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Shrimp - The Devastating Delicacy

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### ABSTRACT

Many consumers are unaware of the impacts of shrimp farming on both the people and the natural environments where farming occurs. This article provides information about the consequences of shrimp farming and shrimp fishing, including potential problems for consumers themselves. Recommendations concerning the consumption of shrimp are provided.

Please note that this article was peer reviewed but not double-blind reviewed.

### ARTICLE

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#### **1. Overview**

Shrimp, once considered a luxury food eaten on special occasions, has become more affordable and available in recent years. But, scratch the surface and you'll find that the true cost of cheaper shrimp is hidden. The true price of cheaper shrimp for consumers in the North is being paid by the environment and people in poor communities along the coastlines of tropical countries of the South - in Latin America, Asia, and Africa. Here diverse natural landscapes are being radically transformed into vast monoculture cropping systems called "shrimp farms" laid out for as far as the eye can see.

In the Nellore district in Andhra Pradesh state of India, for example, more than 2,000 families in five coastal villages living near a large shrimp farm complex became "shrimp refugees" within a few short years after rich investors moved into the area and started

converting the landscape into shrimp "farms". Life became a nightmare for these villagers from the time construction of the 15,000 acre shrimp complex began in 1992 until, in 1995, the investors shut down after a deadly viral disease killed off the shrimp crops and they abandoned the area. Unfortunately for the villagers, after just three years of shrimp farming operations, groundwater supplies used for drinking, household purposes, and crop irrigation had become unusable after supplies became polluted by saltwater and other chemical compounds contained in the effluent discharged from the shrimp ponds. The Andhra Pradesh State government had to evacuate more than ten-thousand inhabitants of the fishing villages because the water was poison. The removal beginning in 1998 of the five coastal villages saw 10,000 inhabitants forced to move to other areas many kilometers from the seashore. Village fishermen are now walking more than 15 kilometers daily to get to the coast and back in order to fish in the sea that once lay at their doorsteps. Entire families were ripped asunder because local land shortages made it impossible to relocate everyone altogether in one location.

The Nellore story is no isolated, one-off occurrence; not in India, nor in other developing, coastal countries where there is industrialized shrimp farming. Rather than creating jobs and opportunities for sustainable development, industrialized shrimp aquaculture is undermining local communities. Modern shrimp farming has caused so many environmental problems and social impacts that an increasing groundswell of social discontent has risen in Asia and Latin America. There are frequent, violent confrontations, in which shrimp farm hired goons attack innocent protestors and violate their civil and human rights, including in some instances, murdering local people who become too outspoken.

At the same time, the health of consumers of farmed shrimp is potentially at risk. It is not uncommon for farmed shrimp to be laced with an assortment of banned antibiotics, pathogens, heavy metals, and other toxic compounds which, if consumed in sufficient quantity, imply potential health risks to consumers. In more ways than one, then, shrimp is a devastating delicacy.

## **2. Farmed shrimp tied to a destructive global commodity system**

While landings of wild shrimp from capture fisheries have hovered between one-and-a-half and two million tons a year since the early 1980s, the stunning rise in production from shrimp farms that have sprung up along vast stretches of tropical coastlines of many developing countries has seen output explode from under 84,000

tons in 1982 to nearly a million tons last year, an eleven-fold increase.

Today, about one-third of all the shrimp produced worldwide is farmed, and during this decade farmed shrimp production is tipped to double. Today, more than a quarter-of-a million so-called "shrimp farms" operate worldwide in more than 60 countries, occupying 1,307,380 hectares of coastal areas (in production). In 2001, about one-million tons of farmed-shrimp were produced worldwide, representing roughly one-third of the world's total shrimp production (farmed and wild caught). Worth more than nine billion dollars per year in international trade, farmed shrimp is now the single most valuable marine species on the planet.

Two species, Pacific white shrimp (*P. vannamei*) and black tiger prawns (*p. monodon*) account for more than 85 percent of the world's farmed shrimp production. More than two-thirds of the world's production comes from just six countries: Thailand, China, Indonesia, Vietnam, India and Ecuador. The biggest markets are the U.S.A., Japan, and several European Union countries, particularly Spain, France, the U.K., Italy, and the Netherlands. In the U.S., the world's leading shrimp consuming country, shrimp competes with tuna as the most popular seafood. Americans consume more than a half-a-million tons of shrimp annually, most of it imported farmed shrimp. Indeed, about 40 percent of all the farmed shrimp produced each year worldwide is consumed in the U.S.. The European Union is the biggest importer of shrimp (farmed and wild caught) in the world, importing about half-a-million tons annually, compared with 332,409 tons by the United States and 274,199 tons by Japan.

Shrimp aquaculture is a classic manifestation of the destructive excesses of globalization. A major global industry has formed around shrimp - producing, processing, transporting, and selling it to American, Japanese, and European consumers, all the while ignoring the resulting environmental and social upheavals. The "world shrimp commodity system" is a global production and world consumption system dominated by corporate control and organizational forms. The 'overnight' wealth to be made in shrimp farming has attracted get-rich-quick developers all along the marketing chain, from the 'farm gate' to the restaurant plate. Foreign capital and expertise provided by transnational corporations has merged with investment from local shrimp entrepreneurs, corporate and private, who essentially see only the vast profits to be made but ignore the quite severe environmental and social costs. Governments lack the political will to stop the damage since it was usually the central government that promoted shrimp

aquaculture development in the first place, supported by hundreds of millions of dollars in loans and aid from the international development assistance agencies such as the World Bank and bilateral agencies such as U.S. AID. Politicians and regulators, in most instances, have turned a blind eye to the severe problems generated by their shrimp 'development' policies. Very often, government officials and politicians have their own money tied up in the shrimp business, so are not motivated to impose profit-reducing restrictions. Governments in the shrimp consuming countries - Japan, the U.S. and Europe -- have put no brakes or controls on investments by their corporations or private investors in shrimp farms in the producing countries, essentially refusing to take any responsibility for the damage being done. This is despite their own citizens being the major consumers of the end product, shrimp. The boom and bust cycle of 'slash and burn', the increased concentration and expansion of transnational corporate (TNC) operations, and the elite-class expropriation of marginal classes from livelihoods and natural resources have all lead to substantial, long-term, negative social and environmental consequences.

The shrimp industry is not accountable and seeks enormous short-term gains by sidestepping (and lately greenwashing) issues of long-term environmental degradation and social justice. TNCs , supported by multilateral development banks (MDBs) such as the World Bank, Asian Development Bank, etc., and intergovernmental organizations (IGOs) like the United Nations Food and Agriculture Organization, direct the shape and directions of this new global regime of industrialized, export-oriented aquaculture. The strong-arm tactics of the International Monetary Fund provide the 'incentive' for governments to clear the way for expansion in their countries (making 'offers' that Governments just can't refuse!). As a result, the role of the nation-state is subordinated to the increased involvement of multinational firms and international agencies and the requisite global infrastructure at all levels of the shrimp commodity chain. The ability of the nation-state to manage these contradictions effectively is overwhelmed by the international scope of the industry's fluid structure, which represents neither region nor context. In today's free-trade environment, and under the rules of the "new global food regime", the financial interests involved in the global shrimp commodity chain will be increasingly at odds with the nutritional and livelihood interests of coastal and rural communities in those countries where shrimp aquaculture is expanding.

### **3. The basics of shrimp farming**

Shrimp are farmed in a series of quite large, artificial ponds, usually dug to a depth of about a meter or so, formed by levees built by

earth-moving equipment. Normally the site of a farm will be on an estuary or next to a coastline to provide a ready source of brackish or salt water. Shrimp culture ponds can be a converted extensive coastal fish pond, a large rice paddy area or land producing other agricultural crops, salt flats, lagoons, or a newly excavated site in a clear-felled mangrove forest. It is in construction of shrimp farms that the initial and most blatant damage to the environment is done by stripping away natural or existing farmed landscapes. Often, the ecology of an entire region covering hundreds of square miles will be transformed in this manner within a short time span.

In some countries, such as India, Bangladesh, and Thailand, there was a tradition of a rice/shrimp rotating system, with rice grown part of the year and shrimp and other fish species cultured the rest of the year. In such low-yielding, 'natural' ponds the harvest was small but sustainable over long periods. The produce was usually for family consumption or sold in local markets.

Although there are still many of the more traditional style farms in production, the trend during the past twenty years has seen long standing, sustainable traditional farms pushed out by modern, commercially-oriented, high-output shrimp operations. Lured by the promise of rapid, robust profits, investors keen to get rich quick in shrimp farming have been moving to even greater levels of intensification of production in order to dramatically increase rearing of juvenile shrimp to market size. Instead of relying on natural tidal flows to stock ponds, as the traditional aquaculture systems have done, the industrialized methods of shrimp farming rely on manual, high-level stocking of ponds with either wild-caught or hatchery produced 'post-larvae' (PL). Shrimp PLs are crammed into these intensive ponds at density rates up to 100 times greater than the stocking rates of the more traditional, lower-yield, systems. The higher intensification requires the intensive use of artificial production inputs including a range of chemicals, fertilizers, therapeutics, antibiotics, and artificial feed - making the process anything but "organic". It is not uncommon for the shrimp itself to become tainted by the residues of some of these compounds, which can then be ingested by unwary consumers.

#### **4. Environmental impacts**

The extent and nature of the negative environmental impacts of shrimp aquaculture arise primarily from two aspects: 1) construction and 2) ongoing operation. The severity of environmental threats increases as the number of farms increase in an area and as the intensity of cultivation per farm rises. In order for shrimp ponds to maintain intensive yields and high returns, the wholesale conversion of surrounding land areas is required. Once

shrimp ponds become operational, there is a host of ecological impacts generated with devastating consequences for the environment and human communities in the area.

As the intensity of operations and the density of shrimp farms along tropical coastlines has increased there have been:

- severe degradation and pollution of coastal ecosystems with serious biodiversity implications and the consequent loss of associated goods and services provided to traditional coastal communities;
- soil and water salinization;
- the abuse of antibiotics and toxic chemicals used in production;
- and
- over-exploitation of wild stocks of marine fish and destruction of natural shrimp seed resources.

In addition, wild stocks of marine species, and even the cultured shrimp stocks themselves, are declining, and in some cases collapsing, as a result of habitat loss, pollution, and diseases.

#### **4.1 Clearcutting the rainforests of the sea to build shrimp farms**

Shrimp farming is one of the most relentless destroyers of large areas of pristine tropical wetlands. There is sufficient evidence pointing to a loss over the last 30 years of around one million hectares (2.5 million acres) of ecologically important coastal wetland ecosystems, such as mangroves, salt marshes, lagunas, and the like. This estimate includes wetlands lost to shrimp farms that currently operate and shrimp farms built earlier that have been abandoned without restoration of the wetlands lost.

Mangrove forests are the most notable ecosystems that have fallen to shrimp pond construction, with the massive destruction of mangrove forests in Latin America and Asia. Most shrimp farming in Southeast Asia, for instance, has occurred or still takes place on reclaimed mangrove forests. The mangroves are the coastal equivalent of the terrestrial rain forests, unique and irreplaceable ecosystems containing incredibly diverse species of flora and fauna. They are amongst the world's most productive ecosystems. Mangroves sustain the ecological integrity and productivity of adjacent coastal waters, and are important breeding and nursery grounds for many fish and shellfish, and they provide habitat for a wide range of other wildlife species. There is a direct relationship between declining mangroves and declining fish catches where mangrove destruction is extensive. Much of the tropical world's vast diversity of marine life gets its start within the tidal waters of the mangrove swamps, and mangrove destruction could see a

catastrophic ripple effect on the biological diversity in the world's oceans.

The loss of the mangroves sets in motion the destabilization of entire coastal zones, with sometimes dramatic effects on coastal ecology and human communities. The erosion and heavy siltation that occurs in places where extensive mangrove clearance has occurred can also destroy other important coastal habitats such as sea grass beds and coral reefs. This further diminishes the habitat for rare migrating birds, sea turtles, dolphins, the manatees, including the related endangered dugongs, otters, monitor lizards, and a host of fishes, shrimps, mollusks, and crustaceans relied upon by local people for food.

The extent of mangrove destruction in Thailand and Ecuador provides an indication of the extent of the problem globally. While Thailand is now the world's leading shrimp aquaculture producer, the environmental cost in terms of mangroves and other types of wetlands lost has been high. The Thai National Economic and Social Development Board reported that some 253,000 hectares (634,000 acres) of the country's 380,000 hectares (950,000 acres) of mangrove forests had been destroyed by shrimp farms. In Ecuador, the second largest shrimp aquaculture producer, shrimp cultivation began in 1968. By 1988, shrimp farm installations had destroyed 20% of existing mangrove forests and 80% of existing salt marshes—the equivalent of more than 40,000 hectares of each ecological system. Since 1988, more wetlands and mangrove forests have been destroyed, and in some areas along Ecuador's coastline where shrimp farms are prolific as much as 80% of wetland ecosystems have been demolished. Similar high percentage rates of destruction of mangroves and other types of wetlands have occurred in Indonesia, Vietnam, Bangladesh, India, and Honduras in the Gulf of Fonseca. Even though the ecological and economic importance of mangrove forests and other coastal wetlands are now well known, their destruction continues as more and more of the remaining wetland areas have been set aside for conversion to shrimp ponds. Major shrimp projects involving the destruction of hundreds of thousands more acres of wetlands are underway or planned in Indonesia, Malaysia, Vietnam, Brazil, Mexico, Belize, and Columbia.

#### **4.2 Poisoning the environment**

Pollution from shrimp farming has severe side effects for local people who inhabit and use the surrounding environments to maintain their food supplies and subsistence economies. To maintain the overcrowded shrimp population in intensive production systems and attain higher production efficiency, copious amounts of

artificial feed, pesticides, chemical additives, and antibiotics must be continuously added. These compounds, together with excrement from the shrimp, make the wastewater from the ponds poisonous. The polluted wastewater is generally pumped back into the surrounding environment in order to save costs, poisoning coastal waterways and the sea, fresh groundwater supplies, native flora and fauna, and adjacent communities. In addition shrimp pond effluents are often high in organic matter, with a resulting high biological oxygen demand that can cause oxygen depletion in receiving waters. The combination of surplus organic matter and increased salinity from pond effluents can cause severe problems, especially for fish populations and other sea life that inhabit the receiving waterways. Saltwater in the ponds also seeps into the local groundwater and the increased salinity damages drinking water supplies and surrounding agriculture land, making alternative cropping (such as rice) nearly impossible.

As with other types of farming, shrimp farming frequently uses exotic species and varieties that are not indigenous to the local area. What effects the introduction of new species will have on the local ecosystem is not yet known. Even if an exotic species of shrimp can be contained in the ponds to which they were introduced, and even though it may appear to be innocuous, there is always the danger of diseases and parasites spreading to local shrimp species. Cultured shrimp, especially in intensive cropping systems, are highly vulnerable to a wide assortment of parasitic fungi and virulent bacteria and viruses, and if these pathogens spread to a local shrimp or invertebrate fishery they can produce serious economic and ecological consequences.

Perhaps most significantly, the conversion of coastal ecosystems into monoculture production areas can have disastrous long-term effects. The lifespan of an intensive shrimp farm is between five and ten years (many are forced to shut down within 3-5 years after choking on their own self-generated pollution). Once the farm is abandoned it is expensive and difficult, if not impossible, to rehabilitate the land for any other purpose (e.g., farming or replenishment of destroyed mangrove forests). This, in itself, is an immense problem. In Ecuador 15% of shrimp farms are now unusable, while in Thailand less than five percent of the initial farms set up in the Gulf of Thailand (Thailand's first shrimp growing region) remain in operation today. The bottom soil of an abandoned shrimp pond that has been used for intensive culture is usually too saline for agriculture or other uses, so the conversion of land to shrimp farming may, for practical purposes, be irreversible.

The environmental impacts of shrimp aquaculture do not occur in isolation, but are a part of a complex of coastal threats emanating from industrialization, urbanization, increased use of agricultural chemicals, recreational and tourism development, and petroleum exploitation. Coastal areas are especially susceptible because they are downstream from sources of urban and agricultural pollution. In addition, large urban centers are often on or near the coastline, and the compounding environmental stresses reduce the capacity of the coastal environment to absorb the damaging effects of shrimp farming.

### **4.3 Shrimp Farming's Ecological Footprint**

Modern shrimp farming is clearly unsustainable ecologically because its operational requirements vastly exceed the carrying capacity of surrounding ecosystems. The environmental pressures of industrialized shrimp farms have impacts well beyond the boundaries of the immediate site itself. The additional ecological or biophysical "costs" have become known as the "ecological footprint". This "ecological footprint" is the minimum area of productive ecosystem required to sustain resource inputs to and assimilate waste outputs from an aquaculture operation.

For instance studies have shown that a one hectare (2.5 acres) semi-intensive shrimp culture system in Columbia (producing about 4000 kg of shrimp annually) requires the productive and assimilative capacity of between 38 and 189 hectares of natural ecosystem per year. Higher intensity farming operations require even greater levels of support from the surrounding environment. Such systems are extremely inefficient from an ecological energy standpoint, using approximately 295 Joules of ecological work in order to produce just one Joule of edible shrimp protein (that includes inputs such as fish meal, agricultural products in feed and pond productivity plus industrial energy such as labor, energy to catch and produce feed, fuel, fertilizer, maintenance and harvest costs, etc.).

Shrimp ponds demand copious and continuous supplies of fresh and salt water and thus use local water resources with great intensity. Maintaining favorable water quality is an essential aspect of pond shrimp aquaculture. Sea and ground water must be also continuously pumped into the intensive ponds, and polluted water flushed out. Massive amounts of freshwater are required in semi-intensive and intensive ponds in order to regulate salinity, dilute harmful wastes, and replenish dissolved oxygen levels. Shrimp are particularly sensitive to low concentrations of dissolved oxygen in the water. Intensively cultivated ponds must undergo frequent flushing with water exchange rates of between ten to fifty-five per

cent of the pond volume each day. Though riverine sources, if available and not polluted, are sometimes used, underground aquifers generally remain the preferred source of freshwater. It has been estimated that (in the case of farms in Taiwan) for each ton of shrimp produced in intensive farms, between 29,000 and 43,000 cubic meters would be required. Using these figures as a rough guide to freshwater use clearly suggests the enormity of the resource required. According to Biksham Gujja, head of freshwater policy at the Worldwide Fund for Nature in Geneva, to raise one ton of shrimp requires 50 to 60 million liters of water. This water demand places a tremendous burden on local ground water supplies, rapidly depleting local freshwater resources. Shortages of fresh water have resulted in many shrimp-producing areas, such as southern Thailand and Tamil Nadu in India. In Taiwan, substantial land subsidence causing tens of millions of dollars of property damage occurred due to extraction of well water used to dilute coastal shrimp ponds. The flushing of brackish and polluted pond wastewater ends up contaminating adjacent lands and coastal waters.

Over-intensive production, too rapid an expansion, and self-contamination of the water in the ponds have led to disease outbreaks in most producing countries, sometimes to uncontrollable levels. Disease outbreaks became so bad in Ecuador recently that the Government there had no choice but to declare a state of national emergency. A deadly viral disease (ironically, one that originated in Asia) wiped out half of Ecuador's shrimp production, and the situation reached crisis proportions when lost revenues reached more than one billion dollars. Once an area has become contaminated by disease, investors abandon it. Often aided by government subsidies or tax incentives, they move on to new, pristine areas to start the process of destruction all over again.

A related aspect of the ecological footprint linked to the carnivorous nature of shrimp is the threat to the world's fisheries associated with increasing demand for fishmeal used as feed by the aquaculture sector. The quantity of inputs to shrimp farms of dietary fishery resources in the form of fishmeal, fish oil, crustacean by-product meals, 'trash fish', etc., exceeds outputs in terms of farmed shrimp products by a factor of 2 to 3. So, for every kilo of shrimp produced in this manner, between two and three kilos of other fish are required as input. If farmed shrimp production continues to grow in the future, and output is projected to double in the next five to ten years, this will lead to even greater fishing pressure globally as demand for fishmeal to feed the shrimp (and other farmed carnivores like salmon) increases. Currently about 35 million tons of fish caught from the world's oceans are being ground

into fishmeal, oil, and other non-food products annually. That is more than 40 percent of all fish caught from the world's oceans and seas being reduced to feed for farmed animals, including shrimp and salmon.

Apart from the matter of this grossly convoluted "ecological footprint", there are increasing doubts regarding the long-term sustainability of shrimp farming systems based upon these finite and valuable fishery resources, not to mention the efficiency and ethics of feeding potentially food-grade fishery resources back to shrimp (and other animals) rather than feeding them directly to humans. The increasing use of aquafeeds made from fishmeal will mean increasing competition for fish that might otherwise be used to provide food for direct human consumption.

Another example of the extensive ecological footprint of shrimp farming is the capture of great quantities of wild shrimp larvae used to seed the shrimp production ponds. The methods of fishing for larvae are very destructive. The use of very fine mesh nets to capture the larvae can significantly reduce the wild populations of shrimp in the area, but at the same time also capture and destroy the larvae of many other fish and other marine species in the process. Generally, only 10% of what is captured is of the desired species; the rest is simply discarded. The percentage of captured larvae that end up in the ponds for fattening is very low. Optimistic estimates indicate that for each cultivated shrimp about 100 juvenile of other types of fish and/or crustaceans die in the process. This bycatch is left to die on the beaches -- a very high ecological price to pay. Practices such as this may adversely affect populations of other fish and invertebrates in the area, and filter through to declining catches for local people, who rely on these species for food and livelihoods. Such impacts can have an extremely damaging effect on local food security.

## **5.0 The negative social impacts caused by shrimp farming**

The spectacular growth of shrimp farming over the past two decades occurred because governments and international development agencies promoted it, lured by enormous profits to be made. Investors were quick to cash in on the lucrative business, but it is typically only a relatively few investors that have received the lion's share of benefits, while large portions of society, particularly the rural poor, have become disenfranchised and marginalized into severely degraded environments.

### **5.1 Competition and dispossession**

Competition increases dramatically between traditional fishermen and family (peasant) farmers and entrepreneurial shrimp farmers for the use of good quality land, coastal fisheries habitats like mangroves, and other critical areas along the coastline. This competition increases in direct response to higher demand for both local food and export crops. Communities are often dispossessed by shrimp farms of several vital resources over which they have held traditional rights based on long-standing patterns of use - among them, ricelands and the mangrove forests. Clearcutting mangroves for shrimp ponds destroys what was once a potentially sustainable resource. The areas cease to provide a wide range of products for local communities such as building materials, food, fire wood, charcoal and the like.

In the Philippines, for example, there was a marked shift from extensive aquaculture for production of milkfish largely for domestic food supplies to the more lucrative export-oriented shrimp. The result has been not only the loss of a valuable protein source (i.e., milkfish) but also of valuable rice cultivation lands due to conversion into, or salinization by, shrimp ponds - clearly something detrimental to the goal of national self-sufficiency in food.

## **5.2 Downsides of modernization**

Agricultural 'modernization' like this strikes women particularly hard in affected communities, as they are among the first to be overshadowed when commercialized farming overtakes self-provisioning. The shrimp farms consume several important resources in their operation, particularly local freshwater supplies that serve human communities for drinking water supplies, other household domestic needs, and farming purposes such as crop irrigation.

Modern shrimp farming is, like other forms of intensive agriculture, capital rather than labor intensive. As such it provides limited employment opportunities for coastal residents. Any employment opportunities are typically poorly paid seasonal and non-skilled jobs, offering no long-term job security.

An economic study conducted by researchers at Chittagong University in Bangladesh revealed that shrimp farming displaces more jobs than it creates. The study showed that cultivating 100 acres of land with rice employs 50 workers, while cultivating shrimp on the same land employs just five workers. As a result, shrimp farming in Bangladesh's coastal Satkhira region displaced 40 percent of the area's 300,000 inhabitants into the country's overcrowded cities. While a one hectare salt-water fish pond might produce a profit of \$32,000 for investors in shrimp farming, little

financial help trickles down to the people in the neighboring communities who are being badly affected.

### **5.3 Ripple effects**

The environment suffers yet again when social disruptions ripple out through the society. Increasing numbers of displaced families (traditional fishers and farmers), for instance, are forced to resort to destructive fishing methods or improper methods of husbandry in order to extract a livelihood from lands and coastal areas that are diminishing in area and deteriorating in quality due to the appropriation of lands and ecosystems and the over-use and improper husbandry by shrimp farmers. Otherwise, displaced people are forced to leave their traditional homes and migrate to cities hoping to find jobs. But jobs are few, and most people are unskilled laborers anyway, so instead they contribute to the growing urban migration crisis being confronted in the developing world, and compound already complex urban-related environmental and social problems.

In India, where during the mid-1990s 80,000 hectares (200,000 acres) of coastal wetlands and agricultural land had been converted to shrimp farming, thousands of subsistence farming and fishing families were dispossessed as a direct result of shrimp farming expansion. Rice production has been seriously affected in some areas by seepage of saltwater and pollutants from the shrimp ponds. In the Indian state of Tamil Nadu, where 60% of the population is landless, thousands of hectares of land have been set aside for shrimp farms despite concerns over threats to the livelihoods of 25,000 families. In some areas there have been reports of people being forcibly evicted from their lands at gunpoint in order to allow shrimp investors to come in to construct shrimp ponds. While farmers are being run off their lands to make way for shrimp aquaculture, fishing communities are finding their access to the sea blocked from their villages by huge shrimp farm complexes. Fisherfolk can no longer land their boats and spread their nets. Even their catches are declining as once abundant fish populations drop off as a result of mangrove clearance and pollution from the ponds.

### **5.4 Human health impacts**

Impacts on human health related to shrimp farm operations and the effluents discharged are yet to be determined. Even though chemical usage is widespread in the aquaculture industry and the generic chemicals in use are known, accurate statistics on usage are hard to come by. Many chemical compounds, some quite toxic substances, are used in large-scale shrimp farming. Combined with

tons of shrimp excrement, rotting uneaten shrimp feed, and other substances, a chemical soup, unfriendly to human health, is formed. This poisonous effluent from the shrimp ponds is commonly dumped onto the surrounding land and into waterways where its chemical mix may pose health risks to people in local communities.

### **5.5 Costs far outweigh any benefits**

In summing up the social impacts of export-oriented shrimp farming it can be said that its benefits accrue substantially to a minority directly involved in exploitation of coastal resource systems. In the meantime, a series of direct costs are paid by the majority who reside in these areas and who make their daily living from the resources that may be found there. Neither the social nor the ecological costs of shrimp culture development are paid by the investors, who pocket the extremely high profits during the growth phase of the industry, but socialize the costs as society at large is left with the bill for the considerable environmental and social damage.

These are the kinds of issues considered by the Supreme Court of India, which determined in a landmark legal case 1995 that industrialized forms of shrimp aquaculture would be banned within the Indian coastal zone. The Court concluded from the evidence it heard from experts that shrimp aquaculture caused more economic harm than good, with social and environmental costs outweighing the economic benefits by a ratio of four to one.

## **6. Health concerns for consumers**

Infectious diseases are a major concern in aquaculture both in terms of the potential negative impacts on production and the potential for disease impacts on wild populations. Outbreaks of disease are typically caused by widely distributed, opportunistic pathogens. In natural systems they have a low prevalence and low intensity of infection, but in aquaculture operations where stresses lower resistance and stocking density facilitates transmission of disease, impacts of disease outbreaks can be severe.

Total prevention of disease in aquaculture systems is likely to be unattainable in practice. Disease management, therefore, depends upon good culture practice in combination with chemotherapeutic agents. Some agents may be administered (often in feed) on a prophylactic basis, although in many countries, the US for example, this is forbidden. Parasiticides, piscicides anaesthetics, spawning hormones, oxidants, disinfectants, and herbicides (including a wide variety of pesticides such as malathion, parathion, azodin, paraquat, endosulfan and butachlor), are all routinely used. They

are mixed together with a range of antibiotics such as terramycin, erythromycin, oxytetracyclin, nitrofurantoin, and Chloramphenicol.

Despite the importance of the aquaculture industry, documentation of the quality and quantity of chemicals and biological products used by it is scarce. While the microbiological quality of shrimp traded worldwide is closely monitored, chemical residues have received little attention, apart from recent scares surrounding antibiotics nitrofurantoin and chloramphenicol found in farmed shrimp imported into Europe and Canada from China, Vietnam, and Thailand. Nitrofurantoin antibacterials are veterinary drugs whose use in food-producing animals and fish is banned in the EU because of health concerns, including a possible increase in cancer risk in humans. Chloramphenicol has been detected in shrimps imported from Myanmar (Burma). Chloramphenicol, a broad spectrum antibiotic which has latterly been associated with aplastic anaemia in humans, has been banned in the EU, the U.S. and Canada for use in food producing animals and fish. This is a drug of last resort in human medicine for *Salmonella typhimurium* infections. The EC, Canada, and the US have responded to these findings by imposing a requirement to monitor imported shrimp from these areas for the specific residues. At the same time, there are relatively few constraints on chemical usage in aquaculture and many antibiotics are widely available.

Theoretically, the many chemicals other than antibiotics that are added to the shrimp ponds, or by-products from the applied substances, that have a bio-accumulation potential, could be found as residues in the shrimps. This could include dioxin and other highly toxic substances such as PCBs that have been detected in some fishmeals, which comprise part of the farmed shrimp's diet. Unfortunately, little attention has been paid to the risk of residues other than antibiotics in farmed shrimps, and no data from such investigations are publicly available. A related environmental issue with potential implications for humans is that since shrimp ponds are downstream from agricultural lands, pesticides may accumulate in shrimp tissue as well. Other harmful pollutants that are frequently present in estuaries where shrimp farms operate -- for example, radioactive isotopes and heavy metals - can also occur in shrimp tissue.

## **7. A global struggle emerges as the dispossessed fight back**

The explosion of shrimp farming in the 1980s and 1990s has seen dramatic transformation in the livelihoods of coastal dwellers and rural inhabitants. Desperately concerned about the threat to their lives and livelihoods, rural community people affected by the encroachment of shrimp farmers have struck back at aquaculture

owners. From India to Ecuador, shrimp farming has met with significant resistance by local communities to its further expansion. Protests have centered around issues of pollution, takeover of lands, access to water resources, destruction of mangroves, and depletion of surrounding soil quality.

Sometimes violent clashes occur, some ending in beatings and even death for some protesters. In one incident in Bangladesh two villagers lost their lives - one of them killed by a bomb attack arranged by shrimp-farm owners. In India a strong grassroots movement has developed where angry communities have organized to prevent the building of shrimp ponds, and have even attacked aquaculture farms. In one attack, six people from a local fishing village were bludgeoned to death by police. In Honduras, women from local villages have formed human road blocks, placing their bodies in front of intruding bulldozers hired to clear the mangroves for shrimp ponds. Elsewhere, in Guatemala and Brazil, for example, anti-shrimp farming leaders were recently murdered.

## **8. Shrimp destruction is a part of the global fisheries crisis**

The environmental devastation and the toll on affected human communities being caused by shrimp production are just one part of a global problem: the world's oceans are being plundered in order to maintain supplies to markets where a virtually insatiable demand for seafood is intensifying. The booming shrimp market is just one destructive manifestation of the overarching problem. In meeting the ever-increasing market demand in Japan, the U.S., and Europe for seafood, nature and human communities that are directly dependent on marine fish for food are suffering the destructive consequences. Increasing market demand for fish and other fish-based products have led to a massive intensification and industrialization of fishing worldwide, to such an extent that fish populations in virtually every major fishing region of the world are considered to now be fully- to over-exploited, over-fished, or collapsed. This is particularly true of the high-value commercially exploited species, such as wild shrimp. Virtually all of the world's major stocks of wild shrimp are considered to be fully- to over-exploited.

The resulting uncertainties surrounding the future availability of fish in a world where fish stocks are declining while demand continuously increases have motivated many governments, corporations, and entrepreneurs to intensify development of various systems to raise aquatic organisms in more controlled environments. Aquaculture, as the process is generically known (mariculture is the term applied to farming in the marine environment), is being held out as the hope for sustaining the level

of fish supplies to meet rising market demand in the face of a deepening global fisheries crisis.

Not all forms of aquaculture are as destructive as shrimp farming has proven to be. Indeed, some types of aquaculture offer great hope for enhancing the lives of hundreds of millions who are nutritionally insecure, low-income people. On the other hand, putting faith in a global strategy to promote the expansion of coastal and marine-based aquaculture, or mariculture, in the hope of making up the projected shortfalls in future world fisheries supplies is a woefully misguided strategy. For one thing, such an approach glosses over the very grave environmental dangers and excessive demands on natural resources associated with the wholesale expansion of commercialized coastal and marine farming systems. Furthermore, it is the cornerstone of a longer term plan that ultimately aims at the wholesale conversion of the oceans' biological diversity into monoculture cropping systems geared to the exclusive production of high-value commodities, like shrimp, for the world's wealthy few. An analogy can be drawn in the terrestrial environment with the destruction of the Amazon's rainforests and all the complex biodiversity they contain in order to make space for grazing cattle to put beef burgers in the mouths of Americans.

Such a strategy also creates a disincentive for governments that should be hard at work on the urgent need to push back the global fisheries crisis by instituting fundamental, wide-ranging reforms to rid the oceans of the vast fishing overcapacity and destructive fishing practices that underpin overfishing on a global scale. Instead of focusing on solving the problems of world fisheries and putting them on the path to sustainability, governments and industry have grabbed hold of a convenient escape hatch in aquaculture - one that allows business as usual to be maintained, at least in terms of maintaining supplies of fish to northern markets where consumers can afford to pay higher prices for luxury products, even though the practices that underpin production are environmentally destructive and unsustainable economically.

While it may be that investment in appropriate forms of aquaculture could do a lot to help alleviate malnutrition in some developing countries, the current emphasis on the production of high-value species for export is leading in an entirely different direction. This emphasis is not on how to provide a readily accessible source of protein for the world's malnourished through integrated fish farming systems that are ecologically sound, even environmentally beneficial. It is instead being directed largely at the production of high-value species for export to wealthy overseas markets where

people can afford to pay high prices for such luxuries as farmed shrimp and salmon.

There is now a set of conditions conducive to the dramatic expansion of the shrimp farming industry in Asia and Latin America. Such conditions include an increasing market demand for seafood, technological advancements in breeding and nutrition, favorable government policies and incentives that encourage rather than limit expansion, and the resulting massive investment flows. But the developing global shrimp industry is environmentally destructive, intrinsically unsustainable, and inequitable in social terms. It has become a destructive force in a world where more effort and investment should be directed to solving the environmental and social crisis in world fisheries in a manner that ensures sustainable employment and food security for the hundreds of millions of people who rely on fish and fishing as their basis for life and livelihood.

### **AS A CONSUMER, WHAT CAN YOU DO?**

Worldwide efforts are needed to put an end to the destructive environmental and social impacts caused by export-oriented shrimp aquaculture. While enforcement of strict regulations to protect the environment and curbs on the destructive expansion of intensive shrimp aquaculture are urgently needed, pressure to slow the rampant expansion of shrimp aquaculture could well lie with the market itself - with consumers particularly.

The fact that so many seafood consumers in Northern, industrialized countries are turning to shrimp while there is only limited supply creates enormous pressures to expand output. Since shrimp fisheries are limited by nature to what they can catch and offer to the market (there's only so many shrimp in the sea!), shrimp farming has risen up to fill the gap. The more demand grows, the more investors are drawn to pump money into the shrimp farming sector.

Many of those who are directly feeling the ecological and social impacts being generated by the spread of shrimp aquaculture speculate that curbing the expansion of this destructive industry will mean curbing the appetite for shrimp in the big consumer markets of Japan, the United States and Europe.

"People who enjoy eating shrimp don't know that natural resources are being destroyed to bring it to them. If we explain that the price of the shrimp they're eating is the death of many marine species and even the whole gulf [of Fonseca in Central America], they'll understand that they should oppose the shrimp industry's destructive activities." [Saul Montufar, president of the Honduran

Committee to Defend the Flora and Fauna of the Gulf of Fonseca, describing their campaign to raise consumer "awareness" about the environmental damage that goes into providing a plate of shrimp.]

Many people in poor coastal communities in tropical countries who are directly feeling the ecological and social impacts being generated by the spread of shrimp aquaculture respond to the words of India's Shri Banke Behary Das, a founder of the Peoples Alliance Against the Shrimp Industry:

"I say that those who eat shrimp-and only the rich people from the industrialized countries eat shrimp-I say that they are eating at the same time the blood, sweat and livelihood of the poor people of the Third World."

If Banke Behary Das's words strike a chord in you and if you wish to avoid contributing to the environmental destruction and social upheaval being created by shrimp farming, then you can consider the option of NOT EATING SHRIMP (or prawns as they're also sometimes referred to in some markets, e.g. "black tiger prawns"). Or, at least, eating them only occasionally and in small amounts, e.g., a few in prawns in a spicy Thai salad on occasion. Consumers should be concerned about the industrialized way in which shrimp is produced, if not because of the harm to coastal environments and communities, then because increased risks to human health are linked to the continued ingestion of chemicals, antibiotics, and other compounds used throughout the shrimp farming process.

How do you know if the shrimp you want to purchase is farmed or captured by fishing in the ocean? Unfortunately, farmed shrimp are usually not identified at the seafood counter or restaurant as "farmed", and it is difficult, if not impossible, to distinguish just by looking between farmed shrimp and shrimp that are caught in the oceans by fishing. Farmed shrimp are as a rule "tropical" shrimp because that is where the various species used for farming originate and where most shrimp farming takes place. The two most commonly farmed species are black tiger prawns (*Penaeus monodon*) and Pacific white shrimp (*Penaeus vannamei*). Together they account for more than 85 percent of the world's farmed shrimp production.

Wild-caught tropical shrimp should not, however, be considered by the concerned consumer to be an acceptable alternative to farmed tropical shrimp. The dominant fishing method used to capture tropical shrimp in the wild is "bottom trawling". Bottom trawling, in tropical waters especially, is one of the most wasteful and destructive fishing methods in the world. The effect of bottom trawling on the seabed (the benthos) resembles forest clearcutting,

and is widely recognized as a major threat to marine biological diversity. Structures in marine benthic communities are generally much smaller than those in forests but structural complexity is no less important to their biodiversity. Bottom trawl gear crushes, buries, and exposes marine animals and structures on and in the substratum, sharply reducing structural diversity. It also alters biogeochemical cycles. Recovery after disturbance is often slow because recruitment is patchy and growth to maturity takes years, decades, or more for some structure-forming species (e.g. corals).

Greenpeace estimates there could be forty to sixty thousand shrimp trawlers operating worldwide (constituting half or more of the world's bottom trawl fleet), the majority of which operate in tropical or semi tropical waters. The UN FAO's 1994 global assessment of bycatch in world fisheries states that the mean annual discard by weight in fisheries for shrimp and prawns worldwide is 9.5 million metric tons, compared to a landed catch of shrimp and prawns of 1.8 million metric tons. The highest ratios of bycatch to shrimp - over 10kg of fish caught and discarded for 1 kg of shrimp retained - occur in shrimp fisheries in tropical waters. According to the FAO report, shrimp trawl fisheries account for about nine-and-a-half (9.5) million tons of the 27 million tons of bycatch and discards in world fisheries, or 35% of the estimate for total global bycatch. Shrimp trawling stands head and shoulders above virtually all other fisheries as the most non-selective and wasteful fishery in the world.

Shrimp trawling has generated serious, sometimes violent opposition from small-scale, traditional coastal fisherfolk in developing countries in Asia, Latin America, and Africa. The reasons for this opposition include the importance of the bycatch of fish species to coastal fishers, habitat degradation impacting fish spawning and nursery grounds, and gear interactions - shrimp trawlers often run over or destroy fixed fishing gear set by coastal fishers. As a result, Greenpeace cannot recommend that consumers eat wild-caught shrimp as an alternative to farmed shrimp.

What it all comes down to is individual choice, but if enough consumers and consumers' organizations take up the call to avoid eating tropical shrimp, a signal to back off would be sent to the governments, agencies, banks, and investors that are supporting the expansion of the shrimp farming industry. This, in turn, would provide substantial support to environment and development groups and communities in shrimp-producing countries to bolster their on-the-ground struggles to roll back shrimp industry destruction.

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