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National Initiatives, Local Effects: Trade Liberalization, Shrimp Aquaculture, and Coastal Communities in Orissa, India

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Commercial shrimp farming in India expanded rapidly after trade liberalization initiatives were introduced in the early 1990s. This article examines the social, economic and environmental impacts that have been generated in communities along Orissa’s Coast in east India. The results suggest that macro-level policies such as trade liberalization are useful at the national level, but at the local level they can generate imbalanced growth. Although the shrimp farming industry has generated substantial foreign exchange, at the local level it has widened the gap between rich and poor. To protect the livelihoods of the rural communities and the environment, India needs to formulate effective coastal resource management policies and establish adequate institutions at the local level. This will help ensure a stable source of income from shrimp farming for small-scale farmers and minimize adverse impacts on the local environment.

Keywords coastal communities, India, rural livelihoods, shrimp aquaculture, trade liberalization

Supporters of trade liberalization believe that the opening up of domestic markets to foreign competition, combined with increased specialization in those products for which they have a comparative advantage, will result in more efficient use of resources and promote economic growth (Hoekman and Kostecki 2001; Cline 2004). It is also held that the prosperity generated by increased international trade will, in turn, provide the world’s developing economies with more resources for tackling the enduring problems of hunger and poverty (Krueger 1998; Winters 2002). There is now a growing recognition, however, that economic growth does not translate automatically into a reduction of poverty or improved food security. Aggregate measures of consumption and income mask the reality of growing inequities and increased marginalization of the poor in many societies (Cheru 2000). Economic growth in many developing nations has been accompanied by intensive exploitation of natural resources and widespread environmental degradation, the costs of which...
are borne disproportionately by the poor, who depend more directly on natural resources for their livelihoods (Aggarwal 2006).

The liberalization of trade in food products has been the subject of particularly intense controversy owing to its direct linkage to the livelihoods and food security of the rural poor, who constitute the majority of the population in many developing countries. An important consequence of many trade policy reforms has been a shift in production from low-value food crops such as rice and maize, which are the staple foods for local consumption, to high-value food products such as livestock, dairy products, fruits, and vegetables for export (Coxhead and Plangpraphan 1998, Ghosh 2005). Small-scale farmers, however, are often unable to enter and benefit from liberalized markets due to constraints such as limited access to credit and insurance, insecure land tenure, and poor infrastructure (Bardhan 2006). Moreover, although crop diversification has been a means of reducing risk and increasing food security, crop specialization makes farmers more vulnerable to price fluctuations in the world market (Kanji and Barrientos 2002). Rather than having a beneficial impact on the rural poor, liberalized trade has meant that many households are faced with reduced food security and worsening poverty (Ghosh 2005; Patnaik 2005).

In the fisheries sector, global demand for fish and fishery products has soared in recent years, owing both to an increasing population and a greater awareness of the dietary importance of fish (Delgado et al. 2003). The removal of trade barriers, coupled with high demand, however, has provided a strong impetus for increasing fishing effort without concern for sustainable limits. Coastal populations that were once almost entirely dependent on capture sources of fish have seen their resources decline, and fish have become less plentiful and less affordable in local markets (van Mulekom et al. 2006). This has led fishers to adopt short-term survival strategies such as destructive and overfishing practices, which further increase their vulnerability (Meltzer and Chang 2006). The decline of the world’s capture fisheries has also contributed to the development of aquaculture. Proponents argue that aquaculture has enormous potential to contribute to poverty reduction and food security by providing alternative livelihood opportunities for people living in coastal areas (Ahmed and Loria 2002; Edwards 2000). The increasing focus on high-value species for export, however, has raised concern over the contribution of aquaculture to the degradation of coastal ecosystems and the extent to which the poor benefit from improved technologies and increased production (Primavera 2006). The debate over the benefits that aquaculture brings to coastal communities is exemplified by the controversy surrounding the social and environmental impacts of shrimp farming (see, for example, Ali 2006; Biao et al. 2004; Stonich and Bailey 2000).

In India, coastal shrimp aquaculture has been practiced for many centuries. Traditional practices are known locally as bhasabhada fisheries in West Bengal, gheri culture in Orissa, chemmeen ketu in Kerala, and khar land farming in Karnataka, Goa, and Maharashtra. These indigenous practices were developed by local farmers to use low-lying saline lands that were unsuitable for agriculture. During the past two decades, however, more intensive forms of shrimp farming have been introduced, with production targeted at international markets (Hein 2002). In 2004, India earned over US$715 million from shrimp exports (FAO 2006). With only 13% of the area that is considered suitable for shrimp culture having been developed, many see enormous potential for shrimp farming to help raise rural incomes and contribute to the national economy (Karthik et al. 2005; Rajitha et al. 2007). Other analysts, however, point to the environmental impacts associated with shrimp farming and view it
as a serious threat to coastal communities (see, for example, Bhat and Bhatta 2004; Hein 2002). Although the welfare of the rural poor lies at the core of this debate, few community-level studies have been undertaken to investigate how shrimp farming affects rural livelihoods. This article reviews the development of shrimp farming in India and then examines the effects that shrimp farming has had on different stakeholders in communities along Orissa’s coast.

Trade Liberalization and Shrimp Farming

Following independence, India’s development strategy was one of national self-sufficiency, which stressed the importance of government regulation of the economy (Cerra and Saxena 2000). India’s trade regime was among the most restrictive in Asia, with high nominal tariffs and nontariff barriers. The average collection rate from import tariffs was 60% (Go and Mitra 1998). It was not until the late 1980s that the focus of India’s development strategy gradually shifted toward export-led growth. In 1991, owing to a series of international and domestic factors that included sharply higher oil prices due to the Gulf War, reduced remittances from Indian workers in the Middle East, and domestic political uncertainty, India found itself facing a balance of payments crisis (Kumar 2002). The government of India requested assistance from the International Monetary Fund (IMF) in August 1991. The IMF support was conditional on the establishment of an adjustment program that included structural reforms on trade policy. The government’s export–import policy plan (1992–1997) brought major changes to the trade regime by sharply reducing the role of the import and export control system. Quantitative restrictions on imports were eliminated, tariff rates were reduced, and the development of export-oriented industries was encouraged (Chand and Jha 2001).

With a population of over 1 billion people, roughly 60% of whom are involved in agriculture (Government of India [GOI] 2005), it is not surprising that restructuring the agricultural sector was a priority for the government. The main objectives of the policy reforms were to create an appropriate incentive structure for increasing agricultural production and to ensure that the initiatives undertaken complied with global trade agreements (Gulati and Kelley 1999). A key component of the reforms was to encourage farmers to diversify into the production of high value food commodities (Patnaik 1997). Similar initiatives were undertaken in the fisheries sector. Tariffs were reduced and fish and fish products could be exported under the open general license (Salagrama 2004). In addition to encouraging increased exports of capture fishery products, the government also became interested in the potential of aquaculture for increasing production and bolstering the economy in rural areas. Several pilot projects were initiated to develop low-cost fish and shrimp farming technologies for small-scale and marginal farmers. Although culture technologies were developed for several different species, only shrimp farming generated interest among farmers, owing to its potential for high profitability (Rao and Ravichandran 2001).

Although fisheries play an important role in the Indian economy, India does not have a separate national fisheries policy. Successive Five-Year Plans set out broad objectives for production and investment in the sector. In the seventh Five-Year Plan (1985–86 to 1989–90), the government introduced the scheme of Integrated Brackish Water Fishfarm Development for the expansion of brackish water shrimp culture areas. This initiative helped lead to the establishment of a large number of farms
along India’s east coast. The development of shrimp farming, however, was aided by many other factors. These include dissemination of information on shrimp farming methods, investment in ancillary industries such as feed mills and farm equipment, an increase in the number of hatcheries, and high demand for shrimp in international markets (Ganapathy and Viswakumar 2001). At the same time, subsidies and incentives in the form of soft loans, tax breaks and import tariff relaxation were provided to shrimp farmers and exporters. The export-import policy of 1992–97 allowed shrimp farmers to import technology, equipment, chemicals, and feed with simplified procedures. The government also received financial assistance from several international donor agencies including the World Bank, the Asian Development Bank, the United Nations Development Programme, the Danish International Development Agency, the Overseas Development Agency—United Kingdom, and the Government of Japan, to promote shrimp farming in the country (Algarswami, 1995). High-quality shrimp feed, which was unavailable during the 1970s and the 1980s due to import restrictions, could now be purchased from countries such as Thailand and Taiwan. As a result, many private entrepreneurs and corporations started shrimp farming in the coastal areas with the aim of making large profits quickly (James 1999). Coastal Andhra Pradesh became the center of shrimp farming, which subsequently spread to adjacent maritime states. Between 1990 and 1995, shrimp production doubled to 70,000 tonnes, and reached 117,500 tonnes by 2004 (Figure 1).

The rapid growth of shrimp farming generated many criticisms over its social, economic, and environmental implications. The controversy reached the Supreme Court of India, which made a landmark decision in 1996. It directed the state governments to demolish all shrimp farms except the traditional and “improved traditional” systems within 500 m of the high tide mark known as the coastal regulation zone (CRZ). Although traditional systems rely on whatever species of shrimp and fish are present in the tidal water, the improved traditional system stocks ponds with the shrimp seed of desired species. The court ruled that the damage caused to the ecology and economy by shrimp farming was higher than the earnings from the sale of coastal aquaculture produce (Jesurethiam 1997). According to the

![Figure 1. Shrimp production in India.](source FAO, 2006)
National Environmental Engineering Research Institute study, which was commissioned by the Supreme Court, the practice of installing shrimp farms within 500 m of the high tide line violated the fundamental rights to life and livelihood of people in the states and union territories (NEERI, 1995).

In 1997, a petition seeking a review of the Supreme Court ruling was filed by the Ministry of Agriculture, several state governments, the Marine Products Export Development Authority (MPEDA) and private-sector investors. The court issued a stay of its previous order, which required that shrimp farms within the CRZ be demolished. In the following year, the Aquaculture Authority was established at the national level to regulate and monitor activities related to shrimp farming in the coastal areas. In the ensuing years, shrimp farming has continued to expand along India's coastline, which is reflected in the steady growth in production (see Figure 1).

Community Survey

Located on India’s east coast, Orissa has 480 km of coastline that encompass 7 coastal districts. The state’s population in 2001 was 36.7 million, with a per capita income of US$250 (GOI 2002). Orissa is considered to be one of the most backward states in the country in terms of social and economic development. Approximately 47% of the population lives below the poverty line of US$104 per year, compared to a national average of 26% (GOI, 2002). The state's economy is largely based on agriculture, which provides 80% of rural employment and more than half of the state’s income. The fisheries sector plays a smaller role in the state’s economy, but nevertheless provides income and employment to more than 1 million people (Government of Orissa 2002). The state government has played a leading role in promoting shrimp farming. In each of the seven coastal districts, a Brackishwater Fish Farmers Development Agency (BFDA) has been established, which identifies potential culture areas and provides technical guidance to farmers. Approximately 12,800 ha of the 32,600 ha of land in Orissa that have been identified as having potential for brackish water aquaculture have been developed (Government of Orissa 2002).

The community survey was carried out in Chandabali Community Development Block of Bhadrak District (Figure 2). According to the 2001 census, this block has a population 217,459 and contains 285 villages. Semi-intensive shrimp farming began in 1992 with the establishment of eight large corporate farms. These investors were attracted to the area by two main factors. First, land along the coast was inexpensive due to the area’s low population density and its limited suitability for rice production. Second, the construction of a paved road by India’s Department of Defense from Highway 5 (the main link between Chennai and Kolkata) to a coastal military base provided ready access to urban-based processing plants and markets.

The financial success of the corporate farms did not go unnoticed by local farmers, as it was in sharp contrast to the meager incomes they obtained from growing rice. Although a rice farmer could earn a profit of US$150 per crop from 1 ha, a shrimp farmer could earn a profit of US$9000 per crop from the same amount of land, which is about 60 times more. With artificial feed, chemicals, and equipment now available in local markets, and shrimp culture training being provided free by feed companies and seafood exporters, increasing numbers of rice farmers began to construct shrimp ponds. By 2002, shrimp culture was being practiced by 600
farmers spread over 35 villages in Chandabali block (Figure 2). Only 56 farmers, however, held a license from India’s Aquaculture Authority to practice shrimp farming.

In this study, shrimp farmers were divided into four categories based on farm size. Two hectares or more of shrimp pond area was considered a large-scale farm, 1–2 ha a medium-scale farm, 0.5–1 ha a small-scale farm, and less than 0.5 ha a marginal farm. Of the 600 shrimp farmers, 20 were large-scale, 110 medium-scale, 240 small-scale, and 230 were marginal. In addition, there were eight corporate farms, of which only five were in operation. The total area under shrimp farming in 2002 was about 500 ha, of which 80% was under semi-intensive production. These ponds range in size between 0.25 and 1.0 ha, and are stocked at 5–20 postlarvae (PL)/m². Pellet feeds are used, with average yields being in the order of 2200 kg/ha/crop. The remaining farms practice the “modified extensive” system of shrimp farming. In this system, ponds are constructed in the tidal affected low-lying areas, and vary in size from 1 to 2 ha. Ponds are prepared with tilling, liming, and fertilization. Pellet feeds are provided during the grow-out phase. Stocking density is about 5 PL/m². Yields vary from 600 to 1100 kg/ha/crop. A maximum of two crops are grown per year for either production type, depending on the availability of saline water.

Personal interviews were conducted with 60 shrimp farmers from 11 shrimp farming villages (Table 1), which were selected randomly along coast (see Figure 2). Respondents from each category of shrimp farmers were selected randomly from the list of farmers in these villages. Interviews were conducted with the family member who was responsible for the farm operation. Invariably, this was a male.
Interviews with rice farmers were undertaken in the same villages. Since an up-to-date list of rice farmers was not available, potential respondents were identified in consultation with village leaders. Farmers were then randomly selected from this list. In total, 40 rice farmers, all of them men, were interviewed.

Results and Discussion

Shrimp Farming and Local Employment

One of the main rationales for promoting shrimp farming in India was that it would diversify local economies and create income and employment opportunities for the coastal poor. In particular, it is argued that shrimp farming increases the opportunity for local men and women to engage in wage labor either on the farm site or in related support activities such as shrimp processing and marketing (Kumaran et al. 2003). We found, however, that very few employment opportunities have been created for people in Chandabali. When shrimp farming was first introduced, many unskilled laborers were needed for pond construction. Such employment is seasonal, however, and is available only when the shrimp industry is expanding. While there continues to be some growth in pond area, we found that mechanization is replacing manual labor. Over 65% of the shrimp farmers interviewed used tractors to excavate their ponds. They believed that the ponds would be completed faster, and that the pond floors would be smoother, resulting in less chance of water leakage compared to ponds constructed using manual labor.

In comparison to agriculture, shrimp farming is not labor intensive. Fewer laborers are required per hectare. Moreover, on-farm employment is directly tied to the sustainability and profitability of what can only be described as a very risky industry. At the time of our survey the 3 largest corporate farms, which accounted for 64% of the pond area under corporate ownership, had been abandoned due to...
problems with disease. Two of the remaining 5 farms, which accounted for another 18% of the corporate pond area, were only partially active. This left the smaller scale operations as the main potential employers. Many of these farms, however, are family operations that have a limited need for local labor other than for specific tasks such as crop harvesting. The latter is a seasonal opportunity that provides a laborer with 3 or 4 days of employment every 4 months. While shrimp farm security offers longer term opportunities for wage labor, few of the farmers hire local people to guard their ponds.

Contrary to popular belief, shrimp farmers do not pay high wages. Laborers on rice farms receive between US$1.50 and US$1.75 per day, while shrimp farmers pay roughly US$1.10 per day. Shrimp farmers are able to pay a lower wage as laborers prefer to work on shrimp farms. Shrimp farm employment is relatively long-term (4 months or more) compared to rice farming, which requires wage labor at specific times—planting and harvesting. Moreover, employment on a shrimp farm, be it for pond maintenance, feeding, etc., is not nearly as physically demanding as planting or harvesting rice. In order to attract laborers, local rice farmers have had to raise their wages.

Kumaran et al. (2003) suggest that shrimp farming provides jobs for local women. We found no evidence of this in Chandabali block. Indeed, the low level of involvement of women in shrimp farming is in sharp contrast to their highly visible roles in rice farming and fishing. In rice farming households, women participate in weeding, harvesting, processing, and marketing. In traditional fishing households, the men go to deep water to catch fish, while the women sort, dry, package, and market the catch. In the case of shrimp farming, however, women are not involved. There are several reasons why shrimp farming in India is a male-dominated economic activity, some of which are both cultural and practical. First, shrimp farms are usually located at distance from the villages. Workers travel back and forth and/or stay overnight on site. As women are responsible for child care and food preparation for the family, they simply cannot add this component. In addition, many farm areas are quite isolated and it is not considered safe for women to stay over night.

A few local women are involved in collecting *Penaeus monodon* shrimp seed (postlarvae) from seawater, a task that is very seasonal and required only during the time of stocking. This seed is sold at a lower price than that charged by hatcheries, as it is considered to be more risky. Wild-caught seeds are not screened for the presence of viruses or other pathogens that could result in the loss of a shrimp crop. Postlarvae from a hatchery cost US$9.00 per thousand, while wild seed costs roughly US$6.50 per thousand. Seed collectors who do not have a storage facility may sell for as low as US$4.50 per thousand. The lower price provides a strong incentive for small-scale and marginal farmers to purchase wild-caught seed.

Although seed collection supplements the incomes of several households in Chandabali, this activity is very controversial. Collectors use nets with a mesh size of less than 1 mm and capture *P. monodon* fry along with the juveniles of many other species of finfish and shellfish. The latter are sorted out and discarded on land. In order to catch one postlarvae shrimp, hundreds of other fry may be destroyed (Bhattacharya and Sarkar 2003; Hein 2002). Destroying the juveniles of commercially and ecologically important fish and shellfish on such a large scale could have a significant impact on biodiversity and capture fisheries production in the area over the long term. Studies at Chilika Lake in southern Orissa suggest that shrimp fry collection has
already depleted the stock of fish, shrimp, and crab in the lake (Samal 2002). During informal discussions held with traditional fishers in Chandabali block, many indicated that they were very concerned about the impact of shrimp fry collection on marine fish stocks and how this would impact on their livelihoods in the future.

**Socioeconomic Differentiation**

The perceived potential for high economic returns from shrimp farming has attracted many investors. These investors, however, are not all on equal financial footing, which is reflected in their farming and marketing practices. Most of the large-scale farmers have invested their own money or have access to commercial lending institutions, which means that they can sell their crop directly to exporters without interference from middlemen. They also are better able to invest in more advanced production methods. About 70% of the large-scale farmers interviewed treat their intake water. They also use aerators to support higher stocking densities, employ a variety of chemicals to help protect their crops from disease, and have built crab nets in order to improve biosecurity. They often hire technicians trained in aquaculture to look after their shrimp ponds. These factors allow them to use relatively higher stocking densities (10–20 pieces of postlarvae/m², compared to 5–10 pieces/m² for small-scale and marginal farmers), which provide higher pond yields at lower production costs per unit. The large-scale farmers also purchase their postlarvae from hatcheries. Hatcheries are able to conduct a polymerase chain reaction (PCR) test to detect the presence of any virus.

The situation for small-scale and marginal farmers is quite different. They simply do not have the financial resources needed to purchase advanced technologies and technical assistance. As the majority of them have no formal training in shrimp farming, they often rely on “local experts.” One government biologist indicated that these “experts” have sometimes recommended pond treatments that are lethal for the shrimp crop. About 77% of the small-scale and marginal farmers interviewed do not treat their intake water, which increases the risk of introducing waterborne pathogens to their ponds. In addition, roughly 58% of them purchase postlarvae collected from the wild, which again increases the risk of disease and places the farmers at greater financial risk. About 82% of the small-scale and marginal farmers interviewed had an outbreak of disease at least once in the past 5 years, compared to 60% for the large operations.

Financing a shrimp pond is a considerable challenge for investors who lack their own capital. Because it is difficult to obtain loans from the commercial banks, many shrimp farmers have had to look to local sources of capital. Overall, 70% of the shrimp farmers interviewed had borrowed money from shrimp feed agents, and another 12% had borrowed from local financiers. As noted in Table 2, however, small-scale and marginal farmers had the greatest reliance on local lenders. This type of borrowing has a large negative impact on their incomes. One of the conditions imposed by feed agents is that farmers must sell their crop to the agent who provides the loan. When the farmer purchases feed, fertilizer, and other inputs on credit, the typical markup over the usual market price is about 10%. When purchasing the harvest, the agent pays roughly 4–5% less than the prevailing farm gate price for shrimp. The agent also collects 10% of the volume harvested as a commission.

The financial data collected indicates that for every 100 kg of shrimp harvested, a farmer grossed US$534. If debt free, a farmer would realize a net profit in the order
of US$245. If the farmer purchased feed on credit, however, the payment made to the feed agent to cover the extra markup on feed, the lower farm gate price, and the 10% crop commission would reduce his profit to US$147. The agent also makes a profit from the sale of the harvest to a middleman. It is not uncommon, therefore, for feed agents to have higher profits from a successful harvest than the farmers, and without assuming any of the risk. Should a shrimp crop fail or international market prices fall, the farmer remains indebted to the feed agent. The financial situation of the farmers is further aggravated by the fact that many feed agents are not in any hurry to pay for the shrimp. About 68% of the farmers interviewed did not receive payment for their crop at the time of harvest. The average waiting period was 3 months, which imposed considerable financial hardship on the households. Although this situation might suggest that farmers should look elsewhere for capital, borrowing from local money lenders is also an expensive proposition. The monthly interest rate is 5% (60% per year). In a period of just 4 months, farmers typically owe the lender one-third of their gross income in interest for the cost of feed only. Should a crop fail, a farmer who borrows more money to start another crop can quickly amass a very large debt. Three farmers (one medium and two marginal farmers) indicated that due to crop failure they had to sell their land (rice fields) to pay for their loans.

### Degradation of Coastal Resources and Environment

Coastal ecosystems, which typically include wetlands, mangroves, and estuaries, are very fragile environments. The excavation of shrimp ponds, construction of service roads, and discharge of shrimp pond effluents into freshwater areas, among other things, can have a significant impact on these resources. In turn, the degradation of coastal areas due to the introduction of shrimp farming can have a negative impact on the welfare of local people who depend on these resources for their livelihoods. Although national regulations have been enacted to prohibit shrimp farming in sensitive areas, there is little enforcement of these regulations at the local level.

In Chandabali block, shrimp farming has physically blocked traditional users’ access to common property coastal resources, including mangroves, wetlands, and capture fishing grounds. This lack of access has a significant impact on people’s welfare. There are also nonincome effects. Female respondents indicated that the effort required to collect firewood and fodder has increased because access to mangrove forests has been blocked, and because of the degradation of those mangrove forests that are still accessible. Prior to the development of shrimp farming the women

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### Table 2. Sources of capital for shrimp farming

<table>
<thead>
<tr>
<th>Farmer type</th>
<th>Invested own money (%)</th>
<th>Borrowed from feed agent (%)</th>
<th>Borrowed from local financier (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large-scale</td>
<td>5 (50)</td>
<td>3 (30)</td>
<td>2 (20)</td>
</tr>
<tr>
<td>Medium-scale</td>
<td>3 (25)</td>
<td>9 (75)</td>
<td>–</td>
</tr>
<tr>
<td>Small-scale</td>
<td>2 (10)</td>
<td>14 (74)</td>
<td>3 (16)</td>
</tr>
<tr>
<td>Marginal</td>
<td>1 (05)</td>
<td>16 (84)</td>
<td>2 (11)</td>
</tr>
<tr>
<td>All categories</td>
<td>11 (18)</td>
<td>42 (70)</td>
<td>7 (12)</td>
</tr>
</tbody>
</table>
would typically travel 2–3 km to collect firewood. Now they must travel 5–6 km. As most of the wetlands have been converted to shrimp farms, women are no longer able to collect fish from these areas. Generally, this has meant that the contribution made to household income by women has been declining. Local people also find it difficult to access grazing land for their domestic animals, as most of the wetlands and village common lands have been converted to shrimp farms.

Shrimp farmers use a wide range of chemicals, fertilizers, and drugs in an effort to keep their shrimp crop healthy. The effluent from the shrimp ponds carries with it a mix of pollutants. These include, but are not limited to, excess lime, organic wastes, pesticides, chemicals, and disease microorganisms. All these wastes end up in the surrounding local water bodies, either through periodic pond water exchange or at harvest when the ponds are drained. The release of such by-products adversely affects local water bodies and marine life. Our survey found that the use of chemotherapeutics by shrimp farmers in Chandabali is a common practice. Although the government of India has banned 20 chemotherapeutics from use by shrimp farmers, only a few of the respondents were aware of this regulation. This finding comes at a time when the major shrimp importers such as the European Union, the United States, and Japan are becoming increasingly intolerant of chemical residues in shrimp. Farmers who continue to use the banned chemotherapeutics may soon find that they can no longer obtain access to international markets.

Local people believe that the production of rice is declining due to cropland conversion from paddy fields to shrimp farms. About 68% of the shrimp farmers interviewed stated that their shrimp farms were previously used for rice cultivation. As most of the coastal lands have been converted to shrimp ponds, shrimp farmers are now moving inland to develop new sites. In addition, about 38% of the rice farmers interviewed reported that rice production had declined because of salinization of their paddy fields from neighboring shrimp farms. That said, it is very difficult to obtain accurate data on the extent to which shrimp farming has affected production of rice. Many other factors may account for the relatively low rice yields that farmers are now experiencing. Nevertheless, such strongly held opinions can have an important impact on community relations and provide impetus for policy change. Many rice farmers thought that the government should ban shrimp farming in rice growing areas.

Conclusions

Trade liberalization has been promoted as means of spurring economic growth and reducing poverty. Within the fisheries sector, increased trade most certainly has the potential to be an important source of foreign exchange as well as to provide improved livelihood opportunities for the poor. The extent to which the latter is realized, however, depends greatly on how the gains from increased trade are distributed. The rapid increase in shrimp production to meet global demand has provided India with badly needed foreign exchange. This study has shown, however, that the benefits and costs associated with increased production and trade in shrimp are highly unevenly distributed within rural communities. From the perspective of the poor, shrimp farming has provided few tangible benefits. Indeed, in Chandabali block, shrimp farming is creating an increasing inequality in employment opportunities and incomes. Those with better skills and more resources have benefited most. For most women the quality of employment is poor, with very low incomes.
and limited opportunities for skill development. Moreover, local incomes from pre-
existing livelihood activities such as fishing and farming may be affected negatively
by the loss of habitat and environmental degradation. Any benefits related to broad-
ening the economic base of rural areas, generating local employment, enhancing
food security, and conserving local environments are minor.

Whether the shrimp industry can become a stable and environmentally benign
source of income for the coastal communities will ultimately depend on the practice
of sustainable forms of farming methods and strong cooperation among the small
and marginal farmers. To achieve these, India has to develop and implement strict
environmental regulations on several fronts. These include the integration of shrimp
aquaculture into coastal resource use and development plans, and improvements in
food safety and quality controls. These are needed both to safeguard local consumers
and to secure access to international markets. Farmers must be encouraged to
improve their pond management practices and to reduce their environmental impact.

Presently, small and marginal farmers lack technical background and access to
credit from commercial financial sources. This has put them in a financial squeeze
where they are forced to pay more for farm inputs, and also receive less for their
product. It is difficult to empower each farmer or to solve the problems at an
individual level. One option could be to establish cooperative societies at the local
level to manage the shrimp farms collectively. A group farming approach, which
relies on synchronized farming operations and collective management by the farmers
of a locality, has been found successful in Kerala; production has been increased
and costs reduced by improving access to the input market (Srinath et al. 2000).
The other advantage is that the cooperatives can negotiate with commercial banks
for credit, with feed companies for required inputs at a reasonable price, and with
seafood exporters for marketing the shrimp.

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