

Beyond the pond, beyond the state: improving governance of the shrimp aquaculture production-consumption system

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Version: 21 Jul 04

Abstract

The sustainability of the shrimp aquaculture production-consumption system has been seen first and foremost seen as a technical problem solvable by better engineering, management systems, and regulations, particularly at the outgrowth pond stage. Interventions through food safety standards and trade have targeted pond practices and harvesting techniques of capture fisheries. In Thailand and Vietnam the role of smaller farms, traders and suppliers as well as local communities and wider public in decision-making about coastal zone development and regulations of shrimp aquaculture, has been small. The state, on the other hand, has had much closer relationships with processing and export firms, whether as larger independent companies in Thailand, or state enterprises in Vietnam.

In this paper we argue that institutional and governance innovations to improve sustainability of shrimp aquaculture need to go beyond the pond and the state. They need to start in the ocean where many critical inputs are derived and end on the plate where consumers have the final say on what is eaten or not. They need to consider the interests of not only producers and consumers, but also of intermediate firms in the supply chain, and other affected and concerned people. Perhaps the most significant change required, however, is to draw critical attention away from a focus on ideal rules and sets of incentives towards improving the processes by which decisions about institutional arrangements are actually made and implemented. This applies both to local coastal zone management and international trade and environment negotiations.

Key Words

Shrimp aquaculture; industry networks; commodity chain; governance; Thailand; institutions; sustainable development; production-consumption systems; coastal zone management; fisheries;

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1 Introduction

The rapid growth in production, trade and consumption of aquaculture-raised shrimp largely unfolded in the absence of effective institutional arrangements that could make the industry environmentally sustainable.

There were at least four key reasons for this.

First, is the speed with which the industrialized production systems entered and reconfigured livelihoods and economic organization in coastal regions. In the developing tropical countries, where most production occurs, environmental bureaucracy, regulations and environmental monitoring capacities were comparatively limited. Moreover, the shrimp aquaculture industry quickly became a major source of foreign exchange earnings, and lucrative returns to some producers, and key suppliers of inputs. Not surprisingly government regulatory actions lagged behind promotional activities and private sector initiatives (Lebel et al. 2002).

Second, most of the attention has been focused on the outgrowth farming practices, or on individual parts of the commodity chain, such as food safety in processing. This has not made the best use of potential leverage within the production-consumption system for improving sustainability. The shrimp commodity chains stretch across disparate parts of the globe and involve extraction of multiple resources and pollution of several sinks along the way (Lebel et al. 2002). Each part has its own governance arrangements.

Third, is that successful production of shrimp in aquaculture systems is directly dependent on several goods and services obtained from coastal and marine ecosystems that are not easily substitutable and are in danger of being irreversibly over-exploited. These are services often obtained at very low costs, and so undervalued in aquaculture commodity chains (Naylor et al. 1998, 2000). These include the water treatment services to remove excess nutrients and more resistant pollutants provided by coastal aquatic ecosystems, nursery habitats for wild larvae used for stocking and the fish and shrimp that are the main components of feed (Primavera 1998).

Fourth, the problem does not lie just in changing the “rules of the game”, but also in the processes by which these rules are negotiated and agreed upon, or mechanisms of governance. Sustainability of shrimp aquaculture has been seen, first and foremost, as a technical problem solvable by experts, even where issues of institutional design and incentives are concerned. The assumption has been that regulation is the “state’s responsibility” and, where this capacity is insufficient, that “industry” should self-regulate in their own interests. The interests of affected people not directly involved in the commodity network, has usually been overlooked (Vandergeest et al. 1999). Participation when it has been invoked has primarily been seen as a means (cf. Parfitt 2004) of gaining support or compliance to goals set by the state or industry.

Taking these four points together, in this paper, we will argue that institutional innovations to improve sustainability of shrimp aquaculture need to go beyond the pond. They need to start in the ocean where many critical inputs are derived and end on the plate where consumers have the final say on what is eaten or not. We also argue they need to go beyond the state and its close linkages with agri-business. Small-scale farmers, hatcheries and traders, as well as the local communities where farms and factories are sited, consumers and broader civil society including the international research community, could contribute a lot more than they have to improving the sustainability of the industry. Although the primary focus of this paper is on the development of the industry in Thailand, to explain the changes and constraints, we often need to examine the behavior of firms, consumers and civil societies in importing consumer nations.

Our approach is as follows. First, we describe the main components and linkages of the shrimp production-consumption system surrounding production in Thailand and Vietnam and then summarize the key sustainability issues that have arisen. Second, we identify some of the main underlying causes of environmental governance failures related to shrimp aquaculture. This provides both about the industry itself but also about wider issues of environmental governance in Thailand in

general. We end the paper with a synthesis of ways governance might be improved and the implications this would potentially have for sustainability. As such, this paper is as much a critique of civil society as the state, for without significant participation from local communities involved in, and affected by shrimp aquaculture, both in producing and consuming societies, the prospects for improving environmental governance remain weak.

2 Governance and the sustainability of agro-industrial networks

2.1 Industrial networks and value chains

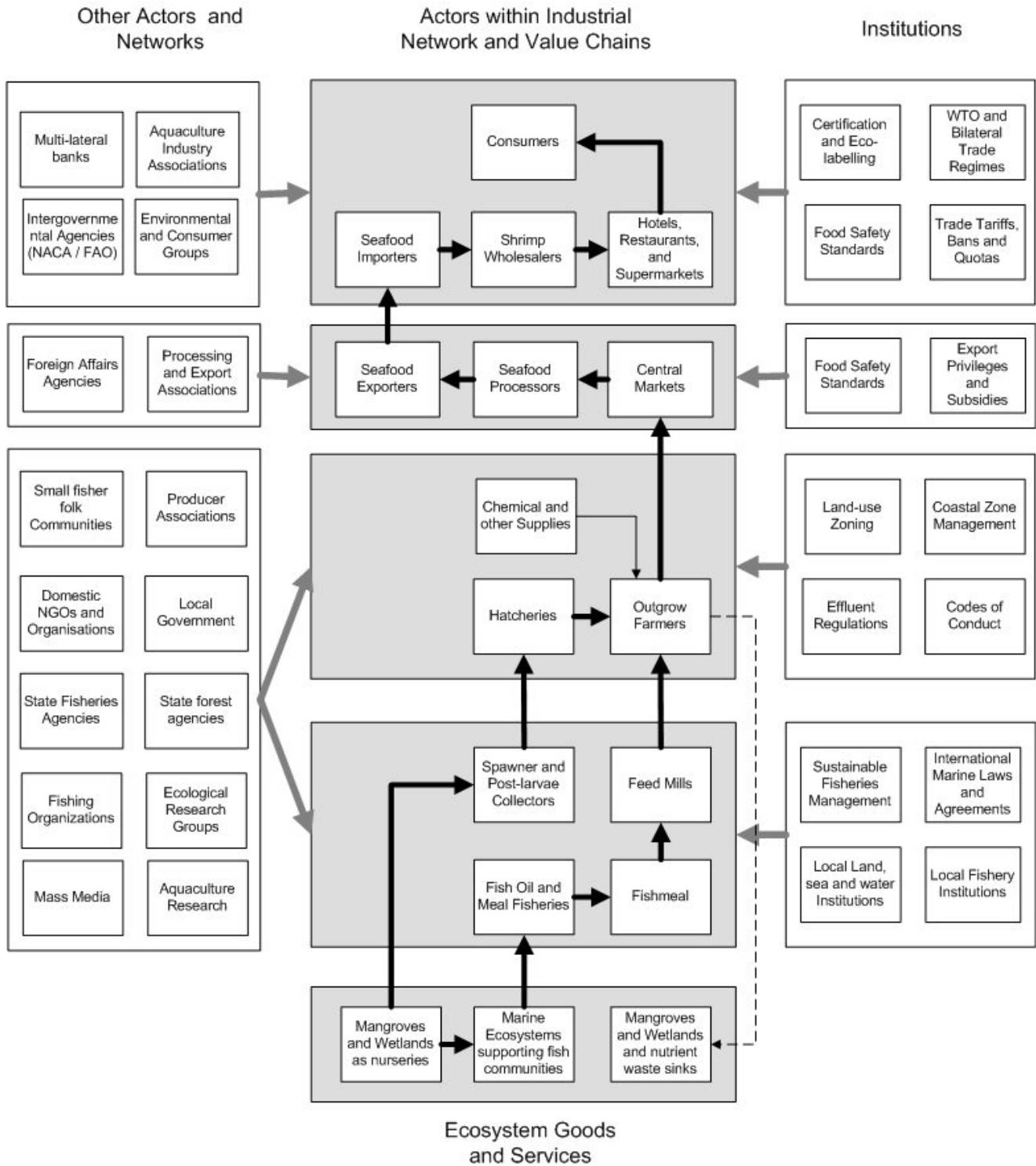
The shrimp aquaculture production-consumption system is an industrial network with both strong linkages typical of manufacturing and other processed food systems, and weaker linkages characteristic of conventional farm-based commodities (Lebel et al. 2002). The value-chain image of production-consumption chain draws attention to material flows and the vertical dependencies between different firms (Figure 1, dark arrows). The food processing, export and retail sector is, comparatively, dominated by large firms. Concentration and vertical integration has been a feature of globalization in agri-food sector over the past decade including shrimp (Goss et al. 2000). Nevertheless, there often a surprising number of alternative channels from the feed inputs from Peru through to shrimp reared in Thailand or Vietnam to being consumed in Japan once the complexity of wholesalers, intermediate markets and retail outlets in the consuming countries are taken into account (Kagawa 2003, Lebel et al, in prep.)

Apart from those parts of the chain with significant vertical integration there is also substantial horizontal integration, especially in Thailand, among feed and chemical and pharmaceutical companies. Vertical integration in Vietnam is heterogeneous and qualitatively different. Several value chains in north and central Vietnam were initially dominated by state enterprises. The level of specialization and differentiation, however, is modest. Although the upstream parts of the system in Southeast Asia are dominated numerically by small owner-operated enterprises many of these have also begun to organize into informal and formal, often place-based, associations. In several areas in the Ca Mau peninsula of Vietnam, in contrast, farmers ponds were originally organized through leases in state enterprise projects. Over the past 4 years (2001-4) many of the developments have taken on characteristics more similar to the intensified, individual owner-operated, small enterprises typical in Thailand. The role of these sub-networks in spreading innovations and exchange of market and other information should not be underestimated.

A common idea in the supply chain environmental management and industrial ecology literature is that efforts taken by a larger “central” firm in a network can spill-over into their supplier and retail networks (e.g. Pesonen 2001). Large multinational firms in these central roles are often under scrutiny from NGOs, employees and environmental regulators and so often must make moves towards greening first. When they do they may preferentially seek partnerships with, or train, smaller suppliers which are willing adopt particular environmental management system or standards. Whether this model can help in shrimp aquaculture is, however, far from clear as many small farming enterprises appear to have weak and unstable links with suppliers, traders and processors. This makes investments in improvements by the larger firms in particular small suppliers harder to justify.

It is not only actors directly within the value chains through which inputs and “shrimp” flow that matter, but also various coalitions of actors attempting to influence the network (Figure 1, left column of boxes) . This includes both state, private sector and civil society organizations and their networks. For the most part, like regulations and institutions (Figure 1, right column of boxes), they deal with only restricted parts of the overall agro-industrial network.

Figure 1 Key structures and actors in the shrimp aquaculture production consumption system.



2.2 Sustainability challenges

Much has already been written about the sustainability challenges posed by the industrialization and intensification of shrimp aquaculture (Lebel et al. 2002). In Table I we classify some of the key issues.

Table I. Sustainability issues, at various positions along the shrimp aquaculture commodity web. The relative importance of these issues are summarized on a crude three-point scale from low to high (--,-,+,++)

	From Sea to Pond	At the Pond	From Pond to Plate
Main Ecological Sustainability Issues	(--) Fisheries for fishmeal and fish oils to be used in shrimp feed compound problems of over-harvesting; (-) Sufficient quality mangrove habitat to serve as nursery for spawners and healthy wild shrimp populations;	(--) Nutrient-enriched effluents, and occasionally containing other chemicals, has adverse impacts on aquatic and coastal ecosystems; (--) Sediments dumped into common water ways and mangrove creeks degrading habitat and access for small scale fisheries (--) Discharge of saline water, affecting productivity of rice, sugar palm and other neighbouring land-uses (---) destruction of mangroves and other wetland habitats during conversion to intensified shrimp aquaculture	(-) Local water pollution from processing operations; (-) Conventional energy emissions in processing, transport and storage (-) Waste packaging
Main social and economic sustainability issues	(-) When prices push fishmeal and oil sourcing from near Thailand competition with local food markets as well as capture fisheries affects livelihood security of smaller scale fisher folk;	(--) Reduced access of poor to wetland resources especially women (--) degradation of resources upon which livelihoods of poorest households depend (-) pressure from fishing trawlers confounds pressure from land-based shrimp activities on small scale fisheries	(-) impact of international trade agreements and standard setting by consumer countries changes competitiveness of exports among countries (-) various factors favoring concentration of ownership making it harder for small traders, distributors and retailers; (-) insecure employment for young women in factories ;

2.3 Environmental Governance

In this paper we use the term environmental governance to describe the ways society organizes to use power to manage natural resources and the environmental *and social* impacts of their use. It includes the activities of not only governments, but also other actors, including business, non-governmental and international organizations and networks or communities of affected and concerned people each with competing claims to authority over particular issue areas.

Governance thus involves many social structures and processes that influence how decisions are made, rules enforced, conflicts resolved and projects funded, monitored and evaluated. The interplay between actors and institutions can be complex especially when several scales are involved -- as is typical for decision-making over commodity chains.

Given the complexity of the shrimp production-consumption system (Figure 1) it is obvious that governance doesn't come directly from careful planning or purposeful design by some over-arching body, but rather emerges from the interactions of actors with formal and informal institutions. While most of the attention in the past been given to formal institutions, such as laws, regulations and codes of practice, in many cases, we will argue, it is the more informal institutions, the business norms in a particular part of the industry, the social norms of the society in which their operations take place, and the political norms for openness and fairness, that matter most. This makes analysis less straightforward as our questions must be, in part, indirect addressing outcomes and what people, to understand better processes that may not very visible. To this end we offer an initial framework of questions to ask about the production-consumption system (Table II).

Table II Framework of questions about environmental governance in production-consumption systems.

1. *How are environmental and social sustainability problems identified, and by whom? Whose, and what type of, solutions are considered?*
 2. *How are involuntary risks and expected benefits distributed? How have institutional changes affected customary and legal access and rights of different groups?*
 3. *To what extent, and by what means, are different stakeholders and affected persons involved in decision-making? Are the processes of negotiation, conflict resolution and compensation transparent and fair? Do deliberative or coercive processes dominate?*
 4. *How are actors networks in business, state and civil society organized? Is the system capable of self-organization, or is a strong state regulatory presence essential for sustainability? What have been the impacts of centralized state planning?*
 5. *What mechanisms are there for handling cross-scale interactions, or institutional interplay, in particular, arising out of differences in interest and competition across disparate parts of the commodity chain?*
 6. *What roles have research-based and tacit or experiential knowledge systems had in changing perceptions of risks, opportunities and sustainable practices? What are the principal pathways for vertical (along the chain) social learning ?*
 7. *What are the most important ecosystems and environmental feedbacks or linkages to which institutional arrangements should or need to respond for the overall production-consumption system to be sustainable? Are these linkages growing more or less visible?*
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3 Shrimp aquaculture ¹

The history of shrimp aquaculture production is littered with environmental and social development governance failures. These have systemic causes arising from a lack of accountability, transparency and justice in patterns of social organization, locally and in the formal political system. There is a strong perception that individuals can do what ever they want on private land regardless of consequences to others, that water and the sea is for all to use for free.

3.1 From the sea to the pond

One of the less well known, but perhaps most critical impacts of the industry noted in Table I is the impact that aquaculture of carnivorous species like shrimp and salmon has on wild stocks because of the current need for high level of fish meal and fish oil in the artificial feeds used in production (Naylor et al. 1998, 2000). Earlier claims that most of the by-catch used in fish-meal production is not eaten are false as many species are consumed in developing countries, like Thailand. In any case, many fisheries and coastal ecosystems around the world are in a serious state of decline (e.g. Jackson et al. 2001; Bellwood et al. 2004) and the harvesting for shrimp and shrimp feed has not helped. Efforts to substitute fish-based inputs with vegetable-derived protein are technically feasible, but as far as we know, their have been no major efforts to directly regulate composition of feeds or promote “sustainable” sourcing labeling schemes in Thailand. Such initiatives may have to be directed at

¹ This should include one or two points about marine governance: law of the sea, economic exclusive zones, shrimp trawling restrictions and conflicts;

animal feed industry as a whole and not just shrimp to be effective in helping with marine conservation.

Finally, a key constraint on the industry in Thailand, while it has been dependent on black tiger prawn (*Penaeus monodon*) has been availability of ocean-caught spawners to supply hatcheries, which can make up to about half of the total operating costs of a hatchery. While success at completing multiple-life cycles in captivity remains restricted to a few research and commercial laboratories this remains a vulnerable part of the system.

Hatcheries have a major interest in the performance of the outgrowth ponds they service. They can ill afford a bad reputation among farmers. For this reason they are often very active in providing information and advice about rearing practices and conditions. In the next section we look in detail at the range of issues surrounding the out-growth pond stage, but this link between hatcheries and pond operators should not be forgotten as it remains an important leverage point for improving practices in both directions.

3.2 At the pond

From institutional gap to bureaucratic contest

Environmental governance in the coastal zone has emerged from a history of neglect. The state traditionally placed little value in the ecosystem goods and services that derive from wetlands, mangroves, coastal rivers, and estuaries. As a consequence there were few regulations and little interest in developing land considered as “wasteland” unless it could be easily converted into more productive uses. As a consequence wetlands and mangroves have historically fallen into organizational and institutional gaps. Thus, in Thailand, while the Royal Forestry Department eventually came around to taking responsibility for mangrove forests, the Department of Fisheries handled coastal and marine ecosystems as well as inland fisheries, but the Irrigation Department has responsibilities for river ecosystems and riparian habitats, and finally the Department of Pollution Control has responsibilities for water quality monitoring.²

The fact that aquaculture did not clearly fit under a single legal framework or agencies’ jurisdiction made matters especially challenging. Should aquaculture be controlled by intensive agriculture, forestry, fisheries or industrial legislation? The institutional dilemma apparent in Thailand (Flaherty & Karnjanakesorn 1995) and Vietnam (Lebel et al. 2002) was also an important factor in poor regulation of land conversion and water management.

The rise of shrimp farming as a profitable “national” enterprise, and an opposing conservation and local livelihoods discourse, altered the values given to mangroves and coastal waterways. For more than a decade these areas are a subject of an on-going territorial war between different parts of the state bureaucracy. The Director-General of Fisheries in 2001, could demand that degraded mangrove forests be turned over by the Forestry Department, so they could be converted into shrimp farms (Samabuddhi 2001), while his counterpart, The Forestry Chief, was appealing for more funds to reclaim and recover mangrove forest reserves for reforestation. During the development of the industry the government has frequently altered and reversed policies in response to inter-agency, corporate and NGO pressure (Ridmontri 1996, 1997b; Huitric et al. 2002). Improved access to, and capacity to use, remote sensing imagery to monitor coastal land-use changes has played a role (Vandergeest et al. 1999).

In Vietnam the bureaucratic contest between fisheries and forestry agency interests has been similar with the two parts of the state often working at cross-purposes. The adoption of the Ten Year Aquaculture Development Programme by the Vietnamese Ministry of Fisheries in 1999 marked the beginning of larger scale state investment and promotion in the industry. As recently as 2001 several of the targets set were revised upwards despite on-going conflicts with EU over antibiotic residues in

²² Include a comment about Vietnam here;

exports. Although most of the plans target rice farms for conversion to higher value shrimp, research shows that significant areas of mangroves are also being cut and destroyed (Thoa et al. 2003).

Land and water in the coastal zone

Ownership patterns of land use for ponds are complex. Although there is a large number of spatially discrete small and medium-scale farms, and only a handful of very large corporate farms, in-depth inquiries about ownership often reveal investors with multiple holdings in different locations, often through renting, but again this also varies greatly from region to region within Thailand (Vandergeest et al. 1999; Lebel et al. 2002). Pond managers that take care of day-to-day operations are not necessarily those making the major investment decisions. Moreover, each time shrimp prices rise or there is a major disease outbreak there is substantial turnover in land-users. Although in the mid-90s most contract farming systems had failed in 2000-2003 several new large contiguous areas came under direct control of larger firms along the eastern coast of Southern Thailand. Despite some consolidation of ownership, however, Vandergeest et al. (1999) characterization of the pond stage as numerically dominated by smallholders remains a fair generalization for Thailand.

Failures of governance have also arisen from incomplete solutions that rely on solely on engineering and wishful thinking about technology uptake and the capacity of humans to manage manipulate and restore ecosystems. One of the more ambitious engineering schemes to reduce conflict among shrimp and other land-uses, as well as deal with several other land management problems, was the large tidal dam and set of dykes and canals constructed in Pak Phanang, Nakhon-sri-tammarat province. The dam embarrassingly flooded the downstream town Pak Phangang in its first days of operation. Dykes to separate fresh and salt-water rearing areas are claimed to have disrupted natural spawning. In any case the ability for shrimp farmers to now rear-shrimp in freshwater after a short acclimatization period means that the barriers to inland farming and access to saline waters have been largely removed. In 2003 villagers called for dykes to be opened to rehabilitate rivers ecosystems and allow time for a complete re-evaluation of the project (Samabuddhi 2003).

Many institutional solutions to problems of declining water quality from shrimp farm effluent have been proposed. Most suffer from focussing on the “rules” rather than the process by which rules are formed and introduced. For example, a tax on feed could reduce food conversion ratios resulting from wasteful feeding practices (Brennan 2002) or a tax on shrimp seed stock to discourage high stocking rates (Thongrak 1997). The industry would resist and likely block any such instruments. Direct regulation of effluent depends on ability to monitor and enforce infringements. It has not yet been attempted in Thailand, and is unlikely to be realistic option given large number of independent producers and need for frequent sampling to cope with high variability of nutrient concentrations in effluent (Brennan 2002).

For the most part the various zoning declarations that were introduced in Thailand to reduce conflict with conservation or other land-users were rarely enforced (Vandergeest et al. 1999). This changed dramatically when shrimp farmers began culturing in low-salinity environment of the central plains north of Bangkok (Flaherty et al. 1999). With the “rice-bowl” of Thailand under apparent threat the media and public interest soared. The National Environmental Board used provisions under the 1992 Environment Act to order Provincial Governors to ban shrimp farming in fresh-water agricultural areas (Flaherty et al. 1999). An intense, polarized debate followed among government agencies with coalitions forming between industry and the Department of Fisheries opposing the bans on the one hand and Department of Land Development, media and environmental groups on the other. Although concerns remain over salinisation the initial concerns over water use have been removed with subsequent research. Inland shrimp farms and rice farms use similar amounts of water implying that conversion would have little affect on amount of water available for irrigation (Bratten & Flaherty 2000).

Self-regulation: codes of conduct

The difficulty the state has had in coming up with institutional arrangements on its own has provided support for an alternative focus on voluntary self-regulation by the industry. One example is the code

of conduct process in Thailand. Industry involvement in the development of the codes is strategic in that these may serve as foundation for future more formal regulations (Boyd et al. 2002). The current Thai code for example is endorsed by the Thai Marine Shrimp Farmers' Association, Thai Frozen Foods Association and the Thai Food Processors Association.

Boyd et al. (2002) review of existing codes of conduct for shrimp farming is particularly valuable because of the role the authors have played in several of these. They note a general lack of attention given to social issues, and that most are filled with general statements with little detail on implementation that would be required for them to be useful in developing country contexts. The various codes, of course, do not have independent origins. The Thai code of conduct was based on the Global Aquaculture Alliances Codes of Practices (Boyd 1999) which in turn can be seen as based on the FAO (1995) Code of Conduct for Responsible Fisheries. The Thai system was initially developed by a Canadian consulting firm BTG-Golder in partnership with Dr. Siri Tookwinas of the Department of Fisheries under funding from the World Bank (Buranankanonda & Kanadpon 1999). Although shrimp farmers were invited to several facilitated meetings as part of the process of developing the code in Thailand, for the most part this has been a process dominated by experts.

Uptake of the code has been slow. Nevertheless, Boyd et al. (2002) are optimistic that such codes can be revised and improved with better participation. Even so the large number of small producers in Thailand provides a huge challenge for education, monitoring and certification programs. For this reason most specific efforts, for example on wastewater discharge, have started by targeting big industry (Wangvipula 2002).

Local Politics

While institutional gaps, and later, bureaucratic competition partly help explain environmental governance failures, and industry-driven codes of conduct may help, the characteristics of local power politics in rural Thailand has and will remain a key constraint on improving governance of shrimp aquaculture industry.

The structure of power in Thailand, and in the provinces, in particular, results in conditions where those most likely to be affected by environmental externalities and changes in access to be the poorest and least empowered. A Jao Pho (Godfather) tradition (cf. McVey 2000) has persisted in many locations where shrimp farming has developed, making the rule of law weak, and the threats of violent retribution real. In our own field work we have frequently been told about "industry fixers" who take care of "problems" in the industry, in particular, with respect to loan repayments, land disputes, and local opposition to shrimp farms. The murder of a conservationist Jurin Ratchapol who had been protesting farm encroachment in mangrove areas on Phuket illustrates the risks (Hutasingh 2001). Shrimp farmers and villagers also frequently make allegations about links between dealing with amphetamines and shrimp farming operations and occasionally these appear in the mainstream media (Muangkaew 2003). Needless to say investigating such issues in detail is difficult. It should be noted, in fairness, that there is a dark-side to most natural-resource based industries in Thailand, not just shrimp.

As a result there has been a history of corrupt practices by which land and water needed for shrimp farming is acquired in the first place. We have documented several cases in southern Thailand where individuals acquire land papers to a piece of land then expand the area several fold into mangrove and other wetland areas, and then pay corrupt officials to alter land documents. In Vietnam, we were told how "fong-bee" (or money in an envelope) could solve license, tax, zoning and other "difficulties" with establishing shrimp farms in the Mekong Delta. More subtle forms of corruption and discrimination, for example, in privileged access to assistance and land in state enterprises to family members and friends in Vietnam, or to local public canal and water works, in Thailand, is also the norm. In both countries this requires complicity of both forest department and local government officials.

The new constitution in 1997 that provided several provisions for decentralization that strengthened the decision-making capacity of local government councils, (Tambon Administration Organisations)

might have been thought of as a way to overcome lack of accountability. Our own research suggests that as far as shrimp farming goes outcomes vary greatly from location to location. Positions on councils are often dominated by shrimp farm owners and industry interests. In a few places there appears to be genuine efforts at arriving at more equitable solutions to local water quality, land dispute and development problems. In many others environmental consideration and livelihood concerns of the poor continue to be given low priority.

3.3 From pond to plate

Trading, processing, marketing and retailing parts of the shrimp production-consumption system involve far fewer actors than those in the earlier parts of the chain. Sea food processing and storage companies and their associations, in Thailand, are particularly powerful group politically (cf. Goss et al. 2000) and have been well supported by the state. Some of the key measures for processors and exporters are taken through Thailand's Board of Investment by setting up tax and other incentive structures in designated industrial zones (Suwunnamek 1997).

Food Safety Standards

Much of the attention, effort and progress in improving the management of shrimp aquaculture system have not been directed at the goal of protecting the environment but rather to meet public health requirements of importing nations. Nevertheless, this has had important repercussions for environmental governance as it is driving changes in farming practises, for example, reducing antibiotic use. It should be noted that in this case the leverage for change has come primarily from consuming nation governments.

In 2002 a major trade dispute arose between the EU and Thailand after the EU banned shrimp imports after detecting residues of chloramphenicol and nitro furans in the Netherlands (Arunmas 2002). The two antibiotics use in animals but banned because of potential harmful effects on humans. Thai producers countered with arguments that standards were impossible to achieve. In diplomatic tit-for-tat they also claimed to have tested dry milk products from EU and finding higher levels. As it turned out one of the products was produced in Asia and the data for the other were questionable. In any case there was little doubt about the high use of antibiotics in shrimp farming.

Graslund et al. (2003) reported that farmers in different regions of Thailand were using, on average, up to 13 chemical and biological products. There seemed to very little understand about how to control and combine these products and information on proper use was scant (cf. Chanratchakool et al. 1998). Use of the antibiotic Chloramphenicol in animal feed is prohibited in Thailand, but surveys show they were being used (Graslund et al. 2003). WHO Report on infectious diseases highlights the danger of antibiotic resistance to human health/ FAO (1995) Code of Conduct for Responsible fisheries has several references to antibiotic use and notes that drug which have not been certified for aquaculture should be strictly regulated (FAO 1997). Widespread use of antibiotics with little knowledge about correct practises in shrimp farming has created serious risks of development of antibiotic resistance (Holmstrom et al. 2003). Prophylactic use should be prohibited and uses once disease outbreaks occur should be highly controlled and restricted to antibiotics unimportant to human health (Holmstrom et al. 2003). Holmstrom et al (2003) see the solution in dissemination of information to farmers and strengthening regulation. They also note the importance of targeting the manufacturers and retailers of antibiotics as these are the actors who have benefited most from their use. Until this latest round of trade disputes there had been no specific regulations on use of chemicals in aquaculture in Thailand, but many of these chemicals are used for other purposes and regulated. This underlines the importance of international governance for chains.

This has been especially the case in the drive towards meeting international food safety standards symbolized in recent government's strategy of making the Thai nation the "*Kitchen of the World*" and making 2004 the "*Food Safety Year*" (Sutharoj & Pongprasert 2003). A related EU funded (10.7 million euros) initiative with ASEAN aims to upgrade capacities for food inspection, testing and certification, while promoting standards like the US Food and Drug Administrations HACCP program and GMP (Good Manufacturing Practices) in SMEs (Akkarasriprapai 2004a).

In Vietnam, The National Fisheries Inspection and Quality Assurance Center is responsible for export quality inspections and standards (Loc 2002). It is recognized by key shrimp importers, the US, EU and Japan. In 2002 almost 10% of all inspections revealed failures to meet hygiene, safety or quality standards for export. Nevertheless in same year 38% of total shrimp export volume were destroyed or returned (Loc 2002). Dr Nguyen Huu Dung, the General Secretary of the Vietnam Association of Seafood Exporters and Producers, a voluntary business organisation, was very critical of the strictness of EU which saw shrimp exports from Vietnam falling from 61 to 20 million tonnes between 2000 and 2002 (Akkarasriprapai 2004b). He argued that food safety regulations should be based on negotiated agreements with trading partners and not on unilateral arguments about protecting consumers. Although most companies have applied the HACCP program implementation is still weak and mostly to meet export obligations rather than as a way to ensure product quality (Loc 2002).

We note that in 2002 in Vietnam approximately a third of sea food companies were still state owned enterprises (Loc 2002). In our interviews with managers of state and privately-owned factories in Nha Trang and Ca Mau we came away with the strong impression that while state-backing was good for security of employment and budget, it greatly hindered innovation in technology and markets because the bureaucratic structures were slow and unwieldy (Lebel et al. 2002). Participation in global export markets is also frequently hampered by out-of-date and substandard equipment.

Although a wider issue, shrimp has nevertheless, often been near the centre in Thailand and Vietnam because of its high commercial value, role in international trade and its poor record with chemical contaminants. Adoption of more stringent and complex standards will increase costs for exporters, but these in turn could improve competitiveness in key markets in the longer run.

Seafood businesses and national governments are being required to strengthen implementation of Sanitary and Phytosanitary Standards (SPS) in aquaculture production to meet food safety and animal health requirements under WTO trade agreements. Hazard Analysis Critical Control Points (HACCP) procedures are progressively targeting activities upstream from the point of export, and in the future, are likely to include all major inputs to aquaculture such as feed and larval stock (Phillips et al. 2003). This is likely to help improve some aspects of the production processes, but it will also put substantial pressure on small and medium enterprises involved in the shrimp industry. They do not have the capital or capacity to meet new standards without assistance. It isn't clear that the state or agri-business actually "wants" to help as the demise of larger number small-scale suppliers could probably be to their further advantage. Shrimp farmers grower's associations may be able to resist these trends by sharing of key equipment, consultation, training and above all, information, needs.

Trade

Over the past decade changes to trade rules have played an important part in the development of the industry and provide some insights on the difficulties of greening trade. Free trade rules constrain the extent to which importers can influence production methods, although, it is clear food safety can provide significant leverage.

The complexity of governance actor interaction state is underlined by the 2003-04 disputes between several shrimp exporting nations and the US International Trade Commission over trade dumping. Dumping refers (among other things) to the practice of exporting products to another country at below the prices offered in domestic markets. Trade dumping allegations against Thailand and five other exporting nations were upheld by a decision in February 2004 meaning that substantial anti-dumping duties, some of them retroactive, could be imposed on shrimp imported to the US. The impact of the proceedings, even before final rates were introduced in mid-2004, has cascaded from importers back through the chain so that farmers in southern Thailand are opting out of production (Pongvutitham 2004).

The dispute also highlights the role of coalitions of interests. The Southern Shrimp Alliance which initially petitioned the commission represents interests of shrimp-capture fisheries in the US has been countered by a very mixed coalition. At one level Vietnamese and US ministries agreed to

cooperate to fight the US actions, while within the US Consuming Industries Trade Action Coalition and the American Seafood Distributors Association sought to also fight duties on import shrimp because of impact it would have on jobs and profits of shrimp processing companies and retailers because of higher domestic prices (Anon 2004a,b,c).

Thailand has promised to introduce traceability for aquatic products into the commodity chain within its borders. Traceability refers to the idea that the channel through which products move from processing through to distribution can be assured as coming from certified production systems along all steps of the value chain. Both the US and EU have been pushing for traceability of aquaculture products. Government and business in Southeast Asia has been scrambling to prepare. The challenge for Vietnam is even greater as most domestic agri-businesses are relatively un-experienced in exporting to global food markets. Foreign-owned and joint-venture factories may find it easier to meet standards.

In Japan, product labeling for shrimp is common in supermarket, but as most shrimp are consumed outside the home much consumption takes place without consumers getting direct information from labels. This may limit the value of certification and eco-labeling schemes that could be designed, but on the other hand, restaurants, hotels and stalls selling shrimp may themselves use such labeling as way of ensuring quality of their products to customers. Greenpeace campaigned in Germany urging consumers not to purchase shrimp products from Asia and Latin America because they cause mangrove destruction, water pollution and social impacts. The impacts of this campaign were not long-lasting.

On the other hand, globalization and rationalization of retailers in food business over the past decade has led to a major shift in concentration of control and ownership in retail sector. Large transnational companies, like Carrefour, Tesco, Auchan, Royal Ahold Asia Pacific and Wal-Mart operate hypermarkets in most continents (Glover 1999). Their potential leverage in retail of environmentally-friendly shrimp, and conversely, on continuing the drive for unsustainable practices is unexplored, but likely to be large.

Certification and eco-labeling schemes are being tried but still only cover very small fraction of total volumes traded. There are several critical international governance issues that suggest the future for such schemes may be quite circumscribed. Countries, for example, are increasingly reluctant to push for, or support, such schemes in fear of the backlash under WTO rules which do not allow discrimination based on production and process methods (so-called PPM rule). Developing countries in particular have been strongly opposed fearing these will be used as unfair trade barriers to their exports. It should be noted that as recently as July 2003 the WTO Committee on Trade and Environment revived PPM arguments to counter-act exploration of eco-labeling schemes based on life cycle analysis (Eckersley 2004). Thailand, China, Indonesia and US were among those opposing the suggestion. In 1997, the Chief of the Department, Plodprasop Suraswadi, was active in calling for development of a counter organization to conservationist groups and to resist eco-labeling schemes (Ridmontri 1997a).

Vietnam, was in 2000, in some ways well placed to capture niche markets for organically grown, large, high-value shrimp. The diversity of semi-intensive practices, based on local technologies, and polyculture methods (Binh & Lin 1995; de Graff & Xuan 1998; Lebel et al. 2001), however, is struggling without good market structures to fit into export supply chains and is unlikely to persist once standard feed-company technologies become more widely available (cf Johnston et al. 2000).

The importance of fisheries and aquaculture to livelihood in developing countries means that it is very important that these nations, especially the interests of small scale-producers and traders, are effectively represented in international negotiations over standards and trade requirements (Phillips et al. 2003). That this will indeed be the case is far from clear.

4 Governing sustainability transitions

4.1 Beyond the state

Technocratic rules

Conventionally the task of improving the environmental performance or sustainability of shrimp aquaculture has been seen as a role for the state. In Thailand, the Department of Fisheries has been responsible for most of the activities aimed at improving the sustainability of marine shrimp farming (Tookwinas et al. 1999). In Vietnam the Departments of Fisheries, Agriculture and Rural Developments have all been involved in the main shrimp growing areas in the Mekong Delta. In both countries, these include technical, regulatory and monitoring programmes. But if we look more closely at how environmental and social problems are identified and the kinds of solutions considered we get a very different picture of “governance”.

NGOs and academic research institutions have played an important role in drawing attention to the problems of loss of mangrove cover, and to a lesser extent, the social impacts of industry intensification and expansion. Problems with water quality, sediment disposal and disease have been obvious to local communities and neighbouring shrimp farmers from near the beginning. Scientific research and the bureaucracy in consuming nations was important in bringing the issue of antibiotic use in shrimp farming into the international trade and food safety arenas. The shrimp industry in Thailand and Vietnam, however, has been much more prominent when it comes to arguing about measures and solutions, lining up when it can with those parts of the state that promote the industry, and recruiting domestic and international academic researchers in support of their cause.

One of the more credible groups, but still with only a modest-on-the-ground record, is the Network of Aquaculture Centres in Asia-Pacific (NACA). As an intergovernmental organization it promotes co-operation in development and management of aquaculture. Together with the FAO and World Bank, NACA, has frequently been able to de-politicize environmental and social issues surrounding shrimp aquaculture by re-casting them as debates about purely technical or management capacity issues in the producing countries. This could facetiously be described as a contribution to better governance. Their 1998 Technical Consultation on Shrimp (NACA/FAO 2000) concludes that sustainable shrimp culture was desirable and achievable goal. Like much other material produced by the consortia it remains “promotional” in character, reflecting, the weight of interests of the member states.

The tactics of the now large number of non-government organizations opposing shrimp aquaculture are comparable (Stonich & Bailey 2000). Likewise they represent diverse interests, with multiple campaigns and attention-spans. Among the most visible internationally are the : Industrial Shrimp Action Network; Mangrove Action Project; Environmental Justice Foundation; World Wildlife Fund, and GreenPeace International. One of the difficulties faced by NGOs and concerned individuals in developing countries is that it is often far from clear that the larger and distantly-based international NGOs actually have much understanding or concern for the livelihoods of people in shrimp growing areas. The value of joining alliances with “outside” networks is, therefore, not always clear, as key interests and responsibilities diverge.

Broadening Participation

At the state level broader decisions about zonation, legality of inland shrimp farming, and the adopting of standards and codes is entirely technocratic. Participation is a means to get adoption and compliance of practices promoted by state and corporate interests. In Thailand, several key decisions with respect to shrimp farming, have been made, and then over-turned through ministerial cabinet resolutions and decrees without debate in parliament or clear avenues of public consultation.

Thus, one of the most glaring weaknesses in decision-making with respect to shrimp aquaculture development in both Thailand and Vietnam is the lack of involvement of affected and concerned persons. Meetings, technical and consultation workshops, when they do bring in “local communities” focus on shrimp farmers themselves, but not those with other livelihood strategies or excluded from

entry because of lack of capital or access to appropriate land or water. It is only outright conflict that has brought different local stakeholder groups do facilitated tables. Even then it is mostly powerful economic interests that represented and active in negotiations. Small scale fisher folk, mangrove and wetland collector-gatherers, and small-scale rice farmers are near to voiceless. Economic and political power is tightly linked. The local businessman that arrives in his new 4-wheel drive is already ahead of the four fishermen that walked: before the meeting has started. Violence and other means of coercion are implicit in the economic differentials and clearly understood in rural societies.

Overall, local resistance to shrimp farming in Thailand has been comparatively modest. Vandergeest et al. (1999) argue that is for a couple reasons: first, the high level of participation of village elites in the shrimp farming activities; second, the threats of violent retribution for opposing or exposing illegal and corrupt activities; and, third, private property is seen as sacrosanct making it hard for government officials or local communities to pressure what others do on “their land” even when this has off-site impacts on common pool resources. Nissapa *et al.* (2002) describes several case studies of successful creation of community-based management systems and problem solving in coastal communities, but much more research is needed on how communities-based management approaches in shrimp growing areas have fared.

In Vietnam, non-government organisations that might organise opposition to shrimp farming, are primarily associated with academic institutions, and must operate cautiously, or part of larger international organisations. These have contributed to mangrove restoration. On the other hand, the networks arising out of the commune system remain strong in some locations can be mobilised for water management problems.

Despite the growing amount of rhetoric given to participation in assessments and decision-making there is still very little critical analysis of its impact on outcomes (Rayner 2003). Does greater participation in water and land management decisions lead to more sustainable trajectories of development in coastal shrimp growing areas? What forms of participation lead to better outcomes and which to worse?

Bigger business and little networks

Agribusiness now plays a major role in linking primary producers to world markets, whereas in the past this was a role much more influenced and under control of the state. A 1999 Asian Development Bank agriculture sector restructuring loan reinforced this trend of enlarging the role of agribusiness in the managing and planning of the agriculture sector. Corporate – state relationships have always been close in Thailand with key board-members often being political leaders and vice-versa. Family connections are also often present. In shrimp aquaculture the Charoen Popkhand Group has been a key player in Thailand and the region (Goss *et al.* 2000) with investments virtually all parts of commodity network and a dominant role in the feed industry.

The influence of big business interests in the supply and processing part of the commodity chain within Thailand has only been countered by cooperation among farmers and hatcheries. In short, those with the strongest economic interests to maintain some control By far the most sophisticated grower’s association that has arisen in Thailand is the Surat Thani Shrimp Farmers Club (or translated as Growers’ Association, SSFC) which was established in 1990, in part as a response to the collapse of intensive shrimp farms in the Upper Gulf area of Thailand. The organization has had an evolving agenda, initially focused on reducing costs for shrimp farming inputs, but later including conservation and social responsibility activities (CORIN 2000). The organization runs a successful annual “Shrimp Day”. A national Thai Marine Shrimp Farmers Association (TSA) along similar lines was established in 1996. The two organizations continue to collaborate closely, with the TSA working more at larger national international level. The TSA, for example, is a member of the Global Aquaculture Alliance, and has also engaged substantially with associations representing interests at other parts of the chain (food processing, feed mills). The SSFC differs from several other organizations which have emerged in that it was very much driven by a group of concerned farmers (CORIN 2000) rather than led by state, large corporation or academic institution interventions. The SSFC and TSA are largely funded by donations from successful members, although income from

laboratory consulting services, membership fees and joint activities are also important (CORIN 2000).

To date there is been rather little effort to combine the insights based on tacit and experiential knowledge of shrimp farmers with those of formal research in academic and other state institutions. For the most part innovation is seen by the state as coming from their laboratories or those of large corporations and being “diffused” out to farmers. Field work in Thailand suggests they opposite may occur at least as frequently, of innovative practises being generated by farmers and hatchery operators spread through their informal networks and associations, and only later being picked-up and refined by the larger corporations, formal research institutions and state extension agencies. Could the information flows among these little networks of small producers hold one of the keys to sustainability of the shrimp aquaculture-production system?

In summary, to argue that we need to look *beyond the state* is not a claim that this automatically leads to better governance, but rather that this is how the world works, and in what context new institutional arrangements must be effective. It is also not an argument that the state is not needed. If anything, experiences in Thailand and Vietnam, suggest that industry self-regulation is unlikely to be effective, and that local communities in producing countries without state protection and support are likely to loose out to the wishes and needs of consumers and larger processing and export companies. It is only through improving public participation, not just of farmers and firms, but also concerned and affected people, in both producing and consuming nations that negotiating (Leeuwis 2000) responsibility for involuntary risks and negative externalities of shrimp farming can be fairly distributed.

4.2 Beyond the pond

Although shrimp farming production is embedded in larger agro-industrial network the focus of most sustainability policy has remain targeted on the pond even where the points of leverage have been further downstream, for example, with trade inspections and standards. This emphasis is in part a reflection of the relative power of various actors, with those with power looking to shift responsibility elsewhere rather than “share” the burden. Who should be responsible for the costs of meeting international food standards? If eco-labelling certification schemes were introduced should the extra costs of evaluating and monitoring be borne by exporter or consumers?

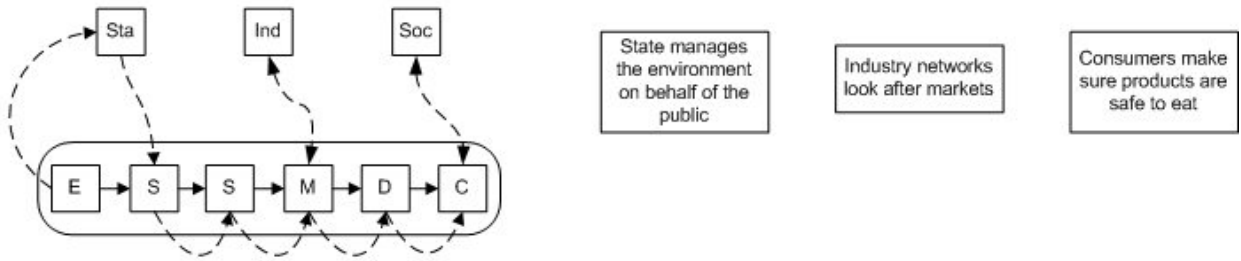
The previous section brought home the point that the shrimp production-consumption system, especially decision-making and practices of hatcheries and shrimp farms, is governed in a much more complex way then a focus on states and their institutions would suggest. The same is true for other parts of the chain. Apart from the regulations associated with trade there has been little consideration of other ways that disparate parts of value chains within the network might be brought together – for example over negotiating responsibilities, and cost-share burdens, of creating new markets for sustainably produced, distributed and disposed shrimp-derived products.

The possible role of information, through various “traceability” schemes, has not included attention to the possibilities of reinforcing feedbacks in such systems so that they can “learn”. For example, labelling and certification schemes, are not linked in an adaptive way to changes in conditions of water ways or ocean fisheries. How could upstream-downstream social learning be facilitated in agro-industrial networks composed of weak and strongly linked value chains? We propose there at least three broad models by which the greening of value chains and hence the overall production-consumption system may be brought about (

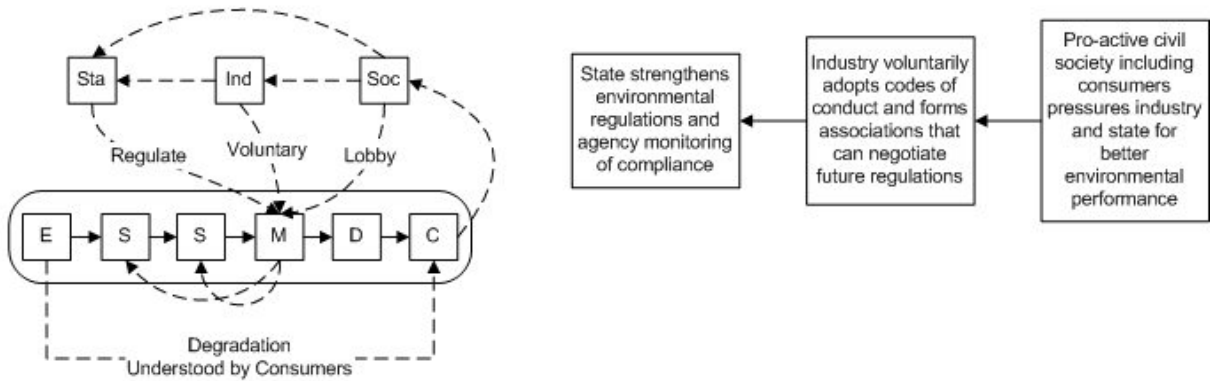
Figure 2).

Figure 2 Three stylized models for how greening of a value-chain can come about and the assumptions they make about governance.

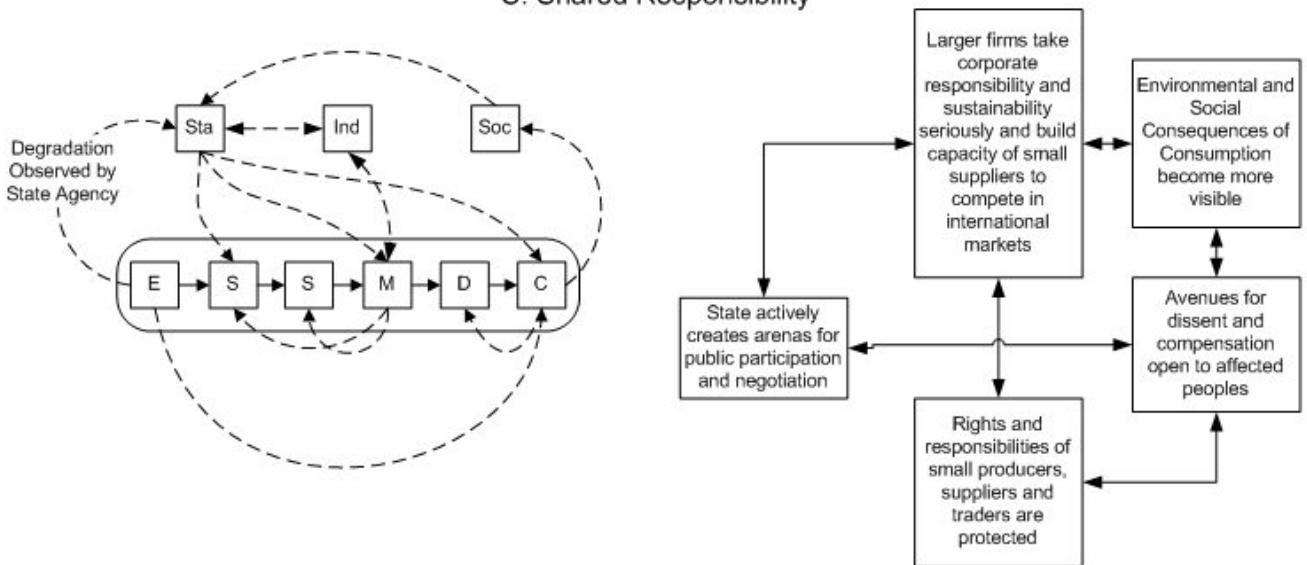
A. Independent spheres



B. Society moves first



C. Shared Responsibility



Going beyond the pond, also means going beyond shrimp. Although our focus on this paper has been on possible leverage along value chains, this is not to dismiss the importance of place- or resource-based institutions and governance mechanisms, for example, focussing on water pollution or fisheries or integrated coastal zone management. To strong a focus on single commodity has several limitations for analysis of governance. First, we note that internationally one of the important interactions currently underway is between various intensively managed high-value aquaculture products, and indeed other agricultural businesses. Salmon and shrimp are using some of the same marine resources. Second, shrimp farming activities whether along the coast or further inland along waterways need to be part of comprehensive efforts to protect water quality and aquatic ecosystems from pollution from agri- and manufacturing industries as well as domestic untreated sewerage sources. In fact the need for high water quality by shrimp farmers could be used as a lever to improve overall water quality management in catchments. To date most regulations and monitoring targets factories, but in future, intensive farming, for example poultry and pigs, should also come under scrutiny. Finally, and perhaps most importantly, corporate strategies, of farmers, feed producers, and exporting seafood companies are usually not constrained to a single commodity. Large companies like CP have investments in aquaculture, poultry and feed mills in many countries and can switch target commodities with a substantial amount of flexibility. Farmers also are flexible and always looking for the next “animal to crop”. The rapid spread of an alternative introduced species of shrimp, *P. vennemmi*, in Thailand over the past 3-4 years is a good illustration of this. Governance mechanisms need to take this “flexibility” into account and not be overly commodity-specific. The point remains to transform production-consumption systems into more sustainable configurations.

4.3 Ecologically plausible

For sustainability of the industry to be ecologically plausible will require governance mechanisms that provide appropriate negative feedbacks when use of input resources or assimilative capacities of sinks are in danger of being exceeded, or pushed beyond thresholds of recovery. This implies both monitoring and the capacity and will within the system to take precautionary actions based on those findings. It also implies the important role that research-based understanding about environment and livelihoods should have in decision-making about coastal zone management. Research can help policy-makers gain an understanding of some of these thresholds, for example, the areas of mangroves needed as nursery habitat for gravid females (Ronnback 1999) through use of ecological footprint or similar methods (Larsson et al. 1994; Folke et al. 1998).

One of the toughest challenges for sustainability is that firms are adept at switching sources of inputs in ways that tend to mask ecological feedbacks and aggregate impacts, at least temporarily. As fishing stocks fall in one areas of the ocean for the supply of fish meal and oil, feed meals can switch to alternative oceans. Of course stocks don't just change because of over-fishing for shrimp feed, but for multiple reasons, include inter-annual climate variability associated with the El Nino-Southern Oscillation. Likewise the main areas of shrimp production can shift rapidly between countries, in response to changes environmental conditions, especially disease risks and water quality, and changes in costs of production and currency exchange rates.

Technological innovation is a continuous phenomenon - affective governance requires constant surveillance of industry development especially with respect to use of chemicals and biological materials. The widespread adoption of antibiotics as a preventative water treatment practice reached such high and serious proportions because nobody was looking. Over the past two years (2002-04) producers in Thailand have largely switched from the native black tiger shrimp (*Penaeus monodon*) that had been the basis of the industry up to this point to the western white shrimp (*Penaeus vannamei*) the conventional shrimp farmed in Central America because of its apparent greater resistance to disease. The consequences for native fauna, including possibilities of introducing new diseases, do not appear to have been considered, and it is now likely to be too late. Increased use of biotechnology is inevitable in the shrimp aquaculture industry as it has been many other aspects of agri-business. Many technological innovations are beneficial and should be celebrated as creative outcome of competition among firms and farmers, but they can also bring new risks, which have to be anticipated, monitored and be revealed to the public.

Bye (1990) reflected the views of many others when he argued that shrimp aquaculture is similar to other modern food producing enterprises like intensive culture of pigs or poultry, and so should be treated similarly, as essentially benign activities, rather than as a nascent industry. The first part of this argument is fair. The second part is not now, if it ever was. The way pigs and poultry have been reared in developing countries in Thailand has also undergone a very rapid transformation. These are now very different enterprise than the ones 20 or even only 10 years ago for which key agricultural land and water related laws and policies were devised a long time ago. Health scares with pork colour-additives, and eutrophication of waterways from piggeries are cases in point. Modern agriculture and agribusiness are not necessarily benign and are much more “industrial” in character than they were. Regulations and planning just haven’t caught up. Labeling a business as agriculture or industry clearly matters for perceptions about how they should be regulated, and firms will where either hat depending on what image it is best to portray: the modern technologically improved age or play nostalgically to the consumers’ and decision-makers’ memory of recent rural roots.

The increased intensification of animal rearing systems combined with increased mobility and connectedness of processing units in modern export-oriented production-consumption systems poses new types of risk because it may be reducing system resilience. The past five years has seen several examples of disease outbreaks both in developing countries in Asia, as well as in the mature economies of EU and US. Consider BSE (Mad Cow’s Disease) in cattle, bird flu in Hong Kong and then throughout much of Asia, Viral Encephalitis in Malaysia. The reasons include the following. Firstly, highly intensified systems could increase risks of animal disease and virulency as well as opportunities for human cross-infection. Secondly, high mobility of animals, animal-derived products, and of course the people who work in these industries, means diseases can spread more quickly and completely. Thirdly, at some stages much of the material may pass through only a few critical shared processing factories which then become extremely susceptible because there is no redundancy in the system. Conversely, there are opportunities for harmonization of standards and better information flow. The industrialized and globalised shrimp aquaculture production-consumption system has many of these characteristics. Unfortunately, the response of Asian governments to these risks has to become even more secretive (Fahn 2004) and that is the real reason to be scared.

5 Conclusion

Aquaculture production and trade has, and can make further, important contribution to social development in Southeast Asia and other developing regions in the tropics.

Competitive, profitable and sustainable businesses can be based on producing high value traded commodities from using ecosystems goods and services in ways that don’t undermine the continued functioning of those ecosystems. Unfortunately, the industrialization of shrimp aquaculture has created commodity network that is longer, more complex, and open to exploitative practises in several parts of the system. Improving environmental governance of shrimp aquaculture production-consumption system requires attention be paid the three key features.

First, there is no single appropriate level of environmental governance. There is a need to go beyond the pond. Mechanisms to handle cross-scale and up-down linkages along the chain are required to compliment institutional arrangements targeting individual parts of the system.³Second, improved access and quality of information about inputs, production processes and their impacts needs to be available to the general public in producing and consuming nations. Third, measures of success for the production-consumption system need to be re-defined. Conventional hierarchical and scale approaches to institutions may be inadequate when dealing with networks with strong value chains.

In an earlier paper we concluded that the pursuit of sustainable of production systems in different places may not converge on the same solutions, or even have a solution in particular places (Lebel et al. 2002). This paper extends this conclusion by noting that place-based efforts to improve

³ although 2 and 3 may be accurate it isn’t clear that earlier text actually supports these conclusions;

sustainability needs to be complimented by efforts at improving environmental and social performance along key value chains in industrial networks, starting in the ocean through to the plate.

The emphasis in actual policy and in the literature or finding better ways of reducing negative externalities of the shrimp aquaculture industry has focussed on the policy instruments to regulate or create incentives for more sustainable practices and avoid conflicts. This has been seen as a technical affair to be decided by experts in state bureaucracies or industry. There has been relatively little attention given to the way in which these institutional solutions are to be arrived at. Public participation is either token, as a way of getting “free labour” from rural people for protection and management works, or purely as way to improve efficiency and compliance. That participation may change goals and forms of decision-making is not considered. The lack of attention to governance issues, of representation, transparency and accountability in decision-making, monitoring and evaluation processes is why the rules on paper have for the most part had little affect on practices on the ground, and when they have had an effect, these have fallen hardest on small-scale input suppliers, producers and traders in the developing countries. Improving the sustainability of production-consumption systems around high-value, ecosystem-dependent, internationally traded commodities like shrimp requires much more attention to improving governance.

Acknowledgements

This research was largely funded by grant no. 60176 from the John D. and Catherine T. MacArthur Foundation to Louis Lebel, Chiang Mai University. Additional support for follow-up work has come from the U.S. National Oceanic and Atmospheric Administration’s Office of Global Programs for the Knowledge Systems for Sustainable Development Project. Thanks are due to Ngyugen Hoang Tri , Suparb Pasong, Amnuay Sangnoee and Le Kim Thoa for their inputs into earlier project meetings and working papers where issues about regulation of the shrimp industry in Thailand and Vietnam were discussed.

Literature Cited

- Adger WN, Kelly M, Ninh NH, Thanh NC. 1997. Property rights and social incidence of mangrove conversion in Vietnam. CSERGE Working Paper GEC 97-21. Centre for Social and Economic Research on the Global Environment: University of East Anglia.
- Akkarasriprapai B. 2004a. EU help on food standards. *The Nation*. 12 May 04.
- Akkarasriprapai B 2004b. Food safety: EU’s new standards slammed. *The Nation* 29 May 04.
- Anon 2004a,b,c. Trade groups oceans apart in dumping row. *The Nation*. 28 May 2004; Watchdog warns on shrimp tariffs. *The Nation*. 3 April 2004; Shrimp tax ‘would hit prices hard’. *The Nation*. 25 June 2004.
- Bellwood DR, Hughes TP, Folke C, Nystrom M. 2004. Confronting the coral reef crisis. *Nature* 429:827-833
- Binh CT, Lin CK. 1995. Shrimp culture in Vietnam. *World Aquaculture* 26:27-33.
- Boyd CE 1999. Codes of practice for responsible shrimp farming. Global Aquaculture Alliance. St Louis, Missouri, USA.
- Boyd, C.E., Hargreaves, J.A. and Clay, J.W.: 2002, Codes of Practice and Conduct for Marine Shrimp Aquaculture. Report prepared under the World Bank, NACA, WWF and FAO Consortium Program on Shrimp Farming and the Environment. Published by the Consortium. 31 pages.
- Brennan, D.: 2002, Pollution control options for Australian prawn farms, *Aquaculture Economics and Management* 6, 325-338.
- Buranakanonda A, Kanadpon W. 1999. Voluntary guidelines to ensure sector’s future will be finalized by June. *Bangkok Post*. 8 April 1999.

- Bye VJ. 1990. Legal political and social constraints in aquaculture. Pages 123-144 in De Pawu N, Billard R (Eds). Aquaculture Europe 80. Business joins science. European Aquaculture Society Special Publication 12.
- Chanratchakool, P., Turnbull, J.F., Funge-Smith, S.J., MacRae, I.H. & Limsuwan, C. (1998). Health Management in Shrimp Ponds. Bangkok: Aquatic Animal Health Research Institute.
- CORIN 2000. Shrimp farming experiences in Thailand: a continued pathway for sustainable coastal aquaculture. Coastal Resources Institute: Prince of Songkla University, Thailand.
- De Graff GJ, Xuan TT. 1998. Extensive shrimp farming, mangrove clearance, and marine fisheries in the southern provinces of Vietnam. *Mangroves Salt Marshes* 2:159-166.
- Dierberg FE, Kiattisimkul W. 1996. Issues, impacts, and implications of shrimp aquaculture in Thailand. *Environmental Management* 20:649-666.
- Dryzek J. 1999. Transnational democracy. *The Journal of Political Philosophy* 7(1):30-51.
- Fahn J. 2004. Green hopes turn to despair. *The Nation*. 1 April 04
- FAO 1995. Code of Conduct for Responsible Fisheries. Rome: FAO.
- FAO 1997. FAO Technical Guidelines for Responsible Fisheries, No. 5. Rome: FAO.
- FAO 1998. Report of the Bangkok FAO technical consultation on policies for sustainable shrimp aquaculture. FAO Fisheries Report 572. United Nations Food and Agriculture Organization: Rome.
- Flaherty M, Karnjanakesorn C. 1995. Marine shrimp aquaculture and natural resource degradation in Thailand. *Environmental Management* 19:27-37
- Flaherty M, Vandergeest P, Miller P. 1999. Rice paddy or shrimp pond: tough decisions in rural Thailand. *World Development* 27:2045-2060.
- Glover, J. (1999). The Changing Consumer in Asia, Paper, 1999 Food and Agribusiness Executive Development Program, September, Singapore.
- Goss, J., Burch, D., and Rickson, R.E.: 2000, Agri-food restructuring and third world transnational: Thailand, the CP Group and the global shrimp industry, *World Development* 28, 513-530.
- Goss, J. and Pacheco, D.: 1999, Comparative globalisation and the state in Costa Rica and Thailand, *Journal of Contemporary Asia* 29, 516-545.
- Graslund S, Holmstrom K, Wahlstrom. 2003. A field survey of chemicals and biological products used in shrimp farming. *Marine Pollution Bulletin* 46:81-90.
- Holmstrom K, Graslund S, Wahlstrom A, Pongshompoo S, Bengtsson B-E, Kautsky N. 2003. Antibiotic use in shrimp farming and implications for environmental impacts and human health. *International Journal of Food Science and Technology* 38:255-266.
- Huitric M, Folke C, Kautsky N. 2002. Development and government policies of the shrimp farming industry in Thailand in relation to mangrove ecosystems. *Ecological Economics* 40:441-455.
- Hutasingh O. 2001. Murder of conservationist fails to end encroachment: prawn farms face no legal action. *Bangkok Post*, 10 May 2001.
- Jackson, J.B.C., Kirby, M.X., Berger, W.H., Bjorndal, K.A., Botsford, L.W., Bourque, B.J. et al. (2001). Historical overfishing and the recent collapse of coastal ecosystems. *Science*, 293, 629-638.
- Johnston D, Trong NV, Tien DV, Xuan TT 2000. Shrimp yields and harvest characteristics of mixed shrimp-mangrove forestry farms in southern Vietnam: factors affecting production. *Aquaculture* 188:263-284.
- Kagawa M. 2003. Trade linkages in shrimp exports: Japan, Vietnam and Thailand. Master of Science Thesis. Auburn, Alabama.

- Lebel, Louis, Nguyen Hoang Tri, Amnuay Saengnoee, Suparb Pasong, Urasa Buatama, Le Kim Thoa, 2002. Industrial transformation and shrimp aquaculture in Thailand and Vietnam: pathways to ecological, social and economic sustainability? *Ambio* 31(4):311-323
- Leeuwis C. 2000. Reconceptualizing participation for sustainable rural development: towards a negotiation approach. *Development and Change* 31:931-959.
- Loc VTT. 2003. Quality management in shrimp supply chain in the Mekong Delta, Vietnam: problems and measures. Centre for ASEAN Studies. Discussion paper no 43.
- Luttrell C. 2001. An institutional approach to livelihood resilience in Vietnam. PhD. Thesis: University of East Anglia.
- McVey R. 2000. (Ed) Money and power in provincial Thailand. Institute of Southeast Asian Studies. Silkworm Books: Chiang Mai.
- NACA/FAO. 2000. Aquaculture Development Beyond 2000: the Bangkok Declaration and Strategy. Conference on Aquaculture in the Third Millennium, 20-25 February 2000, Bangkok, Thailand. NACA, Bangkok and FAO, Rome. 27pp.
- Naylor R, Goldberg R, Mooney H, Beveridge M, Clay J, Folke C, Kautsky N, Lubchenco J, Primavera J, Williams M. 1998. Nature's subsidies to shrimp and salmon farming. *Science* 282:883-884.
- Naylor, R.L., Goldberg, R.J., Primavera, J.H., Kautsky, N., Beveridge, M.C.M., Clay, J., Folke, C., Lubchenco, J., Mooney, H. and Troell, M. 2000. Effect of aquaculture on world fish supplies. *Nature* 405, 1017-1024.
- Nieland AE, Soley N, Varley JB, Whitmarsh DJ. 2001. Shrimp aquaculture: economic perspectives for policy development. *Marine Policy* 25:265-279.
- Nissapa A, Masae A, Boromthanarat S., Jungrungrot V. 2002. Institutional and policy perspectives in the management of fisheries and coastal resources in Thailand. Pages 143-182 in ...
- Parfitt T. 2004. The ambiguity of participation: a qualified defence of participatory development. *Third World Quarterly* 25(3):537-556.
- Patmasiriwat D, Bennis M, Pednekar S. 1999. International trade, environmental issues and the impact of sustainability of shrimp culture in Thailand. Pages 132-141 in Smith PT (ed). Towards sustainable shrimp culture in Thailand and the region. Proceedings of a workshop held at Hat Yai, Songkla, Thailand, 28 October – 1 November 1996. Australian Centre For International Agricultural Research: Canberra.
- Pesonen H-L. 2000. Environmental management of value chains: promoting life-cycle thinking in industrial networks. *Green Management International* 33: 45-58.
- Phillips M, Bueno P, Haylor G, Padiyar A. 2003. From farm to plate: international trade in aquaculture products has a human development dimension of special interest to the Asia-Pacific region. *Samudra* (November) 12-15.
- Pongvutitham A. 2004. Threat of US punitive duties: shrimp-farmers give up, switch businesses. *The Nation*. 22 May 04.
- Primavera JH. 1998. Tropical shrimp farming and its sustainability. In De Silva S (Ed) *Tropical mariculture*. Academic Press: London. Pp 257-289.
- Rayner S. Democracy in the age of assessment: reflections on the role of expertise and democracy in public-sector decision making. *Science and Public Policy* 30(3):163-170.
- Ridmontri C. 1996. Chuchep calls for sacrifice of forests: prosperity must be considered he says. *Bangkok Post* 28 December 1996.

- Ridmontri C. 1997a. Shrimp exporters to unite to counter green critics. Bangkok Post 3 January 1997.
- Ridmontri C. 1997b. Chuccheep wants to pump B1.89bn into shrimp farming. Bangkok Post 28 August 1997.
- Samabuddhi K. 2001. Fisheries to continue promotion: degraded mangrove forests sought. Bangkok Post, 22 September 2001.
- Samabuddhi K. 2003. Halt to river basin projects demanded: ecosystems said to be under threat. Bangkok Post. 24 September 2003.
- Shang YC, Leung P, Ling B-H. 1998. Comparative economics of shrimp farming in Asia. *Aquaculture* 164:183-200.
- Składany M, Harris CK, 1995. On global pond: international development and commodity chains in the shrimp industry. PP 169-94 in McMichael P. (ed). *Food and agrarian orders in the world-economy*. Westport: Praeger.
- Stonich SC, Bailey C. 2000. Resisting the blue revolution: contending coalitions surrounding industrial shrimp farming. *Human Organization* 59:23-36
- Sutharaj P, Pongprasert S. 2003. Govt aims to boost food sector R&D. *The Nation*, 21 October 2003.
- Suwunnamek O. 1997. The role of multinational agribusiness and the Shrimp Farmer's Cooperatives to the sustainability of the shrimp industry in Thailand. Ph.D. Thesis: Agricultural Sciences, University of Tsukuba.
- Thoa LK, Tri NH, Luttrell C, Lebel L, Pasong S. 2003. Institutional interplay over mangrove resources in Vietnam. USER Working Paper: Chiang Mai University.
- Thongrak S, Prato S, Chiayvareesaija S, Kurtz W. 1997. Economic and water quality evaluation of intensive shrimp production systems in Thailand. *Agricultural Systems* 53:121-141.
- Tookwinas S, Boonyarapalin M, Choongam C, Poongern J. 1999. On farm quality assurance for shrimp production in Thailand. Pages 111-122 in Papers presented at the Bangkok FAO technical consultation on policies for sustainable shrimp culture. Bangkok, Thailand 8-11 December, 1997. FAO Fisheries Report No 572, Supplement.
- Vandergeest P, Flaherty M, Miller P. 1999. A political ecology of shrimp aquaculture in Thailand. *Rural Sociology* 64:573-596.