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Greening the Blue Revolution:

A Natural Assets Perspective

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Greening the Blue Revolution:

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Introduction

Aquaculture refers to the cultivation of both aquatic plant and animal species. This paper examines recent trends in the extraordinary expansion of aquaculture from a natural assets perspective. It attempts to evaluate the extent to which current trends in aquaculture development can contribute to the major objectives of natural asset building: poverty reduction, environmental protection, and social justice. It begins with a summary overview of patterns in the recent expansion of aquaculture production worldwide. Especially important is the relationship of aquaculture production to 'capture fisheries' and to the livelihood strategies of the poor in locales where aquaculture is growing. Important as well is the complex relationship between the livelihood strategies of the poor and their food security – especially because aquaculture often is promoted as a means of enhancing food security as well as a good measure of human well-being. The paper then goes on to describe the risks and benefits associated with current trends in aquaculture development in terms of an assets framework that includes not only natural assets but social and human assets as well. Next the paper makes some preliminary suggestions about ways to enhance the assets of the poor through the four strategies of investment, redistribution, internalization, and appropriation. Finally, the paper discusses opportunities and obstacles for academic-activist/non-governmental organization (NGO) collaborations in natural asset building. Particularly important is the potential for innovative strategies to promote alternative, more equitable, and socially-just visions of development as envisioned and being carried out in Asia, Latin America, and Africa by grass-roots groups, NGOs, and others. Of special interest here is the feasibility and potential for networking among these groups as a strategy for enhancing natural, social, and human assets of the poor.

The main arguments of this paper are the following:

- In many cases, aquaculture development makes a significant contribution to foreign exchange earnings.
- However, the prevailing models of aquaculture threaten to undermine rural livelihoods and food security, and to degrade aquatic and terrestrial environments in the name of development.
- Even the FAO admits that to date, aquaculture development has done little to improve the lives of the poor in areas where it has been expanded.
- Low income communities are organizing to fight this threat and to advance alternative strategies for fisheries/aquaculture development that simultaneously protects the environment and reduces poverty.
- Others (e.g., donors, NGOs, governments, academics, foundations, consumers, etc.) can support them in their struggle.

Recent Trends in Aquacultural Production

Aquaculture is simultaneously hailed and justified as the 'Blue Revolution', the answer to the global decline in capture fisheries and the means to contribute needed protein to a growing human population. Indeed, according to the FAO, global production of cultured fish and shellfish more than doubled in weight and value between 1987 and 1999, from 15.5 million metric tons to 36 million metric tons and from U.S. $ 24.4 billion to US $ 50.4 billion (FAO

2001). While yields from capture fisheries reached a plateau around 1989, yields from aquaculture have steadily increased both in absolute amount as well as in the percentage of total food fish and as the percentage of the global catch. Currently, aquacultural crops account for about 25% of total fish and shellfish consumed directly by humans. Aquaculture's contribution to human food is expected to expand significantly in the future in order to meet growing demand and declines in capture fisheries. The FAO predicts that aquaculture crops may increase to more than 50 percent of the total value of the global food fish catch by 2010 (Stonich and Bailey 2000). Aquaculture is a diverse enterprise, more than 200 species are cultivated using a myriad of production technologies, within an unknown number of institutional contexts. Table 1 summarizes world aquaculture production by species group in 1999. Note that shrimp and salmonids account for only 6% of aquaculture production by weight but 21% by value.

Table 1. World Aquaculture Production by Species Group, 1999.

Species Group	Weight (kilotons)	% of total	Value	% of total
All aquatic organisms	42,771	100	53,563	100
Carps	14,902	35	14,477	27
Tilapias	1,099	3	1,427	3
Salmons, trout	1,392	3	4,568	9
Shrimp, prawns	1,131	3	6,670	12
Oysters	3,712	9	3,430	6
Mussels	1,451	3	525	1
Scallops	952	2	1,351	3
Clams	2,745	6	3,147	6
Brown seaweeds	5,268	12	3,217	6
Red seaweeds	1,782	4	1,354	3

Source: Food and Agriculture Organization of the United Nations, *Aquaculture Production Statistics*. Table B-1, Aquaculture production by species group, pp. 56-57, Rome, 2001.

Table 2 compares aquaculture production by continent in terms of weight and value.

Table 2. Aquaculture Production by Continent, 1998.

Continent	Weight (kiloton)	% of total	Value US$ (millions)	% of total
All aquatic organisms	39,431	100	52,458	100
Africa	189	<1	464	1
America, North	656	2	1,531	3
America, South	670	2	2,360	4
Asia	35,815	91	43,548	83
Europe	1,960	5	4,313	8
Oceania	141	<1	242	<1

Source: Food and Agriculture Organization of the United Nations, *Aquaculture Production Statistics*. Table B-1, Aquaculture production by continent, pp. 56-57, Rome, 2001.

Asia's production accounts for more than 90% of global aquaculture by weight and more than 83% by value, with China alone accounting for more than two-thirds – most for domestic consumption within China. North America, Europe, and Japan together account for less than 10% of aquaculture production but consume most of the seafood that is exported and traded internationally. Outside of China, the growth in aquaculture has been in the production of high value, carnivorous species, especially crustaceans and salmonids. Even in China there has been a significant effort to expand production of these species for export in the world market (Stonich 2001). A few countries dominate production in regions outside Asia usually with the production of one species. Two examples of this are Ecuador with the production of shrimp and Chile with the production of salmonids. These are countries without a history or tradition of aquaculture and in which traditional consumption of seafood is quite low compared to Asia (Stonich 2001).

In many ways this Blue Revolution in aquaculture is analogous to the Green Revolution in agriculture. As the Green Revolution was acclaimed as the means to end world hunger, the Blue Revolution often is hailed as a way to increase incomes and the available supply of affordable food among the poor in the global South. As the Green Revolution was necessary to the establishment of the global agro-food system, the Blue Revolution is an essential part of

integrating many important aquatic species and coastal ecosystems into that same global system. Financially strapped national governments with the assistance of international donor agencies frequently are significant promoters of export-oriented aquacultural development regardless of the social and environmental consequences. Globalization also has been advanced in a number of ways: by augmented vertical and horizontal integration of production that brings together powerful transnational enterprises in the agro-food sector; by an increasing number of multinational joint ventures involving Asian, Latin American, U.S., and European corporations and governments; and by the emergence of a vast network of organizations and corporations that provide services and products (Skladany and Harris 1995; Stonich 1995). Increased globalization has enabled producers to transfer production among countries in the event of unacceptable social conflicts, ecological destruction, epidemic disease outbreaks, or natural disasters.

Despite notable achievements, the rapid expansion of aquacultural production of some species has raised serious concerns regarding their environmental and social costs. In part to address some of environmental and social concerns that have been raised surrounding the expansion of aquacultural activities, numerous discussions and debates surrounding the sustainability of aquaculture have emerged (Stonich and Bailey 2000). Reminiscent of earlier debates surrounding sustainable agriculture, discussions surrounding sustainable aquaculture have tended to emphasize economic and environmental factors, while simultaneously de-emphasizing the sustainability of rural communities, livelihoods, and local food security (Stonich and Bailey 2000).

Farming Shrimp, Harvesting Hunger

The potential of aquaculture to improve the nutrition and incomes of the poor has been impeded by the emphasis on the cultivation of high-value, carnivorous species destined for market in industrial nations. The primary motives are generating high profits for producers and input suppliers and enhancing export earnings for national treasuries. This is particularly true of industrial shrimp farming – the cultivation of shrimp in brackish water ponds along estuaries and other coastal zones.

Not long ago, shrimp were considered a rare and expensive delicacy. Not anymore. Thanks to soaring demand from the U.S., Japan, and Western Europe, shrimp is now raised on an industrial scale in tropical countries. In 2001 shrimp overtook canned tuna as the USA's most popular seafood product according to statistics compiled by the National Marine Fisheries Service (Seafood International 2002). The dramatic growth in the consumption of shrimp has been due to its increasing affordability. The sharp decline in the price of shrimp over the last few decades has been driven by increased production propelled by the lure of farming it for foreign exchange and stiff competition among producers on the coasts of tropical Asia, Latin America, and Africa. Industrial shrimp farming, more generally, is quite distinct from the subsistence, traditional, or artisanal aquaculture that has been practiced for millenia by local people in Asia and elsewhere.

Industrial shrimp aquaculture is an integral part of the Blue Revolution. National governments, and international development and donor agencies, and hundreds of national and multinational

corporations, have promoted the expansion of industrial shrimp farms. They justify their efforts on the grounds that shrimp farming can contribute to the world's food supply by compensating for the decline in capture fisheries, generating significant foreign exchange earnings for poor Third World nations, and enhancing employment opportunities and incomes in poor, coastal communities. The increasing popularity of industrially cultivating marine shrimp began in the early 1970s. Back then, total world production of shrimp, almost all from wild capture fisheries, was around 25,000 metric tons. Today total world production is close to 1,000,000 metric tons, about 30% from shrimp farming from over 50 countries. Recent industry projections estimate that farmed shrimp will account for more than 50% of total global production within the next five years. While approximately 99% of farmed shrimp are raised in developing countries, almost all of it is exported and consumed in rich, industrial countries – the United States, Western Europe, and Japan.

The explosive growth of the industry has generated mounting criticism over its social, economic, and environmental consequences and has provoked the establishment of hundreds of NGOs at the local, national, and international levels. Escalating conflicts between critics and supporters of industrial shrimp farming have transcended local and national arenas. In 1997 these conflicts catalyzed the formation of two major global alliances: The Industrial Shrimp Action Network, which is composed of environmental, peasant-based, and fisher-based NGOs opposed to unsustainable shrimp farming; and a backlash movement, the Global Aquaculture Alliance, which is made up of industry groups created to counter the claims and campaigns of the resistance network.

Trends in the Production and Technology of Industrially Farmed Shrimp

The booming expansion of farmed shrimp has been part of the dramatic increase in global aquaculture production over the last two decades. During this time, the total production of farmed shrimp has grown faster than any other aquacultural commodity worldwide. Asia raises approximately 72% of cultured shrimp while the rest come primarily from Latin America. For several years now, Thailand has been the world's largest producer of cultured shrimp accounting for nearly 30% of global production. Other major Austral/Asian producers include Indonesia, Vietnam, India, Bangladesh, the Philippines, Myanmar, and Australia. In Latin America, the largest producers include Ecuador, Mexico, Honduras, Brazil, Panama, and Belize, with smaller industries in Colombia, Guatemala, Venezuela, Nicaragua, and Peru.

Shrimp farms vary from extensive, through semi-intensive, intensive, to super-intensive technological systems of production. Regardless of the production system employed, the construction and expansion of industrial shrimp farms transform coastal ecosystems in profound ways. Extensive systems, common in countries like Vietnam, Bangladesh, the Philippines, and Indonesia, are carried out in low-lying natural enclosures close to the sea along estuaries and bays, often in seasonal lagoons. Tidal flows into and out of the enclosures provide the stocking of juvenile shrimp, feed, and water exchange. Stocking densities are low and yields can range up to 500 Kilos per hectare. The semi-intensive systems that predominate in Latin America and China generally are located above the high tide line and characterized by larger capital investments, the construction of artificial ponds from 2 to 30 hectares in size, the use of

commercial feeds, and the use of diesel pumps for water exchange. Yields range from 500 to 5,000 kilos per hectare – much greater than with the use of extensive systems. The most capital intensive and technologically sophisticates systems of production are intensive and super-intensive systems. Intensive systems present in Thailand, Taiwan, and some areas of Indonesia, are characterized by smaller individual ponds (0.1 to 1.5 hectares in size), high stocking densities, the use of commercial feeds, pesticides to kill predators, antibiotics to prevent disease infestation, and non-organic fertilizer to boost nutrient supply, the use of diesel pumps for water exchange, more frequent flushing of pond wastes, and aeration. Yields can be quite high – from 5,000 to 20,000 kilos per hectare – but intensive farms are also most prone to crop failures and diseases, and generate a huge amount of pollutants that are flushed out, choking estuaries and other natural ecosystems (Rosenberry 2001).

Semi-intensive and intensive systems function more or less as forms of aquatic feedlots for shrimp and have environmental impacts similar to those associated with the industrial livestock production of cattle, hogs, and poultry. Juvenile shrimp produced in hatcheries or captured in the wild are used as seedstock in the ponds where the water has been fertilized to create an algae bloom. The water is aerated to maintain dissolved oxygen and replaced regularly to prevent the buildup of metabolic wastes. The shrimp are fed formulated, commercial diets made in part from fishmeal so as to produce rapid growth. In the tropics, two or three crops per year are possible in such ponds. The fattened shrimp are then cleaned, deheaded and packed for export either on the farms or in a nearby packing plant for export to the U.S., Japan, and Europe.

Threats to Local Assets: Environmental and Social Concerns Surrounding Industrial Shrimp Farming

Industrial shrimp farming has induced processes of social dislocation, ecological change, and environmental destruction that are arguably worse than from many earlier Green Revolution technologies. Some of the most serious environmental problems include the destruction of mangrove ecosystems and adjacent coastal wetlands, pollution from pond wastes, disruption of hydrological systems, introduction of exotic species, and depletion and salinization of aquifers and agricultural land.

While coastal communities affected by industrial shrimp farming vary considerably socially, culturally, and ecologically, they tend to share a reliance on diversified household economic strategies (livelihood or survival strategies). They are extremely diversified, flexible, dependent on cash remittances, and can shift among resources in response to changing market conditions and resource availability. Most households integrate subsistence and wage activities by combining fishing, small-scale agriculture, gathering wild foods from coastal wetlands, and doing wage work. Mangrove areas are especially important providing fuelwood and charcoal, as well as eggs, mollusks, and crabs. In the past many of these common pool resource areas were accessible to local communities through some type of common property resource management regime.

This tended to be the case even in areas that were officially ‘national’ or ‘government’ lands. Before the advent of industrial shrimp farming, many local communities had *de facto* access to

these common pool resources for many years because such mangrove and coastal areas were perceived as having little or no value to the broader society. This perception changed dramatically however with the coming of industrial shrimp farms and large areas of these government/national common pool resources were leased or sold to shrimp farmers wanting to construct or expand shrimp farms. One of the most critical social problems identified by local peoples as part of expansion of industrial shrimp farming is the loss of these common pool resources – including mangrove areas, estuaries, and fishing grounds – that local people depend on for both subsistence and commercial economic activities. The loss of access to common pool resources and the disruption of community based common property resource management regimes, has significantly altered the economic options available to local people and in turn to their livelihood or survival strategies. Commercial shrimp farming has displaced local communities, exacerbated conflicts and provoked violence involving property and tenurial rights, decreased the quality and quantity of drinking water, increased local food insecurity, and threatened human health. It is clear that the expansion of industrial shrimp farming has a posed significant threat to natural, social, and human assets at the local level.

The major questions to ask include, do the vaunted benefits associated with shrimp farming outweigh the risks or costs to local people and environments? Do employment opportunities compensate for declines in access to common pool resources, and other social and cultural costs? Are the environmental and human costs balanced in some way by improvements in local lives, livelihoods, and cultures?

The answers to these questions are quite complex, and depend to some extent on individual contexts. Little scientific data exist to answer such questions. However, a widespread shared response by people living in the locales in which the shrimp farming industry has expanded is a thunderous 'NO!' This response has been sharpened by the pattern of murder of those protesting industry practices and expansion in places like Bangladesh, India, Indonesia, Thailand, Honduras, and Guatemala. Goals of employment are not fully met since shrimp farming, outside of harvesting and packaging, is not labor-intensive. Neither is the industry known for providing high wages, except to the few aquaculture experts that set up and maintain production systems. Add to this the fact that income from pre-existing livelihood activities like fishing and farming may be affected negatively by the loss of habitat and environmental degradation. Benefits related to broadening the economic base of rural areas, generating local employment, enhancing food security, and conserving local environments are minor compared to the overarching objectives of industrial shrimp farming – generating profits for corporations and increasing foreign exchange earnings for Third World nations.

From Local through Global Response and Advocacy: ISA Net

The explosive growth of the industry has generated mounting criticisms over its social, economic, and environmental consequences. Since the 1980s, hundreds of grassroots and NGO groups have been established by local peoples in Asia, Latin America, and Africa to resist the unsustainable expansion of the industry's operations. The escalating conflicts between critics and supporters of industrial shrimp farming also have transcended local and national arenas. These tensions have catalyzed the formation of global alliances of environmental and peasant-

based NGOs opposed to shrimp farming and industry groups seeking to counter the claims and campaigns of the resistance coalition (Stonich and Vandergeest 2001).

Witnessing the pattern of impoverishment and environmental degradation in one shrimp farming country after another, a wide array of groups and individuals from environmental and grassroots organizations, natural and social scientists, aquaculture experts, journalists, and policy advocates formed a global alliance to address these problems. It was essential to show that it is the growing appetite of rich countries – the U.S., Japan, and Western European – that lead to the environmental and social havoc caused by farming shrimp. Hence, on World Food Day, October 16, 1997, the Industrial Shrimp Action Network (ISA Net) was founded.

Leading grassroots groups and NGOs in producing countries (like Yadfon in Thailand, Nijera Kori in Bangladesh, WALHI in Indonesia, and Consumers Association of Penang in Malaysia) and environmental groups in consuming countries (including the Natural Resources Defense Council, World Wildlife Fund, Mangrove Action Project, Forest Peoples Programme, and Swedish Society for Nature Conservation), as well as private foundations (such as the MacArthur Foundation and the Rockefeller Brothers Fund), have become involved in the ISA Net to address the social and environmental impacts of industrial shrimp farming.

However, the growing strength and accomplishments of ISA Net and its supporters in turn elicited an organized response from backers of the shrimp industry (producers, processors, importers, input suppliers) and its government and academic supporters. Industry supporters formed the Global Aquaculture Alliance to promote aquaculture and act as a public relations arm of industry.

Enhancing Natural Assets

Today, ISA Net and several supporting institutions are engaged in a variety of efforts to sustain local lives, livelihoods, and coastal environments. During a recent meeting of ISA Net in Hong Kong, members identified several issue areas for focused work. These ambitious initiatives include a focus on:

- livelihood strategies and food security;
- ecosystem health and human health;
- environmental justice aspects of industrial shrimp farming:
- common pool resources and property rights;
- gender dimensions of advocacy efforts;
- information and communication;
- certification;
- consumer campaigns;
- using the above to affect policy.

The issue areas and accompanying strategies identified by ISA Net members fit well with the four routes to natural asset building identified by Boyce and others (e.g., Boyce 2001)[1]:

1. Investment

ISA Net member organizations have advocated for increased community-based management of natural assets and have procured funds from donors that have been invested in efforts to increase local capacity for identifying, understanding, and managing natural assets, and for increasing communication and information flow between members (Stonich 2002). These efforts have included conducting natural resource/asset assessments, mapping natural assets, public education, creating and implementing sustainable aquaculture/agriculture, and mangrove reforestation projects.

2. Redistribution

One of the major activity areas of ISA Net has been to call international attention to the often violent displacement of local communities due to the spread of shrimp farming and to insist on gaining secure property rights for affected or likely to be affected communities and locales.

3. Internalization

Members of ISA Net are quite cognizant of the valuable ecosystem services provided by coastal ecosystems and have recommended a number of means by which local communities could be compensated for maintaining these assets. They have advocated for the local management of these areas on the grounds that local people have the most at stake in maintaining the ecosystem health of such areas. Specific projects have included community-based marine and terrestrial protected areas, community-based management of important areas, and various co-management schemes.

4. Appropriation

One of the fundamental objectives of ISA Net is to increase access to natural assets for coastal peoples through the appropriation of common pool resources and to secure property rights.

Conclusions/Discussion Points

This final section is more a set of talking points than conclusions, presented here in the form of discussion questions.

1. Can aquaculture be an appropriate development strategy that simultaneously builds natural, social, and human assets? What would the characteristics of that kind of aquaculture be?

2. Can transnational/global networks promote natural asset building? Over the last decade, the globalization of industrial shrimp farming induced the emergence of hundreds of peasant-based grassroots and NGO groups in Asia, Latin America, and Africa that are protesting the social and environmental consequences of the expansion of the industry into their locales. With the assistance of international environmental

organizations, private foundations, human rights groups, academics and others, these NGOs formed a transnational network and brought their claims to the United Nations among other venues. Many other issue-oriented transnational advocacy networks also have emerged recently (e.g., peasant networks, indigenous networks, women's networks, anti-biotechnology networks, etc.). What are or could be the roles of such networks in building natural assets? What are the obstacles and incentives confronting such networks?

3. What are (or should be) the cross-scale linkages between local, national, regional, and transnational/global networks?

4. What roles do information technologies (especially distributed IT) play in establishing and maintaining such cross-scale linkages?

5. One of the major purposes of the International Natural Assets Project is to bring together academics and advocates/NGOs to promote social change, ameliorate poverty, and protect environments. What are the theoretical and practical impediments to such collaborations and how can they be addressed and overcome?

Endnotes

[1] This discussion is brief because Isabel de la Torre will present more detailed information on ISA Net's efforts at the conference.

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