia and Latin America, as well as Africa, and studies and reviews of a global nature. The subject matter is broad, from farm level management practice, poverty issues, integration of shrimp aquaculture into coastal area management, shrimp health management and policy and legal issues. The case studies together provide an unique and important insight into the global status of shrimp aquaculture and management practices. The reports from the Consortium Program are available as web versions (http://www.enaca.org/shrimp) or in a limited number of hard copies.

The funding for the Consortium Program is provided by the World Bank-Netherlands Partnership Program, World Wildlife Fund (WWF), the Network of Aquaculture Centres in Asia-Pacific (NACA) and Food and Agriculture Organization of the United Nations (FAO). The financial assistance of the Netherlands Government, MacArthur and AVINA Foundations in supporting the work is also gratefully acknowledged.

Correspondence: Claude Boyd, Email: ceboyd@acesag.auburn.edu

Reference:

Boyd, C.E., J.A. Hargreaves and J.W. Clay 2002. “Codes of Practice and Conduct for Marine Shrimp Aquaculture” Report prepared under the World Bank, NACA, WWF and FAO Consortium Program on Shrimp Farming and the Environment. Work in Progress for Public Discussion. Published by the Consortium. 31 pages.

[1] FAO. 1998. Report of the Bangkok FAO Technical Consultation on Policies for Sustainable Shrimp Culture. Bangkok, Thailand, 8-11 December 1997. FAO Fisheries Report No. 572. Rome. 31p.

[2] World Bank. 1998. Report on Shrimp Farming and the Environment – Can Shrimp Farming be Undertaken Sustainability? A Discussion Paper designed to assist in the development of Sustainable Shrimp Aquaculture. World Bank. Draft.

Abstract

The rapid expansion of marine shrimp aquaculture in many tropical developing countries has proceeded without effective environmental regulation. Most countries with shrimp farming do not have an established regulatory apparatus to monitor and enforce environmental and socioeconomic standards. Therefore, voluntary codes of conduct are a possibility for improving overall management and possibly profitability of the marine shrimp aquaculture industry until effective governmental regulation is implemented.

The purpose of codes of conduct is to provide guidelines for development of voluntary systems of management to reduce negative social and environmental impacts. Such management systems consist of impact identification, formulation of standards, adoption of management practices to comply with standards, identification of indicators, monitoring to demonstrate compliance, and correction of management systems that are not compliant with the standards.

This paper reviews the status of existing codes of conduct for shrimp farming. Most codes contain common elements regarding site selection, effluents, use of drugs and other chemicals, use of nonindigenous species and disease control, and various other operational practices. Typically, codes of conduct do not include consideration of social issues, although the participation of all stakeholders is critically important for a successful code of conduct. Managers can reduce the social and environmental impacts of the industry through implementing better management practices (BMPs) under the guidance of such codes. Suggestions are made for improving existing codes and for preparing new codes, and comments are made regarding the implementation of codes.

Content

Abbreviations and Acronyms

AAF	Australian Aquaculture Forum
APFA	Australian Prawn Farmers Association
BMP	Best or Better Management Practices
CCRF	FAO Code of Conduct for Responsible Fisheries
CFA	Catfish Farmers of America
CMA	Chemical Manufacturers Association
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
FSC	Forest Stewardship Council
GAA	Global Aquaculture Alliance
GMO	Genetically Modified Organisms
HACCP	Hazard Analysis and Critical Control Point
ISANet	Industrial Shrimp Action Network
ISGA	Irish Salmon Growers Association
ISO	International Organization for Standardization
LENKA	Nationwide Assessment of the Suitability of the Norwegian Coastal Zone and Rivers for Aquaculture
NACA	Network of Aquaculture Centres in Asia-Pacific
NGO	Non Governmental Organization
WWF	World Wildlife Fund

Introduction

About 25 percent of shrimp sold on the world market are raised on shrimp farms (Boyd and Clay 1998). In many tropical nations with emerging economies, shrimp aquaculture is a major industry that provides economic opportunities for many people. Shrimp farms operated with good management and business practices can be profitable and benefit the local economy by creating jobs in production, processing, transportation, marketing, feed manufacture, and related support services. In common with most human endeavors, shrimp aquaculture requires resources and has an effect on the environment and local communities in which it is conducted. As with any young and rapidly growing industry, a wide range of mistakes have been made, and negative environmental and social impacts have occurred (Boyd 1996; Clay 1997).

The long-term success of shrimp aquaculture depends upon providing a good culture environment for growing shrimp in ponds. Environmental conditions in shrimp production ponds are directly linked to the ecology of the coastal zone (Folke and Kautsky 1989; Hopkins et al. 1995). Therefore, it is in the best interest of shrimp producers to be good stewards of natural resources and to use environmentally responsible production practices–because damage to the coastal environment leads to negative impacts on shrimp aquaculture itself. Similarly, it is much more desirable and profitable for shrimp farmers to be accepted as responsible members of local communities than to be embroiled in frequent conflicts.

Most shrimp aquaculture is located in developing countries of the tropics and subtropics. In most of these countries, systems of statutory laws and regulations regarding land and water use and environmental protection are in a rudimentary state of development compared to those in industrialized countries. Existing laws and regulations, and their enforcement, are seldom adequate to protect environmental quality. At times they do not even protect basic human rights. In many countries, governmental intervention will not be adequate to prevent adverse environmental and social impacts of shrimp aquaculture for many years, if ever. Thus, environmental organizations are protesting and publicizing the impacts of shrimp aquaculture. One strategy to change the industry is to alter the purchasing decisions of consumers in developed nations by increasing their awareness of the possible negative environmental and social impacts of farmed shrimp.

The public in most shrimp-importing countries is generally aware of the need to protect the environment and natural resources for future generations. An increasing number of consumers consider environmental consequences when purchasing certain products. Some may refuse to purchase a product that has negative environmental effects, or they may pay more for a product with relatively benign environmental or social effects. Individual investors and lending agencies also are beginning to consider the environmental consequences of their investments and loans. Shrimp importers, restaurants, shrimp producer associations, and many individual shrimp producers are well aware of the possible negative effects of bad publicity on the sale of shrimp. Therefore, methods for improving the image of shrimp aquaculture are being formulated and disseminated by various groups within the industry. The approach being taken by several groups is to prepare codes of conduct or practice for shrimp aquaculture that contain recommendations for more responsible production practices. Adopting and complying with codes of conduct are voluntary, but codes could become an important aspect of environmental and social management in shrimp aquaculture in the future.

This case study documents the status of existing codes of conduct and practice for shrimp aquaculture and compares the contents of different codes. The focus is on both environmental and social management because the purpose of codes is to provide guidelines for the development of a voluntary system of environmental management practices that also reduce social conflicts. Suggestions are made for improving existing codes and preparing new codes. Finally, observations are made regarding the implementation of codes.

Environmental Management Systems

The purpose of this section is to discuss the roles and types of actions that governments and the private sector can take to prevent adverse environmental impacts from activities such as shrimp farming. The goal of voluntary codes of conduct should be not only to reinforce but also to extend even further the beneficial effects that can accrue from compliance with environmental laws and regulations mandated by governments. As a collateral benefit, codes of conduct can improve public perceptions of the shrimp aquaculture industry by demonstrating a genuine commitment to environmental stewardship in countries where environmental laws and regulations are nonexistent or generally ineffective.

The goal of environmental management is to minimize, prevent, or mitigate adverse environmental effects of human activities to permit a more sustainable use of resources through better practices. For environmental management to be effective, (1) the possible adverse environmental impacts of human activities must be identified, (2) standards must be formulated to specify amounts of change in variables that are permissible without causing unacceptable environmental effects, and (3) technology-based management practices must be available for preventing excessive changes in environmental variables. To demonstrate that an environmental management system is achieving its goal, indicators must be identified and monitored to show that environmental variables remain within acceptable ranges according to the standards. Finally, if monitoring reveals that environmental variables fall outside acceptable ranges or negative environmental impacts are occurring, improvements must be made in the application of management practices. Thus, an environmental management system consists of impact identification, formulation of standards, adoption of management practices to comply with standards, identification of indicators, monitoring to demonstrate compliance, and correction of noncompliance.

Environmental management is undertaken to protect the environment and allow more efficient and more sustainable use of resources. However, individual perceptions of acceptable environmental impacts differ widely, and sustainable use is difficult to define. There are many opinions about how much change in the environment should be allowed and about the best methods for regulating this change. Furthermore, many of the environmental effects of an aquaculture project appear “off-site” indeed, many of these impacts occur within the public domain. Consequently, the costs of the ecological resources and services used (e.g. feed, water, and waste assimilation) are not included in conventional economic accounting. Project managers are reluctant to invest in treatments to prevent or mitigate effects that occur beyond the immediate project boundaries (or within the public domain) because they see such investments only as costs that cannot possibly be recouped.

Government and the private sector traditionally share responsibilities for assuring environmental quality. Government is responsible for establishing standards for environmental management and enforcing compliance with these standards, using regulations and laws. The cost of evaluating activities to determine possible ecological impacts should be the responsibility of the private sector, but governments must provide guidelines and approve the conclusions and recommendations of such evaluations. The private sector should bear the costs of installing management techniques for preventing or mitigating adverse environmental effects, but, again, government should be responsible for approving preventive measures and mitigation or treatment plans. Development of technology-based treatment or mitigation often exceeds the capabilities of the private sector; in these cases, public funds must be spent on developing effective environmental management procedures and in educational efforts to disseminate information about these procedures.

The cost of monitoring on-site environmental variables should be the responsibility of the private sector, but government needs to verify the validity of the monitoring effort and determine whether compliance with standards is occurring. Government or independent private organizations with governmental oversight best accomplish off-site monitoring. Several human activities usually contribute to off-site

environmental impacts, particularly in the coastal zone. No single activity, however, can be expected to bear the entire responsibility for impact mitigation. Finally, government is the only party with the authority to enforce regulations and laws. The only exceptions are private groups that have imposed enforceable standards and a system of accountability upon their members.

The actions of government are subject to influence by local and national public opinion, the lobbying efforts of special interest groups, and world opinion expressed by other governments, intergovernmental agencies, and other entities such as NGOs. In the United States, Canada, Australia, the European Union, and a few other industrialized nations, environmental management systems are highly developed and usually contain sufficient regulations and laws (or enforcement) to protect the environment and national resources. However, in many developing nations, regulations and laws are insufficient to provide adequate protection of the environment and natural resources. Application of regulations and laws to specific industries or regions is inconsistent because of the effects of changing decisions by regulatory agencies, funding and human resource shortages, political pressure, lack of political will, and governmental and other forms of corruption.

Regulatory Requirements for Aquaculture

Possible methods for regulating aquacultural enterprises include bans, restrictions, land-use classification and zoning, environmental impact assessment, mitigation plans, permits, user fees, performance bonds, and monitoring requirements. Specific methods applied widely to regulating aquaculture include environmental impact assessments, effluent discharge permits, limitations on the use of non-native species, restrictions on drug and chemical uses, standards for feed composition, restrictions on feed use, and other management practices.

Site Selection and Environmental Impact Assessment

One of the most common reasons for failure of shrimp aquaculture farms or for adverse environmental impacts is the location of farms on inferior or marginal sites (Boyd and Clay 1998). Therefore, a comprehensive site evaluation should be conducted to determine if site characteristics are suitable for the construction and sustainable operation of a shrimp farm. Such an evaluation should include determination of the availability and quality of water, climatic conditions, tidal patterns, freshwater flow (including flood levels and frequency); terrain, vegetative cover, soil characteristics, and other related factors. Farm layout and design can be modified to exclude areas of the site with unfavorable characteristics or to avoid or mitigate potentially negative environmental impacts.

All of the information required in a proper site evaluation should also be included in a thorough environmental impact assessment (EIA). However, EIAs must also include the following: a detailed description of the entire ecosystem and the proposed project, identification of potential negative environmental impacts and other hazards, an assessment of the associated risks of such hazards, a mitigation plan for the negative consequences of site development, and a description of the monitoring program (Wood 1995). Integration of the site evaluation and farm layout/design for shrimp aquaculture projects into the environmental impact assessment will allow assessment of the technical and economic feasibility of operating a sustainable project on a particular site.

The scope and complexity of an EIA will increase as a function of project size. Also, sensitive or more diverse ecosystems will need more detailed EIAs. It might be possible to develop simple checklists for conducting EIAs for small projects a few hectares in size, but a team of scientists representing several disciplines (e.g., soil scientists, hydraulic and construction engineers, aquaculturists and social scientists) may be needed to prepare EIAs for larger projects.

In a broader context, suitable sites for marine shrimp aquaculture projects can be identified through comprehensive coastal zone planning and management exercises. Many countries have developed coastal zone management plans that map core areas of undisturbed habitat as well as areas of the coast zoned for various uses, including aquaculture ponds. Planning can also occur with a specific aquaculture focus. For example, Norway established the LENKA (Nationwide Assessment of the Suitability of the Norwegian Coastal Zone and Rivers for Aquaculture) program during 1987–1990 to provide the basis for systematic, planned development of the aquaculture industry. The program identified suitable sites based on specified criteria, primarily through the estimation of environmental carrying capacity in a particular location.

Effluent Regulation

Modes of regulating effluents include disallowing discharge, allowing discharge only if effluent quality is within specified standards (water volume restrictions also may apply), allowing discharge only if BMPs are implemented, and allowing discharge, but applying user fees to effluent pollution loads. Implementation of the first option of no discharge is impractical for most types of pond aquaculture; because some ponds overflow after rains and other ponds must be drained periodically for harvest, renovation, or fish stock manipulation. Discharge permits with water quality and/or water volume criteria require monitoring at regular, specified intervals to demonstrate compliance. This kind of discharge permit is suitable for large operations with one or a few effluent outfalls. The cost and expertise required for an extensive monitoring effort make water quality–and water volume–based permits impractical where many small farms discharge effluent to a common basin. Likewise, assessing a fee for effluents based on mass loading (concentration of pollutant by volume) requires intensive monitoring, and this system does not seem applicable to aquaculture. In our view, the most effective system appears to be the use of general discharge permits that require farmers to implement a set of specified operational BMPs, with minimal basic monitoring requirements. However, Colombia has adopted what appears to be an effective regulation that requires that effluent must be of equal or better quality (based on dissolved oxygen and suspended solids) as the intake water (Gautier 2002). Polluters are charged a fee for effluents of inferior quality.

Regulation of Non-indigenous Species Introductions

Non-indigenous species can escape into the environment and possibly create a biological nuisance. Therefore, countries should have policies about importation, quarantine, and distribution of non-indigenous species based on the precautionary principle. These policies should be based on reliable information and explicitly consider the potential uncertainties and negative consequences associated with introductions. Species should not be introduced without scientific justification. Nonetheless, it is impractical to implement bans on non-native species once they have been introduced. Where non-indigenous species are allowed, culture systems should be designed to prevent escape, but experience indicates that it is difficult, if not impossible, to ensure that no animals will escape.

The importation of species that already occur in a country (or a drainage basin) is often done to provide broodstock or juveniles for stocking. Diseases that are a threat both to aquaculture crops and native populations have been introduced by the introduction and transfer of non-indigenous species. Therefore, strict guidelines for disease inspection and quarantine should be enforced. Several existing codes of conduct (FAO 1997; ICES 1984) and regional guidelines (FAO/NACA 2000) provide appropriate models for species introductions and transfers, with particular emphasis on controlling the spread of diseases.

Drug and Chemical Regulation

A wide variety of antibiotics and other therapeutants are used to control diseases of fish and other aquatic animals, and a variety of chemicals that include fertilizers, liming materials, disinfectants, oxidants, coagulants, pesticides, herbicides, fish toxicants, adsorbents, and minerals are applied to aquaculture

systems (Boyd and Massaut 1999). Most of these products have a long history of safe use in agriculture and the food industry, but some compounds (especially drugs, pesticides, piscicides, and antibiotics) may be toxic, bioaccumulative, or persistent in the environment. Misuse of antibiotics may result in the development of antibiotic-resistant strains of pathogenic organisms. In particular, the manufacture and routine use of feed containing antibiotics is a common way to promote antibiotic resistance. Release of water containing some substances might result in ecological damage, and some compounds could contaminate the flesh of aquatic animals and pose a hazard to consumers (Arthur et al. 1999; Boyd 2002).

Governments should develop lists of approved drugs and chemicals for use in aquaculture. These lists also should give the approved use of each drug, methods of application, and withdrawal time. Drug and chemical regulations for aquaculture have already been enacted in the United States (Federal Joint Subcommittee on Aquaculture 1994) and several other nations, and these regulations could be used as models for other countries. Equally important, manufacturers should be required to provide labels with the composition of chemical products, permissible uses, methods of application, environmental hazards, and restrictions.

Feed Regulation

Governments should require manufacturers to present the proximate composition of feeds on the feedbags. This would include, for example, not just total protein but the amount from fishmeal as well as from vegetable sources. Knowing, for example, whether soybeans used in feed are genetically modified organisms (GMOs) could be very important for the producer trying to sell shrimp to the Japanese or European markets. Rationing the amount of feed that farmers can purchase is possible, but this might lead to the use of low-quality feeds that cannot be regulated. Therefore, feed rationing does not seem feasible as a way of limiting nutrient inputs to ponds. Also, it is virtually impossible to regulate feed use on farms. Government regulation of feed composition could prevent concentrations of nitrogen, phosphorus, and other nutrients in feed that are higher than needed. Some research indicates that feeding rates have a more important effect than feed composition on water quality. The findings of Belize Aquaculture, Ltd., however, suggest that feed composition is also important for water quality (Boyd and Clay 2002). FAO has recently published technical guidelines on good feed manufacturing practices (FAO 2001).

Restriction of Certain Practices

Regulation of most routine management activities on aquaculture farms is impractical. However, some especially damaging practices can be controlled. Governments should develop and enforce regulations on groundwater use, and the practice of salinity dilution in brackish water ponds with fresh water from wells should be prohibited. The discharge of brackish water into freshwater bodies or onto agricultural land also should usually not be allowed. Aquaculture farms should not be permitted in mangrove areas or wetlands. The practice of collecting juvenile shrimp from near-shore environments should be regulated. Some birds prey on fish and other aquatic animals, and heavy economic losses from bird predation sometimes occur in aquaculture. Aquaculturists normally should not be allowed to kill birds, because there are nonlethal means of controlling birds.

Best or Better Management Practices (BMP)?

BMPs generally refer to best management practices (Hairston et al. 1995). The term is used in several ways. It has been used to refer to the best-known way to undertake any activity at a given time. In this sense, it probably refers to the practice or practices of only 1 or a very few producers. A second way, best management practices can be used is to define a few, often different, practices that increase efficiency and productivity and/or reduce or mitigate impacts. Finally, best practices are often required by government or others to encourage a minimally acceptable level of performance (and eliminate bad practices) with regard

to a specific activity. In this sense, the term is used in opposition to unacceptable practices. This latter meaning, however, may be quite distant from "best" practice in any real sense.

During the course of the Consortium's work, a number of individual best practices relating to different activities on farm and off as well as varying by intensity, scale and species have been identified. These practices were then analyzed both to understand how they were developed (e.g. what problem did they solve and what result did they achieve), how they work, and what it would take for them to be adopted by other producers. In the process of undertaking these studies, it has become clear that "best" practices today still fall short both of what is needed and what appears to be possible. In all likelihood, today's best practices will be tomorrow's norm and the day after that an unacceptable practice because it has been superceded. In reality, best practices are often employed only by one or a handful of producers. The challenge is to encourage their further adoption while at the same time pushing even further to find better practices still.

In short, the goal must be to constantly seek out better practices, not just because they reduce impacts, but also because they are more efficient and more profitable. The goal is to improve the norm rather than to simply establish a bar and declare everything above it to be best or good practice and everything below to be bad or unacceptable. From the Consortium's work, we know that we may not have any "best" practices at this time. We have, however, identified a number of better practices, and these practices are far better than the worse ones. Their impact on resource use efficiency can be many fold better than worse practices. Their impact on productivity, and more importantly on profitability, can be similarly striking when compared to worse practices.

The Consortium has come to realize that the industry norm may be best moved not by focussing on incremental increases by the middle range of producers, but rather by redefining the limits of what is thought possible, knowing full well that this is a process that will never be finished. It is a process of relative improvement in efficiency that will continue so long as the shrimp aquaculture industry continues. For that reason, we think that conceptually it is more effective to think about better management practices rather than best management practices even if the latter is the more common useage.

Social Issues

The perceived social consequences of marine shrimp farming projects are viewed by many environmental nongovernmental organizations (NGOs) as cause for equal if not greater concern than their environmental impacts. Social issues have been raised as reasons to disallow or regulate marine shrimp farming projects. In particular, NGOs have claimed that shrimp farming negatively affects traditional users of coastal resources. Traditionally, access to coastal resources in many countries has been open to all users. In such instances, privately held shrimp farms are viewed as incompatible with traditional open-access use. Second, the benefits of shrimp farming are perceived to accrue disproportionately to investors and shrimp farm owners. Furthermore, shrimp are produced for export, so the economic benefits of shrimp farming are limited because capital does not cycle to any great extent within local communities. In opponents' views, participation of local community members in the shrimp industry occurs in the form of relatively unskilled, repetitive manual labor. In reality, however, although the actual extent of employment created by marine shrimp farming is not known, jobs are created in production, transportation, processing, and marketing.

Government regulation with respect to a number of social issues already exists. In many countries, traditional resource users have rights to resources that cannot be denied or disrupted by new resource users. Often states, however, recognize contradictory rights of different users. This practice, of course, leads to conflicts. In fact, different levels of government (local, state, federal) also sometimes grant contradictory rights to different groups.

Governments already have relevant laws and regulations to protect the interests of all those who live in coastal areas. Many of these address specific impacts that have been caused by marine shrimp aquaculture in the past. These laws and regulations should be enforced consistently. At the very least, codes of practice should require signatories to recognize and obey the laws of the land. Since many social (and environmental) issues are already regulated, this is one way to insure that shrimp aquaculturists follow laws.

Where laws and regulations are ambiguous or even contradictory, governments should also seek to clarify tenure systems and management control over coastal resources through comprehensive coastal zone planning. In addition, governments and the private sector should actively seek the participation of local community representatives in permitting, regulatory review, and other decision-making processes. This proactive approach should anticipate potential conflict areas and prevent the need for various conflict resolution scenarios once damage has been done. Also, the private sector should seek to foster goodwill by active and genuine participation in local community life.

Codes of Conduct

A code of conduct is a system of principles proposed for adoption by those conducting certain similar activities in an industry (e.g. shrimp aquaculture) so that they do not infringe on the rights of others or cause some other undesirable consequence. The most basic form of a code of conduct is a set of guiding principles consisting of broad statements about how management and other operational activities should be conducted. Most codes do not have any legal authority, and adoption usually is voluntary. In fact, codes can be developed in circumstances where either government regulations do not exist or are not enforced. In such circumstances, a code of conduct can serve as the precursor to, or the basis for, formal regulation.

One model for developing a code of conduct is provided by the Hazard Analysis and Critical Control Point (HACCP) program of the US Food and Drug Administration, which takes a preventive approach to ensure safety of the food supply. The HACCP guidelines have been used as the basis for legislation regulating many food processing industries, including seafood and farmed fish. The HACCP system involves seven principles that share many characteristics with codes of conduct. These principles cover hazard analysis, identification of critical control points, and establishment of these five mechanisms: preventive measures with critical limits for each control point, procedures to monitor the critical control points, corrective actions to be taken when monitoring shows that a critical limit has not been met, procedures to verify that the system is working properly, and effective record keeping. Application of the idea of "critical control points" and a systems approach to environmental management methods is clearly an appropriate model for developing codes of conduct for shrimp aquaculture.

Codes of conduct are popular in manufacturing industries because many industry leaders perceive that adoption of a code of conduct conveys a message of responsibility to the public. A good example is the guiding principles of the Responsible Care® program of the Chemical Manufacturers Association (CMA) of the United States (Annex 1). The statements in the guiding principles are very broad and general (Chemical Manufacturers Association 1996). However, if CMA members carefully follow these principles, most environmental and social problems related to chemical manufacturing can be avoided. Of course, in the United States, many laws and regulations are in force regarding water and air pollution, solid waste disposal, transportation of hazardous materials, safety in the workplace, and employee relations. It would seem that the Responsible Care program is unnecessary, because most points rose in its statements are already regulated by the government. However, the adoption of the Responsible Care program suggests that CMA members are concerned about social and environmental issues beyond the limits imposed by governmental regulation.

A global code of conduct for fisheries, that include principles for responsible development of aquaculture, has been formulated by the Food and Agriculture Organization (FAO) of the United Nations. The Code of Conduct for Responsible Fisheries (CCRF) asserts "States should consider aquaculture, including culture-based fisheries, as a means to promote diversification of income and diet. In doing so, States should insure that resources are used responsibly and adverse impacts on the environment and on local communities are minimized" (FAO 1995). To this end, this document included a code consisting of 22 broad statements addressed to the nations of the world (Annex 2). If all of the principles outlined in the statements were followed, it is unlikely that social or environmental problems would result from aquaculture. Although, FAO and many other regional and international organizations provide assistance to countries to implement the provisions, few if any developing countries have the resources to formulate and enforce laws and regulations to implement the FAO Code of Conduct for Responsible Fisheries in the foreseeable future. The FAO Code is a voluntary code and has no binding authority. However, the FAO-member countries are obliged to report to FAO on regular basis the success and progress of implementation of the CCRF. The Code does provide, however, an outline of the issues that must be addressed to make aquaculture environmentally and socially responsible and to assure the sustainability of the aquaculture industry.

More explicit information than that contained in broad statements must be provided to producers if they are to apply the principles advanced in codes of conduct. For example, in the CMA Responsible Care program, specific codes of management practices are provided for pollution prevention, process safety, distribution, product stewardship, employee health and safety, community awareness, and emergency response. The Technical Guidelines on the CCRF provides further information and guidiance on how to implement the provisions given in the Code. For example, The Technical Guidelines No. 5 – (Aquaculture Development) provides guidelines on aquaculture development (FAO 1997). However, the CCRF does not provide specific suggestions on management practices for aquaculture

Code of Conduct programs should include detailed technical manuals describing how to apply the recommended BMPs to operations and management. Established programs such as CMA Responsible Care require member self-evaluations, measures of performance, and management systems verification. They also require their members to continually improve their health, safety, and environmental performance and to report their progress to the public. The shrimp farming industry has just begun to consider codes of conduct during the past 3 or 4 years, so none of its code of conduct programs is well established.

Many companies adopt the International Organization for Standardization (ISO) 14001 Environmental Management System Standards (Annex 3). The underlying purpose of ISO 14001 is improvement of environmental performance through improved management systems. However, standards for performance do not exist. Review of the requirements of the ISO program (ISO 1995) indicates that it is essentially a system that provides a framework around which a code of conduct containing an environmental management system can be developed, implemented, operated, and monitored (Annex 3). The company adopting it must develop details of the procedures and practices in the environmental management systems required by ISO. The company operates all aspects of the program. It is a voluntary system, but to claim ISO certification, the program must be approved by the ISO and the appropriate measures must be followed to maintain this approval. A third-party firm that verifies that environmental management systems are in place and being used most often grants ISO approval.

The main difference between the ISO program and the CMA Responsible Care program is that consumers may feel that the International Organization of Standardization has higher standards and enforces their program more rigorously than an industry association such as CMA. In our discussions with others about codes of conduct, there seems to be a consensus that the ISO program would provide a greater degree of environmental protection than code of conduct programs developed by industries. This may or may not be the case, and there is no evidence from other industries that would lead us to conclude that the application

of ISO standards would lead to a greater degree of environmental protection than voluntary codes of conduct.

Nonetheless, certification and product labeling based on ISO 14001 Environmental Management System Standards is an emerging trend within the forestry industry–initially for tropical timber but recently broadened to encompass temperate forests. An international forestry standard proposed by the Canadian Pulp and Paper Association in 1994 was not adopted by ISO. Rather, ISO developed a report to provide "information to assist forestry organizations in the use of ISO 14001 and ISO 14004 Environmental Management System Standards." Participation of buyers' groups, including large home improvement retailers such as Home Depot (USA) and B&Q (UK), have increased the demand for Forest Stewardship Council (FSC)–certified forest products. The FSC has certified 3 percent of utilized forests and 1 percent of production. Notably, the forest certification effort has proceeded largely in the absence of governmental oversight, with its progress coming from the work and participation of forest owners associations, industry organizations, home improvement retailers (e.g. Home Depot) and environmental NGOs (e.g. World Wildlife Fund).

Aquaculture Codes of Conduct and Practice

The purpose of this case study is to consider shrimp aquaculture codes of conduct and practice, but we begin by discussing the codes of conduct developed by several fisheries organizations. Because shrimp farming and finfish culture are similar in many ways, a discussion of the fish culture codes is relevant.

Fish Culture

Irish Salmon Growers Association

The Irish Salmon Growers Association (ISGA) has had a code of conduct in place at least since 1989, and its code is now in a third revision (Irish Salmon Growers Association 1991). The document is thorough and contains major sections on environment, husbandry, insurance, and worker safety. It has appendices describing hazards, disease treatments, and contingency plans for accidents.

The environmental section provides details for preparing EIAs for marine and freshwater sites, and includes licensing information. A water quality monitoring program is described. Other environmental issues that are addressed include bleeding of fish at harvest, chemicals and antibiotics, escapes of cultured fish, mortalities and disposal, predator control, and site selection. The husbandry section considers the recognition of disease and water quality problems and covers stock and stocking density, feeding, fish health, daily checklists, and records. The requirement for liability insurance and the desirability of crop insurance is mentioned. A very through procedure for improving health and safety conditions for workers is provided in the appendix.

The ISGA document stresses the need to have procedures and plans for all activities that can influence production, environment, product quality, or worker safety. There is an emphasis on checklists, monitoring, documentation of procedures, and record keeping. This document obviously has been thoughtfully prepared, reviewed by many different parties, and revised several times.

BC Salmon Farmers' Association

A code of conduct is currently under development by the British Columbia (BC) Salmon Farmers' Association. In 1998, the provincial government completed a comprehensive Environmental Assessment Review of the salmon industry. The development of an industry code of practice was an explicit recommendation in that report. The code will provide and explain "best operational practices" for the province's salmon farming industry. The code is seen as a way to establish performance-based management criteria to serve as the objective basis for standards and guidelines used in monitoring and

enforcement. The code will also include requirements for licensing, monitoring pertinent regulations, and methods for conflict resolution.

British Trout Association
This Code was first prepared in 1992 and subsequently revised in 1995 (British Trout Association 1995). The code was designed to help farmers grow trout and run their businesses efficiently, to safeguard the environment, and to present finfish aquaculture to the public in the best possible way. The code consists of sections on water supply, intake, and discharge; rearing and husbandry; fish food and feeding; importations of live fish and eggs; fish health; fish welfare; safety of staff and health regulations; harvesting; and food legislation. Each section contains a list of guidelines or management practices for use by farmers. The guidelines and practices refer to government regulations of various activities such as effluent discharge, fish transport, and chemical use.

Ornamental Fish Industry (United Kingdom)
This code of conduct is directed primarily at the aquarium fish industry (Ornamental Fish Industry undated). Its sections provide guidelines or management practices for retailers, importers, unpacking imported live fish, care of live fish, manufacture and sale of glass aquaria, testing laboratories, health and safety of workers, sale and supply of goods, and stocking density. The main environmental aspects of this code of practice are preventing escape of nonindigenous species and preventing the spread of fish diseases. Particular emphasis is given to international regulations and conventions involving the transport and introduction of species from foreign nations. The OFI provides a logo for their members to display, and members are urged to allow the public to review its code of conduct.

Catfish Farmers of America
This program was designed by the Catfish Farmers of America (CFA) as an education program to help farmers avoid drug and chemical residues in catfish (Brunson 1997). It contains many suggested practices for pond management to improve water quality, reduce fish stress, and minimize the frequency and severity of disease outbreaks. Many of these procedures also reduce the volume and improve the quality of pond effluents, but the focus is on fish health management. The guiding principle is that preventing diseases through better management is better than relying on disease treatment with antibiotics and other drugs. Nevertheless, valuable information on the use and storage of antibiotics and drugs is provided. The necessity of keeping good records on pond management activities including use of chemicals is stressed.

Farmers enroll in the program by filling out an enrollment card and sending it to CFA; there is no enrollment fee. Those enrolled are identified as Quality Assured Producers, but no self-evaluation or evaluation by the CFA is conducted of those so enrolled. The farmers enroll in the program and follow its guidelines on a strictly voluntary basis.

Australian Aquaculture Forum
This code was prepared by the Australian Aquaculture Forum (AAF) (undated), whose members are the Tasmanian Aquaculture Council, South Australia Oyster Growers Association, New South Wales Farmers Association–Oyster Section, Victorian Aquaculture Council, Aquaculture Council of Western Australia, Oyster Farmer Association of New South Wales, Australian Tuna Boat Owners Association, Pet Industry Joint Advisory Council, and Aquaculture Council of Queensland. The code contains 43 points related to management activities designed to provide minimum standards for environmental performance. These points appear to be based largely (though in a somewhat expanded form) on the environmental aspects of the FAO Code of Conduct for Responsible Fisheries (Annex 2). This AAF code is voluntary, but some parts are also covered by governmental legislation.

Marine Shrimp Farming

Australian Prawn Farmers Association

The Environmental Code of Conduct for Australian Prawn Farmers (Annex 4) was prepared by Dallas Donovan of Pacific Aquaculture and Environment Pty. Ltd. for the Australian Prawn Farmers Association (APFA), with funding from the Australian Department of Environment (Donovan 1998). Conservation and environmental NGOs, governmental fisheries and environmental agencies, and shrimp farmers were asked to review and contribute to this work. Thus, it incorporates the input of most pertinent stakeholders.

The section of the APFA code titled "Appropriate Management Practices" provides suggested management practices for all aspects of farm management, including site selection, farm design and planning, construction, effluent management, feeding, chemical use, and several others. However, the practices are given as general statements with no instructions on implementation. In spite of the lack of instructions for installing or using BMPs, most Australian shrimp producers are well educated and fairly knowledgeable about the technical aspects of aquaculture. They can probably implement most of the suggestions without difficulty. However, because of the lack of detail about implementation, this code has little relevance to producers in most other parts of the world.

The Environmental Code of Conduct for Australian Prawn Farmers is thorough and well prepared. Similar to other codes of conduct, the Australian code lacks an operations manual with more detail to supplement the current document. Australia has a well-developed system of environmental laws and regulations, and the greatest value of this code appears to be helping producers comply with existing environmental regulations. It will be a useful reference for those making codes in developing nations, but it is not an acceptable code for direct adoption in other countries. For example, the Australian code does not address social matters, although these must be addressed in codes of conduct for shrimp aquaculture in developing nations.

Shrimp Farming Industry of Belize

The code of conduct for Belize was prepared by Dixon in 1997 and is similar in style to the Australian code. However, the Belize code apparently was not reviewed or revised as thoroughly, and it is organized less well than the Australian code. Also, the code for Belize is intended primarily for semi-intensive shrimp culture. The code describes the industry in Belize and discusses areas of ecological concern. It then provides BMPs for site selection, construction, pond management, introduction of exotic species, disease management, erosion control, and effluent and waste management. The BMPs consist of short general statements such as, "Any groundwater used in production of shrimp should be abstracted in a responsible manner on the basis of available hydrological data to prevent saline water intrusion into these area." Nevertheless, nearly all points of environmental concern are addressed in a general way by the BMPs identified in the code. The code also contains information on environmental monitoring at the farm level and discusses issues of compliance with BMPs. Social issues are not addressed in the document, however.

There is no discussion of plans to implement the code among shrimp farmers in Belize; its acceptance would apparently be voluntary. Belize has a number of water quality regulations, and adoption of this code may help farmers comply with existing regulations.

Global Aquaculture Alliance

The Global Aquaculture Alliance (GAA) was formed in 1997 as an international NGO supported by aquaculture businesses and organizations. Some of the founding members include Camara Nacional de Aquacultura (National Chamber of Shrimp Aquaculture), Deli Group (a company that operates shrimp farms in Ecuador and Honduras), Ocean Garden Products, Inc. (a shrimp importer/exporter), Zeigler Brothers, Inc. (a feed and equipment supplier), and Shrimp News International (a publisher of shrimp farming information). The stated mission of GAA is to further environmentally responsible aquaculture to

meet world food needs. This organization has a large membership representing most shrimp producing countries but has been more active in the Americas than in Asia and elsewhere. It has focused on shrimp farming, but some members also have interests in the fish culture industry.

The GAA has a set of guiding principles based on the principles outlined in the FAO Code of Conduct for Responsible Fisheries (Table 2). In addition, a series of codes of practice covering mangroves, site evaluation, design and construction, feeds and feed use, shrimp health management, therapeutic agents and other chemicals, general pond operations, effluents and solid wastes, and community and employee relations were prepared recently for GAA (Boyd 1999). These codes contain general recommendations for BMPs similar to those in the Australian and Belizean shrimp farming codes. The GAA Codes of Practice document (Boyd 1999) has been thoroughly reviewed by aquaculture scientists and GAA members, but other stakeholders have not yet reviewed it.

GAA did not intend for its codes of practice to be a primary operations manual. The purpose of the codes of practice document was to provide guidance to national shrimp farming associations or individual farmers, in the form of broad principles, for the development of country-specific or site-specific environmental management systems based on BMPs. This objective is apparently being accomplished because shrimp farming associations in Ecuador, Honduras, and Nicaragua have signed formal agreements to develop country-level codes based on the GAA model, and associations in Belize, Colombia, Mexico, and Panama will apparently do likewise in the near future. The GAA Codes of Practice also has served as the major reference for developing a code of conduct for shrimp farming in Thailand and for a manual on BMPs for Latin American shrimp farming. These two efforts are discussed below.

The GAA expects its members to comply with the suggested management practices, as appropriate for their situation, and to strive for continuous improvement in environmental stewardship and community and employee well being. Toward this end, a member self-evaluation form has been prepared, to be completed separately by associations; hatcheries; manufacturers and vendors; processors; siting, design, and construction personnel; and farm operations staff. The GAA is currently investigating options for further implementation of its code of conduct. Some of the key issues being addressed are: (1) minimum standards for key operational factors, (2) formal systems of record keeping, (3) third-party inspection and verification, and (4) certification. The GAA has decided to include individuals from disciplines such as environmental science, agricultural waste management, and water pollution control in discussions about implementation of the program. Still, many other stakeholders are not yet at the table.

Thailand

The marine shrimp culture industry of Thailand has embarked on a program to develop and implement a code of conduct (BTG-Golder 1999). The World Bank funded the initial phases of the program and the effort was conducted by the BTG-Golder Company (Canada) and the Thailand Department of Fisheries. Thai shrimp aquaculturists have been involved in the activities by participating in facilitated meetings in several locations. The GAA Codes of Practice (Boyd 1999) was used as a reference in the development of the Thailand Code of Conduct. Shrimp farmers and the Department of Fisheries adapted the GAA guidelines to conditions in Thailand.

Policy statements for the Thai code of conduct have been endorsed by the Thai Marine Shrimp Farmers Association, the Frozen Foods Association, the Thai Food Processors Association, the Aquaculture Business Club, and the Thai Government Department of Fisheries. A small manual of operating guidelines and procedures is included (BTG-Golder 1999). Sections include site selection, pond management, stocking density, feed management, shrimp health management, therapeutic agents and chemicals, wastewater and solid waste management, social responsibility, and education. The guidelines for BMPs have minimal detail, similar to those in the Australian, Belizean, and GAA codes of conduct. However, a

detailed manual on procedures for operating shrimp aquaculture farms in a manner consistent with the Thai code of conduct is apparently in preparation.

The implementation of a code of conduct in Thailand and other Asian countries will be much different than in the Americas. There are many small shrimp aquaculturists in Asia, while in the Americas there are fewer producers, but most of them have large farms. At a minimum, the types of BMPs as well as the ability to implement any single BMP will be different for small and large producers. Small-scale producers do not have access to the same level of financial resources as larger ones to implement BMPs necessary to fulfill obligations outlined in a code of conduct, but they do have the ability to implement more labor-intensive BMPs. Different farmers also have different levels of education and technical knowledge. Different types of governmental and international assistance and funding for implementation of codes of conduct will be needed in Asia than in Latin America, but there will also be major differences among countries in the two regions as well. The Thailand Department of Fisheries plans to develop a program to promote the implementation of its code of conduct by small farmers.

Several reports of initial difficulties with the trial implementations of the Thailand Code of Conduct have appeared. Reports indicate that farmers perceive the code as something the government pushed but with which the shrimp producers had little or no involvement. The lessons from implementing the code in Thailand will be very useful for those wishing to implement similar codes in other countries.

Malaysia

The Department of Fisheries in Malaysia has been assisting with the development of a code of practice for shrimp aquaculture for producers in that country. A working paper has been prepared (Anonymous 1998) that contains a draft code of practice. This paper presents guidelines for the following: site selection; hatchery design, construction, and management; construction and management of grow-out farms; non-native and genetically altered species; and records and monitoring. The paper includes an appendix listing relevant existing legislation. The guidelines touch on essentially the same points mentioned in other codes discussed above, but there is no attempt to address social issues.

University of Rhode Island

The Coastal Resources Center of the University of Rhode Island has initiated a project, supported by the US Agency for International Development, to promote good management practices in shrimp farming in Latin America, with an initial focus on Honduras. One part of this project was the preparation of a manual of good management practices (Boyd and Haws 1999). This publication is based on the GAA Codes of Practice, but it is customized for conditions in Latin America (large farms and semi-intensive culture in large ponds) and contains more instructions on implementation of the recommended BMPs than given in the GAA Codes of Practice. Boyd and Haws (1999) point out the importance of socioeconomic issues in shrimp farming, but they do not provide suggestions on good social practices to be used by the shrimp aquaculture industry.

Organic Aquaculture

Agro Eco Consultancy of the Netherlands has prepared a paper on organic aquaculture, focusing on shrimp aquaculture in particular (Hilbrands undated). It is claimed in this paper that "organic production is the most modern way of farming as it seriously takes into account the voiced environmental and social problems." This is certainly an arguable point, and it would be difficult to defend. Hilbrands, however, does emphasize the need for BMPs in shrimp aquaculture and suggests that the FAO Code of Conduct on Responsible Fisheries should be adopted. This paper does not provide any information that is not more extensively elaborated in the other codes discussed above. However, the possibility of shrimp being produced by organic farming methods may be of interest to some consumers, so the idea should not be dismissed.

The Brisbane Expert Consultation

The December 1997 FAO Technical Consultation on Policies for Sustainable Shrimp Culture recommended that FAO convene meetings to elaborate best practices for shrimp culture and desirable elements of the legal and other regulatory instruments for coastal aquaculture. In response, FAO and the Government of Australia convened an Expert Consultation on the 4 to 7 December 2000, in Brisbane, Australia. The Expert Consultation discussed and adopted a set of "Objectives" and "Operating Principles" for sustainable shrimp culture and a set of recommendations including a follow-up process. Among others, the Brisbane Consultation recommended that the objectives and operating principles, and the legal and institutional arrangements to support implementation, be prepared for presentation to an intergovernmental forum for future formal agreement. The report of the Expert Consultation (FAO/Government of Australia, 2001) provides a detailed description.

Assessment of Codes

General Approach

Codes of conduct were being promoted for fish aquaculture before the shrimp aquaculture industry became interested in them. Those preparing codes of conduct for shrimp aquaculture used the fish culture codes as references, as well as other environmental codes such as the CMA Responsible Care and the ISO 14000 programs. The codes for shrimp aquaculture and those for fish aquaculture consider almost identical issues and utilize very similar methods. For this reason, the fish culture codes will not be discussed further.

All codes reviewed in this case study include recommendations for adopting practices intended to improve environmental stewardship. The Australian Prawn Producers Association code of conduct is very specific to Australian conditions, and an Australian shrimp producer adopting the code should have no trouble meeting existing regulations. However, the farmer would need to develop means of implementing the practices. Few instructions for implementation are provided. The other codes are more general than the Australian code. Thus, an obvious fault in all of the shrimp farming codes of conduct is the lack of specific instructions on how to implement the BMPs suggested in the guidelines. The documents containing the GAA codes and the Thai code indicate plans for developing operational manuals with more technical instructions. However, none of these are available at this time.

All of the codes are voluntary. None of them clearly explain how adoption and successful implementation of either the codes, or more specifically the BMPs, will be achieved. This is an important issue. Simply having a code of conduct with supporting BMPs in a document that various parties have endorsed and pledged to support means little if anything. Clear evidence that shrimp producers are using codes of conduct is required to demonstrate the potentially beneficial effects of code implementation. Additionally, codes should not be seen as fixed documents, but rather subject to change as technology and conditions change.

Environmental management is a new approach in aquaculture, and the BMPs in the various codes have generally been selected based on "common sense" rather than extensive research–e.g., the best current information or the best guess from applying environmental management systems from other industries. Although many of the BMPs will provide benefits, there has been little experience with some of the suggested practices in commercial shrimp aquacultural production. It is not clear, much less certain, that all of the practices will provide the expected benefits. The BMPs should be tested for effectiveness and modified as necessary. Demonstration projects for BMPs also will be essential as a component of educational programs. Finally, it will be essential to understand the financial implications of implementing any suggested BMPs. Even with such information, it is likely to be an uphill battle to convince producers to adopt BMPs. Without such information, however, it will be impossible.

To date, codes of practice have been designed primarily by the aquaculture industry and their consultants. Most of the proposed codes consider the important environmental issues, but with the exception of the GAA and Thai codes, there is no mention of social issues. All interested groups that are or can be affected by shrimp aquaculture should participate in discussions related to the design and implementation of codes of conduct. Although most codes have been developed without incorporating the concerns of all affected groups, broad participation is still possible as codes are revised and improved–provided the participation is sought openly and transparently and the comments and observations of those groups who have been previously ignored are given equal weight. Finally, it is important that this consultation, if it is to be more than mere window dressing, occur before certification programs have been established.

The confidence in codes of conduct of members of communities affected by shrimp aquaculture projects, shrimp consumers, and the public at large will be greatly enhanced if there is third-party certification of compliance. This does not diminish the importance of self-evaluation, which can be a strong motive for improvement. However, self-evaluation can be very superficial, or it may not reveal certain problems that would be obvious to an objective reviewer. Furthermore, any given producer will not really be able to evaluate his or her performance relative to other producers in the country, much less the entire world. The GAA has a self-evaluation program and is considering options for third-party certification. However, reports of some early self-evaluations by producers suggest that virtually all operations are being well run and there is little room for improvement. For this and other reasons, all codes of conduct should endeavor to be transparent to the extent of allowing third-party verification.

Standards for all activities that influence the environment are needed in environmental management systems. It is essential to develop standards, or minimal levels of performance, for use in codes of conduct programs. The GAA is currently considering this issue, but standards are not mentioned in the other codes.

A large shrimp farm can develop a complex system of environmental management to comply with the objectives of a code of conduct, educate its workers, adopt and comply with standards, conduct self-evaluations, and allow third-party evaluations of its programs. However, most small shrimp farmers are unable to do these things, particularly if there has been no attempt to develop BMPs for use by smaller, more labor-intensive systems. It would be equally difficult for smaller producers to meet the conditions of codes that were developed primarily to address the issues confronted by larger producers. The governments of countries where shrimp aquaculture occurs will need to develop some remarkable promotional and educational programs if codes of conduct are to be extended to small farmers. However, if the practices of small-scale producers affect the image of the entire industry, then it would behove industry associations like the GAA or the Camara in Ecuador to target such groups as well.

Many of the comments made so far in this section are negative, but there also are many positive aspects of codes of conduct. Identification of environmental issues that should be addressed by developing codes of conduct will raise the environmental awareness of the shrimp farming industry. Many adverse environmental impacts result simply because people are not aware of the consequences of their actions, others because producers do not know how to address some issues. Since most producers will not be involved in preparing codes of conduct, education program to promote codes should raise environmental awareness. Also, if all stakeholders are included in the process of preparing codes of conduct, the discussions that result will be enlightening to both shrimp farmers and those with other interests in the affected resources. Many environmental or social concerns about a project arise from a poor understanding or misconceptions of the project by other stakeholders. Discussions will permit developers to explain the project to other stakeholders and to better understand their concerns. Through information exchange, acceptable alternatives for contentious points can be negotiated.

The proper use of carefully formulated systems of BMPs in codes of conduct can improve the environmental and social performance of shrimp farming. The codes of conduct that have been developed,

to date, certainly contain many good suggestions for more environmentally friendly management. Of course, more detailed instructions for implementation of BMPs and evaluation of the effectiveness of BMPs put into practice would improve the prospects for success.

The BMPs suggested in codes of conduct should also make shrimp aquaculture a more efficient user of resources. Most BMPs focus on better design and construction and more efficient use of resources, so they should reduce infrastructure maintenance and shrimp production costs–and thereby improve the profit potential of shrimp aquaculture. Also, BMPs should protect, maintain, or improve coastal water quality, which is in the best interest of all coastal residents including shrimp producers. Thus, in spite of the initial costs of adopting codes of conduct, long-term benefits should accrue in the form of greater profitability and sustainability, as the goals of maximum economic efficiency and environmental protection are approached. These points should be used to promote the adoption of codes of conduct among producers.

The BMPs should represent the best technological information presently available. Many shrimp aquaculturists use outdated methods either because they do not want to change production techniques or because they are not aware of better techniques. Collecting and explaining good management systems in the form of BMPs provides an excellent way of extending technology to farmers.

Sooner or later, most countries will have laws and regulations for shrimp aquaculture. The shrimp aquaculture industry needs to take an active role in formulating and reviewing these regulations. Without industry input, many of the regulations could be unnecessary, excessively restrictive, or ineffective. The development of codes of practice provides an ideal way for producers to become involved with environmental agencies. In fact, if the shrimp farming industry interacts with environmental agencies in a positive way during the design, implementation, and operation of code of practice programs, the BMPs in these programs, if proven effective, may serve as the basis for future regulations. This has certainly been the case with other types of animal production.

Codes of practice can also provide marketing advantages. Many importers would prefer to purchase shrimp that are produced by environmentally responsible methods; some might even pay a higher price for such shrimp. Codes of practice also would be necessary for any party interested in marketing shrimp that are certified to have been produced in a responsible way.

Aquaculture Codes and Social Issues

Controversy has grown over problems associated with shrimp aquaculture in shrimp-producing and importing countries, as well as in numerous international fora. Public opinion is being influenced by highly publicized concerns over environmental and social impacts of shrimp aquaculture development, food safety of shrimp products, and, more generally, over the long-term sustainability of shrimp aquaculture (Anonymous 1998). Governments, the private sector, international NGOs, and even local community groups are advocating more responsible shrimp farming practices to ensure environmentally and socially acceptable development. Increasingly, there is a perceived need to protect not only the environment but also local communities in coastal areas.

Most would agree that the development of voluntary codes requires the active input of those who would be affected by them (Anonymous 1998). According to the draft Malaysian code, “Constructive advice and input can be obtained and should be sought from these interested parties, which may, for example, include technical experts from institutions such as universities and research institutes, and representatives of local communities and non-governmental organizations” (Anonymous 1998). In fact, one of the most effective ways to develop codes of practice is through collaborative efforts involving the private sector, government authorities, and other interested parties.

The draft Malaysian code has a number of specific environmental objectives, many with direct social implications. These objectives include: minimizing clearing of pristine vegetation and wildlife habitat, minimizing impacts on mangroves or other aquatic ecosystems, minimizing the production and discharge of nutrients, preventing the deterioration of groundwater, avoiding nuisance levels of noise and odor, and disposing of pond sediments in ways that do not harm the environment. In addition, producers are encouraged to take into account neighboring land uses when siting their operations, and they should not block access to marine or estuarine waters.

While the Malaysian draft code specifies a number of important issues and principles, it does not specifically address when or how other interest groups are to be brought to the table. Consequently, after suggesting that the entire reason for having a code is to address environmental and social concerns and after discussing the need for involving different stakeholders, the draft disappoints by making no provision for doing so.

Similarly, the Belize Code suggests that "the shrimp farming industry in Belize has managed to prevent many of the environmental and social impacts experienced elsewhere in Central America" (p. 3). However, the document only suggests positive action in this area, stating that participants of the Belize shrimp aquaculture industry "are encouraged to . . . comply with all legislation and license conditions" and to "consider potential adverse environmental impacts of new projects at the planning stage."

The Belize Code also suggests that the precautionary principle should be adopted only as confidence with an activity increases and that transitions should be made to require the use of best available technology only when it does not entail excessive costs. This final phase is even given the acronym BATNEEC. However, in reality, the precautionary principle is not about being cautious in adopting better technologies, but rather stipulates caution about undertaking certain activities at all without having a reasonable amount of information about whether their impacts would be acceptable or not.

The Belize code also suggests that all reasonable and practical measures must be adopted to rehabilitate shrimp farm production sites that have been shut down, with the goal that no impacts to the environment result from further development of the site. If impacts have resulted from the activity, then rehabilitation should be required to redress those impacts. There are, of course, issues of whether the sites exist on private or public land. What can be required may vary by location.

None of the codes reviewed from industry or government address social issues directly, in a proactive way. This is odd, because many of their introductions suggest that social impact and issues are one of the main reasons for developing codes of practice. The title of the Irish Salmon Growers Association's code, "Good Farmers, Good Neighbors," acknowledges directly that social issues are important. In the introduction (point 5), the same code suggests that the industry should be concerned about "any likely significant effects of the project on all other beneficial uses of the sea and environs (scenic aspects)."

More often than not, however, the codes try to prevent problems for the companies rather than for other stakeholders in the area. For example, the Irish code suggests that companies should "comply with any conditions required by the insurance companies, to ensure that any claims for death, loss or injury are speedily and fully settled." The Belize code recommends that complete and precise hydrological data be reviewed prior to any freshwater abstraction. It goes further to suggest that shrimp aquaculture sites should not be considered in urban areas, or next to large agriculture sites or manufacturing industries. 0Industrial, residential, and agricultural runoff can contain pollutants that are harmful to cultured shrimp. In short, the code is aimed at protecting the producers from other resource users rather than the other way around. Clearly, protection is an important issue, but surely it is not a one-way street.

In fact, a point of particular interest is that the Belize Code stipulates, “archeological sites containing Maya mounds, caves, and artifacts should not be considered for pond production sites” (p. 6). It is curious that the code’s drafters should be more concerned about protecting the remains of a culture that has been gone for 1,000 years rather than about the people who still live in the region.

Many of the codes suggest that aquaculturists' main social concern is what other resource users could do to them. The British Trout Association Code, for instance, suggests “farmers should make themselves aware of the location and nature of other water users and dischargers upstream.” It continues, “Under normal circumstances no new farm should be sited close to an existing farm.” There are no references to what the trout farmers should do to reduce their own social impacts. The one reference to social issues is that farms may present risks to workers, and therefore farmers should obey all laws. In particular, workers should be informed of risks of contracting Leptospirosis (Weil’s Disease), but there is no mention of what might be done to prevent the disease.

The Industrial Shrimp Action Network's Draft Guidelines for Shrimp Aquaculture

The Industrial Shrimp Action Network (ISANet) is a global network of organizations and individuals who are deeply troubled by the environmental and socioeconomic costs of industrial shrimp aquaculture. In December 1998, ISANet issued draft guidelines for sustainable shrimp aquaculture that offer several interesting contrasts to the codes outlined above. These guidelines represent a work in progress rather than a consensus. They were drafted by Rebecca Goldburg of the Environmental Defense Fund and Jason Clay of World Wildlife Fund-US.

In this review, discussions of the ISANet guidelines focus on those addressing social impacts. The ISANet guidelines are divided into four parts—shrimp farm construction and management, government regulation and oversight, protection of human rights, and international actions. The sections on shrimp farm construction and management are either largely derived from or reflected in the writings of Claude Boyd and have been incorporated into many of the codes. Several points in ISANet's guidelines, however, expand upon the environmental points made in other codes as well. The main environmental points that deserve attention include:

- EIAs should provide data collected from both outside and inside ponds, and they should provide sufficient data to monitor the individual and collective impacts of the industry.
- There should be no net conversion of critical coastal ecosystems.
- Shrimp production facilities should not divert essential water flows from critical ecosystems.
- Ponds should be sited so that communities continue to have access to fishing grounds, mangroves, fresh water, and other critical resources that they depend upon for survival.
- The use of exotic species should be prohibited in tidal areas and other areas prone to flooding.
- Areas appropriate for development should be zoned. Criteria that should be used include acidity, and organic and clay content of the soils.
- Fresh water should not be used in shrimp aquaculture ponds.
- Layout and construction of the operation should avoid mixing of influent and effluent.
- Layout should include settling ponds or canals and/or natural or artificial wetlands to treat effluents.
- Water exchange should be undertaken only when necessary rather than on a routine basis.
- Discharge should be of equal or better quality than the intake water.
- No effluent should be discharged into freshwater systems.

The ISANet Guidelines also delineate the government's role in developing and supporting producer codes. Examples include:

- All decision making regarding such processes as leases and rentals of public land or licensing and permits should be transparent.
- The government should insure that local stakeholders receive appropriate consideration, especially regarding such issues as communal resources: food, fresh water, employment, and access to resources.
- The precautionary principle should be applied to policies and regulations concerning shrimp aquaculture.
- The government, and the industry when government does not fulfill its role, should work together on coastal zone management.
- Governments should establish and rigorously enforce a clear legal framework for regulation of shrimp aquaculture's environmental and public health impacts.
- Permits, licenses, or other types of authorizations should be contingent on ongoing monitoring and satisfactory performance.
- Governments should fund research and extension activities with the goal of fostering only sustainable aquaculture; especially those focused on implementing sustainable shrimp production practices on farms.
- Regulations should encourage rehabilitation of degraded or abandoned shrimp ponds.
- Government should consider "polluter pays" instruments and performance bonds to encourage sustainable shrimp aquaculture.

Finally, the ISANet guidelines suggest that several basic human rights should be supported by industry. These include:

- The human rights, including resource rights, of local populations should be respected in accordance with all relevant national laws and international treaties. In particular, agricultural lands to be converted to shrimp aquaculture should not be acquired by coercion. The terms of all leases should be respected.
- Alleged human rights violations resulting from shrimp aquaculture should be investigated by competent, duly authorized authorities and proceed in accordance with the laws of the country in question, as well as in compliance with the international treaties and agreements to which the country is a party.
- Governments should create transparent guidelines and mechanisms that are acceptable to all stakeholders to resolve conflicts arising from the use of resources held in common or to which there are competing claims.

Finally, the ISANet guidelines suggest that national and international institutions should support only those shrimp aquaculture projects that are made consistent with these sustainability criteria.

Strengths and Weaknesses of Codes of Conduct

The strengths and weaknesses of selected codes of conduct for aquaculture and codes of conduct in general were discussed above. A summary of the main points is provided below.

Strengths

The benefits of codes of conduct are as follows:

- Valuable discussions among stakeholders can occur during the formation of codes of conduct.
- The BMPs in codes of conduct can make shrimp aquaculture more environmentally and socially responsible.
- Codes of conduct can make shrimp aquaculture more efficient, sustainable, and profitable.
- Codes of conduct provide an excellent means of technology transfer to producers.
- Positive interactions with environmental agencies and other governmental agencies could result from the efforts to form and operate codes of practice programs.
- The BMPs in codes of conduct could provide the basis for future environmental regulations.
- Codes of conduct can provide marketing advantages.

The extent of the benefits that accrue from the successful implementation of codes of conduct will depend upon several factors. Perhaps the most important factor is the involvement of all stakeholders. In addition, successful codes will depend on using the best available scientific knowledge in preparing BMPs, promoting the program through education of farmers, insisting on both self-evaluation and third-party verification, informing the public of the program, and maintaining a commitment to continuous improvement. It will not be easy to develop an effective code of conduct program with measurable environmental and social benefits, but we are optimistic that this goal can be achieved.

Weaknesses

The main disadvantages of codes of practice are summarized below:

- Adoption is voluntary, so some producers may not follow codes of conduct despite promotional efforts.
- Producers who adopt a code of conduct may selectively adopt BMPs and avoid those that are expensive or difficult to implement.
- There are many obstacles to effective self-evaluation and third-party verification.
- Producers, especially small producers, may lack technical knowledge for using BMPs, and education and training will be difficult and expensive.
- Implementation of programs could be slow and result in substantial costs to farmers.
- Effectiveness of BMPs in codes of conduct is assumed, but monitoring is needed to verify this assumption.
- Unless all stakeholders are involved in preparing codes of conduct, the BMPs may not address significant issues. This is especially true for social issues.

It should be possible to eliminate most of the potential weaknesses from a code of conduct if the parties developing the code are objective and willing to consider all issues fairly.

Comparison of Existing Codes

The environmental issues in shrimp aquaculture are relatively clear, and the negative impacts of the industry have been written about extensively. The individuals who have drafted or reviewed the codes of conduct for shrimp aquaculture were generally aware of this literature. The Australian code of conduct was prepared by revising several drafts based on comments from a variety of stakeholders. One of the authors of the present report (Claude E. Boyd) provided advice to the Australian effort. Dixon appears to have taken into account an early draft of the Australian code in preparing the code for Belize. When Boyd prepared the initial draft of the GAA Codes of Practice for review by GAA, he adopted material from the

first and second drafts of the Australian code and from the Belize code. Boyd also prepared the initial draft of the University of Rhode Island code, using the codes from Australia and Belize and the GAA Codes of Practice for reference. Of course, the University of Rhode Island code was heavily reviewed by several others as well. Boyd also prepared a report on management practices that could be used to lessen negative environmental impacts of shrimp aquaculture in Thailand. The Thailand Department of Fisheries and the BTG-Golder Company used this report in meetings with shrimp producers to prepare the Thailand Marine Shrimp Farming Code of Conduct, written in Thai and English.

The codes of conduct for Australia, Belize, and Thailand have much in common. The main differences among these codes are in the amount of detail and focus. The Australian code is designed to address the issues of intensive shrimp aquaculture in a country where shrimp aquaculture is already subject to extensive governmental regulations. The main purpose of the Australian code is apparently to help shrimp producers comply with regulations. By contrast, the Belize code was formulated for extensive shrimp aquaculture, and it is very general. The GAA codes are also quite general because they were intended to provide guidelines for either county or site-specific codes of practice. The GAA codes served as a model for the Thailand code, but the Thailand code contains fewer practices and somewhat less detail. The Thailand code also focuses on intensive shrimp farming in aerated ponds with little water exchange. It is not clear who drafted the Malaysian code, but it is similar to the Thailand code regarding management practices (with even less detail). The University of Rhode Island document on good management practices was developed primarily for Honduran shrimp producers using low intensity methods in large ponds. There is a greater degree of detail on practical application of good management practices in the University of Rhode Island document than in other codes.

Organizations in several other countries are formulating codes now in various stages of completion and have the codes mentioned in this report at their disposal. Thus, new codes are not likely to differ significantly from those reviewed above.

We have ranked these different codes of conduct on various measures, including how far they appear to move the industry toward providing environmental and social benefits procedures and the strength of their plans for implementation and evaluation (Annex 5).

Implementation

Suggestions for Enhancing Adoption

Codes of conduct are “living” documents that are subject to change as implementation proceeds. The various stakeholders each have a role to play in implementing codes of conduct. As codes are largely voluntary, producer associations organized around a common water body or across a country must take a lead role in code implementation. Leaders of such organizations should assume responsibility for ensuring that association members abide by the codified BMPs. The leaders should solicit the assistance of government-supported extension services, private consultants, and independent third parties to assist with the development of informational and verification programs.

Importers and distributors of shrimp can serve an important role by giving preference to shrimp produced according to third party-verified codes of conduct. Transparent codes and third-party certification will be essential if producers expect to earn a premium for their shrimp in the marketplace. However, creating and reinforcing consumer demand for shrimp produced according to codes can be a powerful force for encouraging producers to adopt BMPs. Independent third parties can provide important input regarding progress of BMP implementation, ecosystem and local community impacts, and possibly monitoring and facility inspection as well.

The problem of extending BMPs to the large number of small producers in Asia and other places was alluded to earlier and presents a formidable challenge to those seeking to change on-the-ground shrimp aquaculture practices. One useful approach may be to identify and utilize innovative "master producers" or "change agents" as a conduit for information to assist in the extension of BMPs to nearby small producers.

Government has a critical role to play by providing resources for BMP demonstration projects, credit for conversion programs, extension personnel and programs, and monitoring and verification. Ultimately, governments will establish and enforce regulatory standards, most likely based on BMPs outlined within codes of conduct.

Status of Existing Codes

There is no evidence of widespread adoption of codes of practice. Claude Boyd often visits shrimp producers to observe their operations and has frequent communication with them. He has noted implementation of certain practices found in codes on many farms. For example, several GAA-member farms appear to be following most of the practices suggested by GAA. The GAA has a member self-evaluation form that has been completed by most members, but the organization recognizes the importance of a more formal approach to implementation of its codes. A committee of the GAA is currently preparing an implementation plan that will contain standards, selected mandatory BMPs, and record keeping requirements. It will require self-evaluation, preparation of a compliance plan, GAA inspection, and third-party inspection.

In Thailand, the Department of Fisheries has been funded by NACA to do a case study of a few farms in the Rayong and Songkhla areas where shrimp producers were willing to implement the management practices of the Thailand Code of Conduct. The Department of Fisheries hopes to use the results of this study as a means of encouraging more farmers to adopt the code. There also is interest in the possibility of certifying shrimp produced by methods in the Thailand Code of Conduct.

There apparently has been little effort to implement the shrimp aquaculture codes of conduct in other countries.

Conclusions

The existing codes of conduct are good as far as they go, but each of them has flaws. The GAA program may be the most promising because the group has already discovered the need to bring in outside parties. However, to date, the GAA has still not invited many other stakeholders to vet their codes. Many stakeholders will have several suggestions about the social aspects of the GAA codes, which are extremely weak, as well as about some of the environmental codes and BMPs. In general, transparency requires that codes be vetted by all stakeholders before they are finalized. In the case of the GAA, it is not clear that its codes will be accepted by other stakeholders after the fact. The GAA and Thai codes give some, if inadequate, consideration to social issues, but most others do not. None of the codes, except Australia, were developed with the involvement of other stakeholders, however, particularly those groups and individuals outside the industry who are likely to be affected most by shrimp production.

In spite of the many problems and limitations associated with the voluntary adoption of codes of conduct and their implementation in a meaningful way, codes of conduct for shrimp aquaculture should be encouraged. They will not be perfect, and they cannot be expected to solve all of the environmental and social problems that can arise from the operation of shrimp aquaculture facilities. However, codes of conduct can enhance the environmental awareness of producers and, we hope, result in more responsible management. In many countries, it will be years before aquaculture will be effectively and efficiently regulated by environmental and social legislation. In the absence of effective regulation, codes appear to

offer one of the best possibilities for improving the environmental and social performance of shrimp aquaculture.

References

Anonymous. 1998. Working paper for discussions on a code of practice for Malaysian shrimp farmers. National workshop, Department of Fisheries of Malaysia, Kuala Lumpur.

Arthur, J.R., C.R. Lavilla-Pitogo and R.P. Subasinghe. 1996. *Use of Chemicals in Aquaculture in Asia*. Proceedings of the Meeting on the Use of Chemicals in Aquaculture in Asia 20-22 May 1996, Tigbauan, Iloilo, Phillipines held by SEAFDEC. 233 p.

Australian Aquaculture Forum. Undated. *Codes of Conduct for Australian Aquaculture*. AAF, Curtin, CT, Australia.

Boyd, C.E. 1996. Shrimp Farming and the Environment– a white paper. National Shrimp Council, National Fisheries Institute, Arlington, Virginia, USA.

Boyd, C.E. 1999. *Codes of Practice for Responsible Shrimp Farming*. Global Aquaculture Alliance, St. Louis, Missouri, USA.

Boyd, C.E. 2002."Chemical and Biological Amendments Used in Shrimp Farming ". Report prepared under the World Bank, NACA, WWF and FAO Consortium Program on Shrimp Farming and the Environment. Work in Progress for Public Discussion. Published by the Consortium. 22 p.

Boyd, C.E. and J.W. Clay. 1998. Shrimp aquaculture and the environment. *Scientific American* 278 (June): 58–65.

Boyd, C.E. and J.W. Clay 2002. *Evaluation of Belize Aquaculture, Ltd: A Superintensive Shrimp Aquaculture System*. Report prepared under the World Bank, NACA, WWF and FAO Consortium Program on Shrimp Farming and the Environment. Work in Progress for Public Discussion. Published by the Consortium. 16 p.

Boyd, C.E. and L. Massaut. 1999. Risks associated with the use of chemicals in pond aquaculture. *Aquacultural Engineering* 20:113–132.

Boyd, C.E. and M.C. Haws. 1999. Good management practices (GMPs) to reduce environmental impacts and improve efficiency of shrimp aquaculture in Latin America, pages 9–33. In B.W. Green, H. C. Clifford III, M. McNamara, and G. M. Moctezuma (eds), *Simposio 5 Centroamericano de Acuacultura*, San Pedro Sula, Honduras.

British Trout Association. 1995. *Code of Practice for the Production of Rainbow Trout*. British Trout Association Limited, 8/9 Lambton Place, London.

Brunson, M. 1997. *Catfish Quality Assurance*. Mississippi Cooperative Extension Service, Publication 1873, Mississippi State University, Mississippi State, Mississippi, USA.

BTG-Golder Company. 1999. The Marine Shrimp Culture Industry of Thailand Code of Conduct (Report submitted to the World Bank). BTG-Golder Company, North Park, Laksi, Bangkok.

Chemical Manufacturers Association. 1996. *The Year in Review 1995–1996. Responsible Care® Progress Report*. Chemical Manufacturers Association, Arlington, Virginia, USA.

Clay, J.W. 1997. Toward sustainable shrimp aquaculture. *World Aquaculture 28*:32–37.

Dixon, H. 1997. *Environmental Code of Practice for the Shrimp Farming Industry of Belize*. Report to the Shrimp Farming Industry of Belize.

Donovan, D.J. 1998. *Environmental Code of Practice for Australian Prawn Farmers*. Pacific Aquaculture and Environment, The Gap, Queensland, Australia.
Available on http://www.apfa.com.au/prawnfarmers.cfm?inc=environment

FAO. 1995. *Code of Conduct for Responsible Fisheries.* Food and Agriculture Organization of the United Nations (FAO), Rome. Available on http://www.fao.org

FAO. 1997. *Aquaculture Development*. FAO Technical Guidelines for Responsible Fisheries 5, Food and Agriculture Organization of the United Nations (FAO), Rome.

FAO. 2001. Technical Guidelines for Good Aquaculture Feed Manufacturing Practice *FAO Technical Guidelines for Responsible Fisheries*. Food and Agriculture Organization of the United Nations (FAO), Rome.

FAO/Government of Australia. 2001. Report of the FAO/Government Australia Expert Consultation on Good Management Practices and Good Legal and Institutional Arrangements for Sustainable Shrimp Culture. Queensland Department of Primary Industries, Brisbane, Australia, 4- 7 December 2000. *FAO Fisheries Report No 659 FAO*. 2001. 76 p.

FAO/NACA. 2000. Asia regional technical guidelines on health management for the responsible movement of live aquatic animals and the Beijing consensus and implementation strategy. *FAO Fisheries Technical Paper 402*, Rome. 53 p.

Federal Joint Subcommittee on Aquaculture. 1994. *Guide to Drug, Vaccine, and Pesticide Use in Aquaculture.* Texas Aquacultural Extension Service, Texas A&M University, College Station, Texas, USA.

Folke, A. and N. Kautsky. 1989. The role of ecosystems for sustainable development of aquaculture. *Ambio 18*:234–243.

Gautier, D. 2002. *The Adoption of Good Management Practices by the Shrimp Industry on the Caribbean Coast of Colombia*. Report prepared under the World Bank, NACA, WWF and FAO Consortium Program on Shrimp Farming and the Environment. Work in Progress for Public Discussion. Published by the Consortium. 62 p.

Goldburg, R. and J.W. Clay. 1998. *Draft Guidelines for Sustainable Shrimp Aquaculture*. The Industrial Shrimp Action Network.

Hairston, J.E., S. Kown, J. Meetze, E.L. Norton, P.L. Dakes, V. Payne and K.M. Rogers. 1995. *Protecting Water Quality on Alabama Farms*. Alabama Soil and Water Conservation Committee, Montgomery, Alabama, USA.

Hilbrands, A. Undated. *Organic Aquaculture and Fisheries, Ensuring Aquaculture and Fisheries Sustainability Through an Organic Approach –The Shrimp Case*. Agro Eco Consultancy, Bennekom, The Netherlands.

Hopkins, J.S., P.A. Sandifer, M.R. DeVoe, A.F. Holland, C.L. Browdy and A.D. Stokes. 1995. Environmental impacts of shrimp farming with special reference to the situation in the continental United States. *Estuaries* 18:25–42.

International Council for Exploration of the Seas (ICES). 1984. *Guidelines for Implementing the ICES Code of Practice Concerning Introductions and Transfers of Marine Species.* ICES Cooperative Research Report 164, Copenhagen.

International Organization for Standardization. 1995. *Environmental Management Systems–Specification with Guidance for Use.* International Standards Organization, Geneva, Switzerland.

Irish Salmon Growers Association. 1991. *Good farmers, good neighbors*. Irish Salmon Growers Association Limited, Dublin.

Ornamental Fish Industry. Undated. *Ornamental Fish Industry (UK) Code of Conduct*. Ornamental Fish Industry, London.

Wood, C. 1995. *Environmental Impact Assessment: A Comparative Review*. Longman Scientific and Technical, Essex, United Kingdom.

Annex 1

Guiding principles of the Chemical Manufacturers Association Responsible Care® Program.

- To recognized and respond to community concerns about chemicals and our operations.
- To develop and produce chemicals that can be manufactured, transported, used, and disposed of safely.
- To make health, safety, and environmental considerations a priority in our planning for all existing and new products and processes.
- To report promptly to officials, employees, customers, and public information on chemical-related health or environmental hazards and to recommend protective measures.
- To counsel customers on the safe use, transportation, and disposal of chemical products.
- To operate our plants and facilities in a manner that protects the environment and health and safety of our employees and the public.
- To extend knowledge by conducting or supporting research on the health, safety, and environmental effects of our processes and waste materials.
- To work with others to resolve problem created by past handling and disposal of hazardous substances.
- To participate with government and others in creating responsible laws, regulations, and standards to safeguard the community, workplace, and environment.
- To promote the principles and practices of Responsible Care® by sharing experiences and offering assistance to others who produce, handle, use transport, or dispose of chemicals.

Annex 2

The FAO Code of Conduct for Responsible Fisheries (Article 9) (FAO. 1995. at http://www.fao.org/fi/agreem/)

9 - AQUACULTURE DEVELOPMENT

9.1 Responsible development of aquaculture, including culture-based fisheries, in areas under national jurisdiction

9.1.1 States should establish, maintain and develop an appropriate legal and administrative framework, which facilitates the development of responsible aquaculture.

9.1.2 States should promote responsible development and management of aquaculture, including an advance evaluation of the effects of aquaculture development on genetic diversity and ecosystem integrity, based on the best available scientific information.

9.1.3 States should produce and regularly update aquaculture development strategies and plans, as required, to ensure that aquaculture development is ecologically sustainable and to allow the rational use of resources shared by aquaculture and other activities.

9.1.4 States should ensure that the livelihoods of local communities, and their access to fishing grounds, are not negatively affected by aquaculture developments.

9.1.5 States should establish effective procedures specific to aquaculture to undertake appropriate environmental assessment and monitoring with the aim of minimizing adverse ecological changes and related economic and social consequences resulting from water extraction, land use, discharge of effluents, use of drugs and chemicals, and other aquaculture activities.

9.2 Responsible development of aquaculture including culture-based fisheries within transboundary aquatic ecosystems

9.2.1 States should protect transboundary aquatic ecosystems by supporting responsible aquaculture practices within their national jurisdiction and by cooperation in the promotion of sustainable aquaculture practices.

9.2.2 States should, with due respect to their neighbouring States, and in accordance with international law, ensure responsible choice of species, siting and management of aquaculture activities which could affect transboundary aquatic ecosystems.

9.2.3 States should consult with their neighbouring States, as appropriate, before introducing non-indigenous species into transboundary aquatic ecosystems.

9.2.4 States should establish appropriate mechanisms, such as databases and information networks to collect, share and disseminate data related to their aquaculture activities to facilitate cooperation on planning for aquaculture development at the national, subregional, regional and global level.

9.2.5 States should cooperate in the development of appropriate mechanisms, when required, to monitor the impacts of inputs used in aquaculture.

9.3 Use of aquatic genetic resources for the purposes of aquaculture including culture-based fisheries

9.3.1 States should conserve genetic diversity and maintain integrity of aquatic communities and ecosystems by appropriate management. In particular, efforts should be undertaken to minimize the harmful effects of introducing non-native species or genetically altered stocks used for aquaculture including culture-based fisheries into waters, especially where there is a significant potential for the spread of such non-native species or genetically altered stocks into waters under the jurisdiction of other States as well as waters under the jurisdiction of the State of origin. States should, whenever possible, promote steps to minimize adverse genetic, disease and other effects of escaped farmed fish on wild stocks.

9.3.2 States should cooperate in the elaboration, adoption and implementation of international codes of practice and procedures for introductions and transfers of aquatic organisms.

9.3.3 States should, in order to minimize risks of disease transfer and other adverse effects on wild and cultured stocks, encourage adoption of appropriate practices in the genetic improvement of broodstocks, the introduction of non-native species, and in the production, sale and transport of eggs, larvae or fry, broodstock or other live materials. States should facilitate the preparation and implementation of appropriate national codes of practice and procedures to this effect.

9.3.4 States should promote the use of appropriate procedures for the selection of broodstock and the production of eggs, larvae and fry.

9.3.5 States should, where appropriate, promote research and, when feasible, the development of culture techniques for endangered species to protect, rehabilitate and enhance their stocks, taking into account the critical need to conserve genetic diversity of endangered species.

9.4 Responsible aquaculture at the production level

9.4.1 States should promote responsible aquaculture practices in support of rural communities, producer organizations and fish farmers.

9.4.2 States should promote active participation of fishfarmers and their communities in the development of responsible aquaculture management practices.

9.4.3 States should promote efforts which improve selection and use of appropriate feeds, feed additives and fertilizers, including manures.

9.4.4 States should promote effective farm and fish health management practices favouring hygienic measures and vaccines. Safe, effective and minimal use of therapeutants, hormones and drugs, antibiotics and other disease control chemicals should be ensured.

9.4.5 States should regulate the use of chemical inputs in aquaculture, which are hazardous to human health and the environment.

9.4.6 States should require that the disposal of wastes such as offal, sludge, dead or diseased fish, excess veterinary drugs and other hazardous chemical inputs does not constitute a hazard to human health and the environment.

9.4.7 States should ensure the food safety of aquaculture products and promote efforts which maintain product quality and improve their value through particular care before and during harvesting and on-site processing and in storage and transport of the products.

Annex 3

Summary of the International Organization of Standardization (ISO) Environmental Management System Requirements

1. Environmental policy shall be defined by management.

2. Planning
   - 2.1 Environmental aspects of activities will be defined.
   - 2.2 Legal requirements will be identified.
   - 2.3 Objectives and targets will be established.
   - 2.4 An environment management program will be established and maintained.

3. Implementation and Operation
   - 3.1 Roles, responsibilities, and authorities will be defined.
   - 3.2 Training needs will be identified and all personnel whose work may effect the environment must have appropriate training.
   - 3.3 Procedures for internal communications and communications with external parties related to environmental issues must be established.
   - 3.4 The environmental management system must be documented.
   - 3.5 A system of document control related to environmental management must be established.
   - 3.6 Procedures must be established and documented to assure that operations are in line with environmental policy, objectives, and targets.
   - 3.7 Emergency preparedness plans must be available to respond to accidents and other emergency situations so that environmental impacts can be avoided or mitigated.

4. Checking and Corrective Action
   - 4.1 The company will establish procedures to monitor all operations that can impact the environment.
   - 4.2 Procedures must be available for investigating and correcting non-conformance.
   - 4.3 A system of record keeping must be maintained on all aspects of the environmental management program.
   - 4.4 An environment audit system will be designed and carried out.
   - 4.5 Management will review the environmental management system at intervals.

Annex 4

Elements of the Code of Practice of the Australian Prawn Farmers Association

Introduction
Ecologically Sustainable Development
Industry Commitment and Environmental Policy
Industry Description
Expected Environmental Outcomes
Potential Environment Impacts
Appropriate Management Practices
Environmental Monitoring
Environmental Complaints
Environmental Records and Auditing
Site Rehabilitation
Code of Practice Review
Consultation
Relevant Environmental Legislation
Definitions

Source: Donovan 1998.at http://www.apfa.com.au/prawnfarmers.cfm?inc=environment

Annex 5

Rating of Codes of Conduct

	Australia	Belize	GAA[1]	Thailand	Malaysia	URI[2]
Coverage of issues:						
Production methods	3	2	3	2	1	3
Environment	3	3	3	2	1	3
Socioeconomic effects	0	2	0	1	0	1
Involvement of stakeholders	3	1	1	1	Unclear	2
Appropriateness of BMPs	3	2	3	2	1	3
Detail of BMPs	2	1	2	1	1	2
Discussion of program's purpose	2	2	3	1	0	2
Plans for implementation	Unclear	Unclear	3	2	Unclear	1
Self-evaluation procedures	0	0	2	2	0	2

[1]GAA = Global Aquaculture Alliance
[2]URI = University of Rhode Island

Note: Ratings are based on authors' opinions. The organic code of conduct was not rated. The higher the number (0 to 3), the more positive our rating.

The World Bank - Netherlands Partnership Program

The World Bank
1818 H Street, NW
Washington D.C. 20433-1234, USA
Telephone : 202-477-1234
Facsimile : 202-477-6391
Telex : MCI 64145 WORLDBANK
MCI 248423 WORLDBANK
Web page : www.worldbank.org
E-mail : rzweig@worldbank.org

Network of Aquaculture Centres in Asia-Pacific (NACA)

Department of Fisheries
Kasetsart University Campus
Ladyao, Jatujak,
Bangkok 10900, Thailand
Web page : www.enaca.org
E-mail : shrimp@enaca.org

World Wildlife Fund (WWF)

1250 24th Street, NW
Washington D.C. 20037, USA
Web page : www.worldwildlife.org
E-mail : shrimp.aquaculture@wwfus.org

Food and Agriculture Organization of the United Nations (FAO)

Viale delle Terme di Carracalla
Rome 00100, Italy
Web page : www.fao.org
E-mail : FI-Inquiries@fao.org

recycled paper

homeoffice@
gaalliance.org

Mission
Principles
Codes Of Practice
Aqua-Issues
Magazine
Join GAA

Responsible Aquaculture Program
Calendar
Activities
Founding Members
Affiliates
Site Map

Home Page
Contact Us

Principles

The **Global Aquaculture Alliance** exists both to promote the aquaculture industry and to advance environmental and social responsibility throughout the process of raising, processing and distributing aquaculture products. GAA expects its members and affiliates to adhere to the basic tenets contained in the following.

GUIDING PRINCIPLES FOR RESPONSIBLE AQUACULTURE

As presented in the GAA publication "Codes of Practice for Responsible Aquaculture," companies and individuals engaged in aquaculture, singularly and collectively:

1. Shall coordinate and collaborate with national, regional, and local governments in the development and implementation of policies, regulations, and procedures necessary and practicable to achieve environmental, economic, and social sustainability of aquaculture operations.
2. Shall utilize only those sites for aquaculture facilities whose characteristics are compatible with long-term sustainable operation with acceptable ecological effects, particularly avoiding unnecessary destruction of mangroves and other environmentally significant flora and fauna.
3. Shall design and operate aquaculture facilities in a manner that conserves water resources, including underground sources of fresh water.
4. Shall design and operate aquaculture facilities in a manner that minimizes effects of effluent on surface and ground water quality and sustains ecological diversity.
5. Shall strive for continuing improvements in feed use and shall use therapeutic agents judiciously in accordance with appropriate regulations and only when needed based on common sense and best scientific judgment.
6. Shall take all reasonable measures necessary to avoid disease outbreak among culture species, between local farm sites, and across geographic areas.
7. Shall take all reasonable steps to ascertain that permissible introductions of exotic species are done in a responsible and acceptable manner and in accordance with appropriate regulations.
8. Shall cooperate with others in the industry in research and technological and educational activities intended to improve the environmental compatibility of aquaculture.
9. Shall strive to benefit local economies and community life through diversification of the local economy, promotion of employment, contributions to the tax base and infrastructure, and respect for artisanal fisheries, forestry, and agriculture.

Feeding the World Through Responsible Aquaculture
5661 Telegraph Road, Suite 3A -- St. Louis, Missouri 63129 USA
Telephone: 314-293-5500 -- Fax: 314-293-5525 -- E-mail: **homeoffice@gaalliance.org**