The Fisheries Sector in Vietnam:
A Strategic Economic Analysis

Development Economics Research Group,
University of Copenhagen

and

Central Institute for Economic Management,
Ministry of Planning and Investment of Vietnam

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Acronyms and Abbreviations

Bn	Billion
CGE	Computable General Equilibrium
CIEM	Central Institute for Economic Management
CPI	Consumer Price Index
CPUE	Catch per Unit of Effort
DERG	Development Economics Research Group (University of Copenhagen)
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organisation, United Nations
FSPS	Fisheries Sector Program Support
HCMC	Ho Chi Minh City
ILSSA	Institute for Labour Science and Social Affairs
ISIC	International Standard Industrial Classification
LURC	Land Use Right Certificate
GSO	General Statistics Office of Vietnam
Ha	Hectare
HH	Household
HP	Horse Power
Km	Kilometre
LURC	Land Use Right Certificate
MEY	Maximum Economic Yield
MSY	Maximum Sustainable Yield
Mn	Million
MoFI	Ministry of Fisheries
MONRE	Ministry of Natural Resources and the Environment
MPI	Ministry of Planning and Investment
N	Number of Observations
Nm	Nautical Mile
OLS	Ordinary Least Squares
SAM	Social Accounting Matrix
SD	Standard Deviation
SME	Small and Medium sized Enterprise
TAC	Total Allowable Catch
US$	United States Dollar
VARHS	Vietnam Access to Resources Household Survey
VHLSS	Vietnam Household Living Standards Survey
VIFEP	Vietnam Institute for Fisheries Economics and Planning
VND	Vietnamese Dong

Preface

This report was commissioned by the Royal Embassy of Denmark (Danida) in Vietnam under Phase II of the Fisheries Sector Programme Support (FSPS), in early 2010. The report was commissioned following an appraisal of the need for an economic study of the fisheries sector conducted by Van Arkadie & Hung (June, 2009).

Following this appraisal, Danida made the decision to support a project which would produce a strategic economic evaluation of the fisheries sector in Vietnam, and which would provide the basis for effective government policies and interventions to implement its fishery sector strategy. Specifically, an overall objective was defined as to improve the effectiveness of government economic policies and interventions in the fishery sector by improving the quality of economic analysis of the sector and to contribute to the development of the capability to undertake economic analysis in the sector. It is hoped that this study, to be presented to Vietnamese government policy makers, will provide a basis for informed choices in selecting and designing government interventions in the fisheries sector of Vietnam.

Acknowledgements

The core research team consisted of the Development Economics Research Group (DERG) of the University of Copenhagen, and the Central Institute for Economic Management (CIEM) in the Ministry of Planning and Investment (MPI) of Vietnam. Mr Simon McCoy led the research, with Dr James Thurlow (World Institute for Development Economics Research, WIDER), Professor Neil Ridler (University of New Brunswick), and Professor Andy McKay (University of Sussex) joining the DERG team. Dr Nguyen Manh Hai, Mr Tran Trung Hieu, and Ms Le Xuan Quynh formed the CIEM research team. Professor Finn Tarp on the side of DERG, and Ms Vu Nguyet Xuan Hong, Vice President of CIEM, supervised the research effort through all its stages.

In addition to the core research team of DERG and CIEM, contributions to the research were made by Dr Nguyen Thi Kim Anh and her team (Nguyen Thi Tram Anh, Hao Van Tran, Pham Thi Thanh Thuy, and Nguyen Ngoc Duy), at the Faculty of Economics of Nha Trang University in Vietnam, and Dr Le Xuan Sinh and his team (Nguyen Thanh Toan, Huynh Van Hien, Do Minh Chung, and Nguyen Thi Kim Quyen) at Can Tho University, who contributed to large parts of the aquaculture research findings. In the area of aquacultures certification and standards, the DERG team was complemented by Dr Flavio Corsin and his team at the newly established ICAFIS.

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The study team would also like to express appreciation for the time that the surveyed fishermen and women made available during the year for the interviews carried out as part of this study. It is hoped that the present report will prove useful in the search for policies geared towards improving their livelihoods.

Finally, while advice has been received from many colleagues and friends, the research team takes full responsibility for any remaining errors or shortcomings in interpretation. All the usual caveats apply.

Executive Summary

Fishing in Vietnam is an ancient tradition and vocation, dating back many hundreds of years. Today, the sector represents an important source of economic growth, employment, nutrition, and foreign exchange. In recent years the sector has undergone a dramatic transformation, evolving basically in-line with a number of trends seen globally. Farmed fish, primarily in the Mekong Delta, now represents over half of total production, and Vietnam has become a major exporter of aquatic products. At the same time, marine catch is plateauing, with all indicators pointing strongly to a situation of overfishing caused by overcapacity.

The fisheries sector in Vietnam is diverse and segmented: large marine vessels with powerful engines fish offshore waters while small (often non-motorised) boats catch small fish near to the shore; tropical fish species are farmed in intensive and commercially competitive ways targeting the export market, as well as in small ponds owned by poor farmers using aquaculture as a means to supplement their crop income; and sophisticated and profitable fish processing companies share the market with household enterprises manufacturing basic fish products for the domestic market. These distinctions are important for policy design.

The sector represents an increasing part of agricultural GDP, and indeed is targeted by the government to continue to do so. However, in the context of Vietnam's industrialisation and associated structural change, fisheries as a percentage of national GDP has been quite stable at around four percent for some time, and its contribution to the Vietnamese economy as a whole is thus comparable to the textiles and garments sector. As with some other agricultural products, while fisheries contributes relatively little to national GDP, it generates a disproportionate amount of the country's export earnings (10.7 percent). And as with the rice sector in Vietnam, most product is passed downstream to the processing sector prior to consumption or export.

Total fisheries production has been growing steadily over the past two decades, climbing to 4.5mn tonnes in 2008, representing an increase of 350 percent from 1990 levels. Much of this rise has been derived from the aquaculture subsector which has grown from almost nothing just twenty years ago. If the aims of the sector 2020 Strategy are realised, such trends will continue, with a compound annual average growth rate of 3.6 percent targeted for the coming decade. Compared to growth of recent years, this actually represents a slight deceleration, though within this, aquaculture is targeted to account for 65-70 percent, implying an aquaculture output double that of today in ten years time.

Aquaculture Production and Export

Vietnamese aquaculture output and value have soared at an annual average growth rate of approximately 20 percent from 2000, exceeding the already high rates of the 1990s. By 2008 Vietnam accounted for almost five percent of world aquaculture output and value, triple that of 1990. Together, two products, Pangasius and the Giant Tiger Shrimp dominate, accounting for about two-thirds of total production and value. Moreover, this species dependence has increased over time. Production is concentrated geographically in the Mekong Delta, and in particular the provinces of Dong Thap, An Giang, and Ca Mau. The narrow dependence on two species has enabled the aquaculture sector to specialize, but it has negative implications for economic risk and regional equity.

Disease is perhaps the most likely and detrimental negative production shock, and there are recent examples from South America of rapidly growing, but short-term focused, aquaculture sectors that have suffered severely from this. In addition, poor quality feed and water quality concerns should be taken into serious consideration. Exogenous shocks such as climate change could also adversely affect production. A further shock could come from media information about the use of antibiotics. This occurred in the US and farmed salmon from Chile. A reason to diversify may also to spread the benefits of aquaculture to all regions of Vietnam. There are a number of other species, besides Pangasius and Tiger Shrimp that could be cultivated successfully outside of the Mekong Delta, some with a comparative advantage that could provide export opportunities; others would be more a means of providing livelihoods and of protein.

Aquaculture targeting in Vietnam is largely expressed in tonnage with little apparent interest in value except where it can be expressed as exports and foreign exchange. Profitability and efficiency are more appropriate benchmarks, and are likely maximised at production levels lower than the sector targets. This is reflected in an (over-)emphasis on Pangasius and Tiger Shrimp due to their beneficial impact on the balance of trade. To this extent, the model is similar to Chilean and earlier Thai experience. However, it appears to be to the detriment to species diversification, particularly species such as seaweed that may be viable only for the domestic market.

A significant factor in Vietnam's successful aquaculture expansion has been the cultivation of products destined for export. Vietnamese policymakers, as in some other countries, whether Chile (farmed salmon) or Thailand (farmed shrimp), have viewed aquaculture not only as source of rural livelihoods but also as an international tradable product, and a source of foreign exchange. The primary export product, Pangasius, is essentially a low value-added generic product, with demand based almost entirely on price. Calculations made in this report find an inelastic own price elasticity of demand and an income elasticity of less than one. Although a normal and not inferior good, Pangasius must compete with low cost white fish substitutes such as Tilapia. If the plans for a continued rapid expansion in production and export are realised, Pangasius is thus vulnerable to oversupply, and appears to be in a poor bargaining position in importing countries. One of the ironies of food products that have inelastic demand is that higher supply actually results in lower revenues, because the increase in output is swamped by the decline in price. Given inelastic price elasticity of demand, the recent proposal to introduce a price floor on Pangasius exports has potential to help the industry, especially in markets where there are currently few substitutes such as the EU. But the possible resulting emergence of a product surplus should be carefully monitored. Limiting output with a species that has inelastic own-elasticity would actually raise revenues- and processors may have an incentive to pass-on some of the higher price to farmers to ensure raw material. This pass-through is more likely if the process of vertical integration continues such that processors own farms themselves.

Processors of Pangasius must therefore develop more sophisticated (value-added) forms such as breaded fillets if the projected output expansion is not to produce a sharp decline in revenues. In short, focus in the sector must switch from targeting production to quality and value. Shifting the demand curve by generic marketing, as was successfully done by salmon farmers some years ago, is one way to do this. In this sense, product branding is key. Despite healthy growth, Vietnamese export produce is still not sufficiently 'visible' on the international market. Furthermore, Vietnamese exporters often target the lower end of the market and compete more on price than quality. This appears to have led to an image problem in that buyers in main import markets associate Vietnamese produce with lower price rather than high quality. The development of a brand name (quality mark) should form a core part of the wider aquatic export promotion strategy of the country.

The potentially disastrous impact of climate change to continued production of both Pangasius and shrimp in the Mekong Delta is well documented. Margins per kg are already very low for Pangasius, such that higher costs will threaten the survival of many farms. Shrimp farms may cope by consolidation given that some economies of scale exist, but in general, options facing farmers are limited. Feed is such a critical cost for farmers that any action that reduces feed costs could offset some of the damaging effects of climate change. As with feed, the cost of medicine is also important. Compared with other countries, medicine is over-used in Vietnam which may be due to poor husbandry practices, perverse incentives by pharmaceutical agents and retailers, or declining quality of fingerlings. There are policies that governments can implement to encourage better management practices, reduce the over-prescription of drugs, and improve the quality of fingerlings.

Aquaculture Certification and Vertical Integration

Increasingly, regulations concerning food health and safety are becoming more stringent and enforced in importing countries. Consumers are not only requiring greater assurances about food safety but also about the environmental and social impacts of production. Market access is thus becoming difficult except for the very largest producers, and small-scale farms may lack the technical knowledge and financial depth to adapt their production. Despite these difficulties, meeting such standards is becoming a prerequisite for access to most importing countries. Such standards may be perceived as non-tariff barriers, but countries wishing to access those markets must abide by them. There is no price premium for meeting standards; instead the cost must be borne by exporters.

While Vietnamese exports are largely concentrated in a small number of major (developed country) markets, there is a growing tail of 'other' destinations. Such a diversification of export markets is a sensible risk-reducing strategy, but many of the 'other' countries impose less stringent standards on their fish imports. In the short-term, it will be tempting to exploit this given the lower compliance costs involved, but the medium to long-term rationale of this are doubtful. Investments should be made now to fulfil the relevant (mandatory and voluntary) certification requirements. A detailed analysis and set of recommendations of *voluntary* aquaculture certification standards is included in the report appendix.

In Vietnam these (traceability) requirements in importing countries have forced the domestic value chain to start to adjust. Domestic processing companies have driven the process, acquiring grow-out farms (particularly Pangasius) and establishing feed mills. Production is, in other words, being integrated down the value chain in a process initiated and managed by, and therefore happening on the terms of, the processing companies. The motivation of this vertical integration may be partly to control costs but the primary concern appears to be the need to meet standards. It may just be an emerging trend at this point, but to the extent that it is profitable and viewed as worthwhile by the processors, large integrated companies including feed manufacture, grow-out fish farms, and processing activities producing aquatic products ready for export are likely to increasingly dominate the aquaculture sector especially in the Mekong Delta. Given the potential efficiencies this could bring, integration is probably the right thing to happen for the industry. But it is important for this trend to be carefully managed by policy-makers in an efficient and equitable manner. This is particularly important vis-à-vis the producers (grow-out farms) who are in general smaller and more vulnerable than the other actors.

Marine Capture Fisheries

Despite year on year rises in ocean catch, productivity has been declining for many years. Due to a classic 'tragedy of the commons' situation, the Vietnamese ocean appears to be overcapitalised- simply put, there are too many fishers chasing too few fish. Moreover, the situation is worsening; with a sevenfold increase in the aggregate horsepower of Vietnam's fishing fleet accompanied by just a threefold rise in production since 1990. The problem is particularly acute in near-to-shore waters- Approximately 60 percent of total catch is caught, and 86 percent of vessels operate, in an area representing just 25 percent of the total exclusive economic zone (EEZ) of Vietnam.

A significant proportion of ocean catch is comprised of so-called 'trash fish': low-value small or juvenile fish, spoiled fish due to poor post-harvest facilities on boats and onshore, and by-product of fishing with non-selective gears. This part of the catch is used primarily in the manufacture of fish sauce and fish/livestock feed. Such a high 'trash fish' component is indicative of the underlying problems plaguing the subsector, such as poor post-harvest techniques and adoption, lack of environmental consideration, and poor control of gears. Policy actions in this area should be a priority.

Results from surveys conducted as part of the report show the marine fisheries supply chain to be highly unbalanced. The processors set the price with the middlemen, and the middlemen set the price with the fishers. Fishers are price takers with slim operating margins, implying a high vulnerability to adverse cost or price changes. A small rise in operating costs can lead to losses, as was clearly illustrated with the fuel price rises of 2008. The response of authorities in this instance of a fuel price subsidy is in many ways understandable. But while subsidising the sector may ease the short term pain on such occasions, and indeed has undoubtedly played an important role in fishers' livelihoods, the economic rationale of longer term subsidisation of the sector is not obvious. Policies can be implemented to attempt to redress the skewed distribution of value-added in the supply chain. In particular, specific attention should be paid to supporting the fishers. Helping fishers to organise themselves into groups such that they interact with the supply chain in a collective way would be one solution. Providing alternative credit sources and initiatives to teach and finance preservation systems on board vessels would also help to reduce fishers' dependence on middlemen. Related to this, report findings illustrate clearly the quality versus quantity trade-off, such that 'low quantity higher quality' catch is not only more sustainable, but also more profitable.

All indications are thus of a marine fisheries subsector that would be more profitable at lower levels of production (catch). As things currently stand, fishers are facing a triple-whammy: They are having to fish longer and harder to catch the same volume of catch; the fish they do catch tends to be of lower commercial value; and the operating costs of fishing (such as fuel) are, in general, rising. In many cases, economic losses are thus being incurred, causing hardship on a fishing community already facing challenges. Indeed, for those small-scale fisheries activities that are seemingly economically viable in Vietnam, it is most likely due to strong market demand (which may come and go), government subsidies to the sector, a low opportunity cost to attracting labour to the ocean, and insufficient attention paid to sustainability.

Addressing Overfishing

There is thus a pressing need to start the process of reducing fishing effort. Labour and capital (fishermen and their boats) are 'sticky', such that any removal of them from the industry can be expected to be a difficult and lengthy process, and should necessarily be accompanied by supporting policies. Regulation (of fishing effort or production) is unlikely to bind unless there are concomitant initiatives put in place to (i) incentivise fishers to behave in a sustainable manner, and/or (ii) provide alternative and/or supplementary livelihood possibilities for fishers such that they are able to seek (part of their) income outside of the subsector. A plethora of possible alternatives has been proposed, but it is clear that local participation is a key factor in determining the success of such initiatives. In this sense, the law surrounding co-management, between fishers and local authorities, should be clarified and disseminated such that the successful initiatives already in place can be applied more widely. In general, it is inevitable that fisheries will continue to play an important role in the coastal economy, despite declining productivity. The most realistically attainable solution will see households holding a portfolio of income-generating activities with a mix of (co-managed) marine capture fishing and a range of alternatives or supplementary activities.

In this context, the value added of the marine fisheries sector does still appear to be growing (albeit less than the economy-wide average). But this is not taking into account the fact that some of the natural capital of fish stocks is being used up in the process of generating this. A strong case can be mounted for the view that the value-add numbers for fisheries in standard national accounts (SNA 93), such as those used in Vietnam, represent overestimations of the true levels due to overfishing. The '*Handbook of National Accounting: Integrated Environmental and Economic Accounting*' (2003), referred to as SEEA 2003, is a satellite system of the SNA. Unlike the present SNA, a depletion-adjusted value-added derived from natural fisheries resources in open access marine and inland water bodies could be included in a SEEA for Vietnam. Mainstreaming SEEA into the ongoing statistical national accounts system while clearly challenging and a big step (technically and strategically), would help to quantitatively demonstrate the losses currently being incurred.

Small-Scale Fisheries

Much of the aquaculture subsector analyses and policy time in Vietnam appear to centre on large-scale production in the Mekong Delta. However, aquaculture is also widely practiced in other (rural) areas of Vietnam, often on a small-scale basis. Indeed, while aquaculture is increasingly viewed as a commercial large-scale industry, the vast majority of farms remain small. In the case of capture fisheries, marine activities, based along the 29 coastal provinces of Vietnam, clearly receive most attention. But in addition to marine water resources, Vietnam has a dense river network, including nine major river basins as well as a substantial inland water surface area of (open access) lakes and lagoons. Very little is actually known about the levels of production, profits generated, and the characteristics of those fishing from such inland common water resources. Due in part to the nature of the subsector, data is thin as catch is simply not reported in any systematic way. As such, just one (relatively modest) national production number of approximately 200,000 tonnes is published every year. Inland capture fishing is the least understood fisheries activity in Vietnam.

Using detailed rural household data, the report shows that such small-scale fisheries activities (both farming and capture from open access water bodies) represent an important contribution to rural livelihoods and food security for many households in provinces in the North and Central Highlands- regions not normally considered to engage much in fisheries. A significant minority of households are found to devote at least one tenth of their (crop) land to ponds regardless of incomes. Inland capture fishing is also found to be important, particularly for the poorer households. Production values contribute in the region of 10 percent to overall household income, and a high proportion of households, regardless of relative wealth, are found to invest in aquaculture.

Sector Interlinkages and Economywide Effects
Feed is the most significant cost component of aquaculture production, and its price and quality are thus critical. Historically, homemade feeds made from caught inland and marine ('trash') fish have predominately been used by fish farms in Vietnam. In recent years a shift in favour of manufactured feeds has been observed, due to increased availability of the latter as well as increased concern about quality and efficiency. Until recently, up to 80 percent of manufactured feed was imported, but the number is now closer to two thirds as new domestic feed manufacture capacity has come on-stream in-line with increased demand. Nevertheless, imports are still significant, and international prices remain therefore important.

Domestic feed manufacture capacity now far outstrips the availability of its primary input (namely, marine 'trash' fish). To the extent that there is overfishing and a low/falling supply of marine (trash) fish to be used as an input for fish feed, there is a constraint (in the form of a high and increasing dependence on low value marine trash fish) to the further development of the domestic feed manufacture industry and therefore aquaculture production more generally. It would be important therefore to be cognizant that such large targeted expansions in aquaculture production may necessarily entail a rise in demand of marine 'trash' fish- potentially offsetting any efforts to reduce overfishing. The linkage between marine fish catch and farmed fish, through the fish feed channel, has important consequences for the sector as a whole.

With the above results in mind, the final chapter of the report develops a computable general equilibrium (CGE) model (calibrated to the 2007 SAM) to simulate the possible economywide effects of some of the key characteristics, trends and long-term official strategies of the sector. A reduction in marine fish catch by 15 percent in both the Mekong Delta region and rest of Vietnam is firstly assumed. This would clearly be highly detrimental to the subsector's GDP. However, due to their use of marine fish as an input, the downstream industries of fish processing and fish feed industries would be hardest hit. For the latter, this has third round knock-on effects to aquaculture, the user of this feed. Clearly fishing households would be hurt the most from such an event, though non-fishing households in the economy would also suffer due to wages being driven downwards from the displaced former fishers.

On top of this scenario, two scenarios exploring different possible paths for expanding aquaculture production beyond the subsector's already strong performance are modelled. More specifically, the economywide effects of achieving a 4.5mn tonne aquaculture production target by 2017[1] via either extensification (i.e., land expansion) or intensification (i.e., yield improvement) are analysed. In order to achieve this output target, the report calculates that an estimated 1.7mn hectares of land needs to be shifted from crops to aquaculture. Such an 'extensification strategy' would lead to rises in production and value-added of the subsector. Demand for feed would clearly increase, and given an assumed falling marine catch, feed imports would thus need to rise substantially. However, there would also be large corresponding declines in food crop production with large associated declines in consumption spending for fish farming households.

Although not stated explicitly, the MARD master plan (as well as other sector documents) appear to target the substantial aquaculture production increases without a corresponding increase in land (pond) area.

[1] The 2020 Strategy implies an aquaculture production target of 4.9mn tonnes by 2020. Assuming linear growth from 2007 levels, production in 2017 would be approximately 4.5mn tonnes.

Such an ‘intensification strategy’ is clearly a desirable objective as it would imply that new resources or productive capacity are effectively being brought into the economy. Under this scenario of rising production and improving yields, the total factor productivity growth rate for aquaculture in the Mekong Delta would increase substantially. Despite the fact that aquaculture production rises at the same rate to the same final volume in both the extensification and intensification simulations, the former requires a trade-off in the form of ponds substituting crop land. As such, an intensification strategy such as this results in larger growth effects. National GDP in 2017 from an intensification strategy is 0.6 percent higher than under an extensification strategy. In this scenario, there is no longer a drop in food crop production (given no substitution of land). In fact, food crop production now actually rises in the model due to the faster economic growth overall. All households benefit from faster economic growth, higher national incomes, and no spike in food prices. In particular, the latter effect helps make intensification a really ‘pro-poor’ strategy (nobody loses and the poor win the most), an unambiguous Pareto gain.

Given the narrow range of species, and the export orientation of the sector, world prices are a serious risk to take into consideration. A final scenario therefore builds on the ‘intensification strategy’ adding a 10 percent drop in real world export prices for aquaculture. A price drop of this magnitude would partially offset the benefits of an intensification strategy. Aquaculture exports would fall dramatically, and in-line with falling aquaculture production, feed demand would also fall. National GDP is lower in this scenario, due to falling aquaculture and feed production. Unsurprisingly, the Mekong Delta area is the worst hit, but overall GDP still rises thanks to the intensification strategy.

1 Introduction

Fishing in Vietnam is an ancient tradition and vocation, dating back many hundreds of years. Today, the sector represents an important source of economic growth, employment, nutrition, and foreign exchange in Vietnam. In recent years the sector has undergone a dramatic transformation, evolving basically in-line with a number of trends seen globally. Farmed fish, primarily in inland areas and the Mekong Delta, now represents over half of total production, and Vietnam has become a major exporter of fish and fish products. At the same time, marine catch is plateauing, with all indicators pointing strongly to a situation of overfishing caused by overcapacity.

The fisheries sector in Vietnam is diverse, characterised by numerous different actors, stakeholders, gears, techniques, and caught/farmed species. Characteristics, trends in production and revenue, and challenges therefore vary hugely within the sector, making generalisations difficult. Moreover, a lot is currently happening within the sector. The Government of Vietnam (GoV) is proactive in many areas, with a new Directorate of Fisheries (D-Fish), born out of the former Ministry of Fisheries (MoFi)[2] recently established in the Ministry of Agriculture and Rural Development (MARD). At the time of writing, the sector's ten year strategy (to 2020) has just been approved (Decision 1690/QD-TTg) worth USD 2.9bn, and a sector master plan for the next five years will subsequently be elaborated detailing more specific objectives for the sector.

In addition, numerous initiatives by local agricultural/fisheries authorities at the provincial, district and commune levels are taking place. International donors and non-governmental organisations (NGOs) are also active, with new financial support to the sector from certain bi- and multilateral donors currently in the pipeline in reflection of the perceived importance of the sector. In this context, a large body of research and analytical work has been produced on the sector (see references). In many cases, the broad nature of many of the challenges and issues facing the sector are thus well-known and clearly identified in official documents and sector reports. As such, decisions, decrees and laws have been issued incorporating provisions for many of the key issues, and it is fair to say that what is now largely lacking is well-planned, coordinated and integrated implementation on the ground.

Nevertheless, the sector is developing extremely rapidly, and a deep understanding of the nature of some of the core (economic) issues and challenges confronting fisheries authorities remain unaddressed (Van Arkadie & Hung, 2009). In this context, the aim of this report is to provide a strategic (long-term) economic analysis of the fisheries sector in Vietnam. Today Vietnam is essentially a decentralized market economy. Production and Investment decisions (in the economy as a whole and in the fisheries sector) are made by private businesses and households, and the role of policymakers is therefore to target how best to support and influence these decisions. Furthermore, there are increasingly close interdependencies among sectors such that a policy action in the fisheries sector, for instance, will inevitably impact on other sectors, and vice versa. This report aims to provide a comprehensive overview of the main economic trends, issues and challenges facing the Vietnamese fisheries sector today. From a national policymaker perspective, there is a legitimate need to see fisheries in context of the overall economy, and the report thus aims, where applicable, to take a step back in order to view the sector within the context of Vietnam's economy as a whole. In that sense it is written for policymakers within and outside the fisheries sector.

Three cross-cutting themes across the whole sector are identified. Firstly, the fisheries sector in Vietnam is highly segmented: large marine vessels with powerful engines fish offshore waters while small non-motorised boats fish small species near to the shore; tropical fish species are farmed in intensive and commercially competitive ways targeting the export market, as well as in small ponds owned by poor farmers using aquaculture as a means to supplement their crop income; and sophisticated and highly profitable fish processing companies share the market with household enterprises manufacturing basic fish products for the domestic market.

[2] Many of the former-MoFi functions and divisions such as NAFIQAD and DPT have remained in MARD.

Second, the concept of sustainability is clearly critical to the future success of the sector. Defining sustainable development as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs' (UN, 1987), fisheries in Vietnam must address many hard decisions if growth in the long run is to be ensured. Finally, somewhat of a 'paradigm shift' needs to take hold in the sector from targeting production volumes to efficiency and value addition. As will become clear, the profitability of the marine capture fisheries subsector, for example, is likely maximised at production levels below current levels.

Chapter 2 provides an overview of the fisheries sector in Vietnam in the context of the economy as a whole. Chapter 3 analyses the fish farming (aquaculture) subsector, while Chapter 4 considers capture fishing from Vietnam's ocean resources. Chapter 5 analyses small-scale fisheries activities in areas outside of the Mekong Delta. Chapter 6 introduces a dynamic (computer generated equilibrium) modelling of some of the trends and issues arising in the previous sections. Chapter 7 summarises some of the main conclusions and policy recommendations from the report. An appendix contains two further sections: The first provides a detailed analysis and set of recommendations for (voluntary) aquaculture certification standards in Vietnam. The second considers the issues associated with fisheries data in Vietnam.

2 The Fisheries Sector in Vietnam: *An Overview*

Fisheries is an important sector of Vietnam, contributing to economic growth, household nutrition, rural employment and foreign exchange earnings. This chapter provides a broad overview of the fisheries sector in the context of the economy as whole.

The Fisheries Law[3] was passed by the National Assembly in November 2003, and entered into effect in July 2004. The law is widely regarded by the majority of stakeholders as comprehensive and highly satisfactory at providing a solid basis upon which to manage fisheries resources in Vietnam. The law refers extensively to the sector master plan, noting that '*the development of fisheries activities… shall be done in accordance with the development master plan…*'[4]

At the time of writing, the sector's ten year strategy (2011-20), hereafter referred to as the '2020 Strategy', has just been approved by the Prime Minister (Decision 1690/QD-TTg), and a master plan for the next five years will subsequently be elaborated detailing more specific objectives and targets for the sector. Also in existence is the MARD Master Plan which includes sections on agriculture, forestry and fisheries, and contains two discrete time periods, from 2005-10 and from 2011-15. In this section, and throughout the report, reference will be made where appropriate to the latter period of the MARD master plan and the overall targets and objectives set out in the 2020 Strategy.

In this chapter, a recently developed Social Accounting Matrix (SAM) is used. The 2007 SAM[5] is based on the (new) 2007 Supply Use Table (SUT) constructed by General Statistics Office of Vietnam (GSO). It is therefore the most up-to-date and complete representation of Vietnam's economic structure currently available. Detailed information on the structure of production and foreign trade is contained with disaggregated data on 63 sectors, of which 23 are in agriculture. Agricultural production is divided into crop agriculture (7 subsectors), livestock (3), fisheries (2- capture fishing and aquaculture) and forestry. Most of the sectors identified in the SAM are in industry, which is separated into mining (4 subsectors), manufacturing (30, of which one is the fish processing subsector and one the fish feed subsector), utilities (2) and construction. Finally, the SAM also contains information on 12 different service sectors, including private services (9 subsectors) and public or government services (3).

The Vietnam Social Accounting Matrix

A Social Accounting Matrix (SAM) is a consistent data framework that captures the information contained in the national income and product accounts and the supply-use table (SUT) of a country, as well as the monetary flows between institutions. As such, it is an economy-wide data framework usually representing the real economy of a country. The Vietnam SAM is based on newly estimated supply-use tables, national accounts, state budgets, and balance of payments. The SAM reconciles these data using cross-entropy estimation techniques. The final SAM is a detailed representation of Vietnam's economy. It separates 63 activities and commodities; rural/urban labour by different education levels; and households by rural/urban areas and farm/nonfarm expenditure quintiles. Labour and household information is drawn from the 2006 Vietnam Household Living Standards Survey (VHLSS). Finally, the SAM identifies government, investment and foreign accounts. It is therefore an ideal tool for economy-wide impact assessments, including SAM-based multiplier analysis and computable general equilibrium (CGE) modelling.

Since the required data for a SAM is not drawn from a single source, information from various sources must be compiled and made consistent. This process is valuable since it helps identify inconsistencies among Vietnam's statistical sources. For example, there are invariably differences between the incomes and expenditures reported by households in Living Standards Surveys. SAMs are economy-wide databases

[3] Law 17/2003/qh11. The law will be revised over the coming years, with a new, or updated, law expected to be ready in 2013.
[4] Article 4, paragraph 1 of English translation of Fisheries Law.
[5] Developed by Arndt et al (DERG, University of Copenhagen), 2007.

which are used in conjunction with analytical techniques to strengthen the evidence underlying policy decisions. One of the major advances of the 2007 SAM over previous SAMs for Vietnam is that it is based on a new 2007 SUT constructed by GSO. It is therefore the most up-to-date representation of Vietnam's economic structure.

The 2007 Vietnam SAM was developed by the DERG/UoC and CIEM in 2009 and 2010 with Danida financial support. More details can be found in DERG et al, 2009 (see references).

2.1 Fisheries in Context

Table 2.1 shows the sectoral structure of gross domestic product (GDP) in Vietnam, with four fisheries subsectors highlighted. Agriculture accounted for 15.6 percent of total GDP in 2007, most of which is generated by crop agriculture, particularly paddy rice. The fisheries sector, as a whole, accounted for 3.2 percent of GDP in 2007, almost half of which is derived from aquaculture. In terms of its contribution to GDP, the sector is thus comparable to the textiles and clothing sector or the processed foods sector. Fisheries exports, taken as a whole, account for 10.7 percent of total exports for Vietnam, of which 7.6 percent comes from the processors.

Table 2.1: National Structure of the Vietnam Economy, 2007

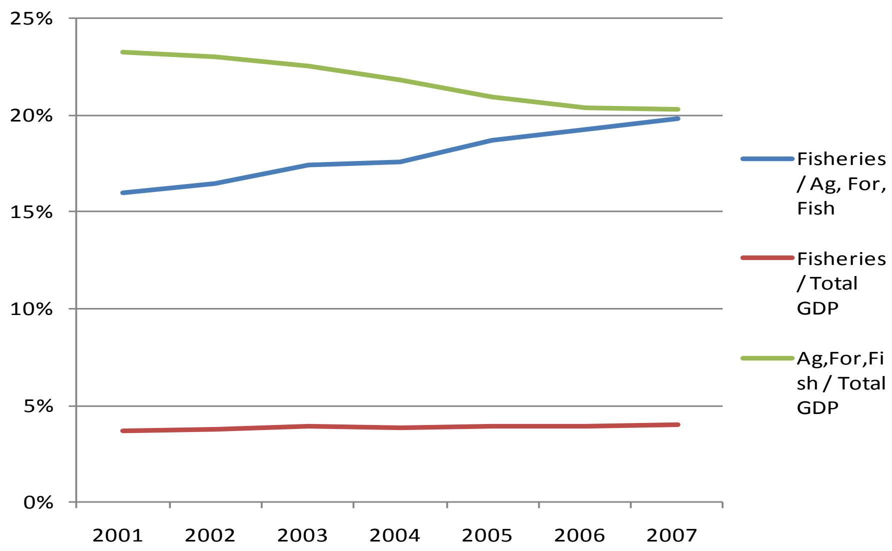
	Share of Total (%)			Export-intensity	Import-intensity
	GDP	Exports	Imports		
Total GDP	**100.0**	**100.0**	**100.0**	**27.0**	**35.4**
Agriculture	**15.6**	**6.8**	**2.2**	**13.7**	**7.4**
Crops	10.4	2.9	1.6	12.2	10.1
Rice	5.6	0.0	0.0	0.0	0.0
Sugarcane	0.3	0.0	0.0	0.0	0.0
Annual crops	1.3	0.5	1.1	16.6	38.4
Perennial crops	3.2	2.4	0.6	35.7	15.9
Livestock	1.4	0.8	0.0	9.0	0.0
Forestry	1.3	0.0	0.6	0.0	20.1
Ocean fisheries	1.1	0.1	0.0	3.1	1.0
Aquaculture	1.4	3.0	0.0	36.6	0.0
Industry	**42.7**	**87.7**	**90.5**	**37.8**	**48.1**
Mining	10.3	14.9	0.4	82.8	15.4
Manufacturing	19.2	72.9	90.0	43.5	58.1
Fish processing	0.5	7.6	0.4	88.7	39.9
Fish feed	0.2	0.0	1.5	0.0	61.4
Other manufactures	18.6	65.3	88.0	41.4	58.1
Other industry	13.2	0.0	0.2	0.0	0.6
Services	**41.7**	**5.4**	**7.3**	**6.2**	**10.6**

Source: 2007 Social Accounting Matrix for Vietnam.
Notes:"Export-intensity" is the share of exports in domestic marketed output; "Import-intensity" is the share of total domestic supply supplied by imports.

One of the advantages of a SAM is that is shows the structural linkages of an economy. For example, while Vietnam exports paddy rice, most of the benefit is passed downstream to the rice husking or processing sector. Although this latter sector contributes relatively little to national GDP, it generates a disproportionate amount of the country's export earnings. Similar observations apply to the fisheries sector: as Table 2.1 shows, marine capture fisheries ('ocean fisheries') directly exports a tiny proportion of its raw output abroad, with most of its output used in the production of fish feed and processed foods (i.e., 'other' products). The fish feed sector is a major source of demand (an estimated one fifth of total marine catch is used for fish feed manufacture- see Figure 2.5), with ocean fishery products accounting for two-thirds of the costs of domestic feed production. However, despite domestic production, Vietnam still relies on imported feeds, with roughly three-fifths of all manufactured feed stocks used in the country imported from abroad. This feed is used in the aquaculture sector, where it accounts for a majority of farm operating costs. The ocean fisheries and aquaculture sectors are therefore closely linked within a production chain. These interlinkages will be explored in detail in Figure 2.5 and Chapter 6.

Figure 2.1 shows the contribution of the fisheries sector to national GDP over time.

Figure 2.1: Fisheries as a Share of National GDP (percent)



Source: 2007 Social Accounting Matrix for Vietnam.
Note: Due to data inconsistencies between sources, absolute numbers may not always tally between tables/figures. In this figure, it is the trends that are important.

Fisheries is commonly grouped with the agriculture and forestry sectors. GDP in all three subsectors is rising in nominal terms, however, fisheries is rising faster, as shown by the upward sloping line showing fisheries as a percentage of 'agriculture, forestry and fisheries'. This is occurring in the context of Vietnam's rapid development and industrialisation, and associated structural change in the economy- reflected in the falling percentage of total GDP accounting for by the 'agriculture, forestry and fisheries' sector. The overall result of this sees the fisheries' share of national GDP changing very little over the past decade.

The 2020 Strategy targets the fisheries sector to account for 30-35 percent of 'agriculture, forestry and fisheries' by 2020, implying an extremely rapid growth. In the MARD master plan, a growth rate of 6-7 percent in fisheries production value is targeted for the period 2011-15, which is broadly in-line with the previous five years. It is also in-line with the plan for livestock production (excluding fish), though higher than that for crop production (2.5-3.0 percent growth). The fisheries sector is therefore clearly being prioritised within the agriculture sector- the value of crop production, for instance, is targeted to fall from representing 70 percent to 64 percent over the coming five years.

Table 2.2 presents factor contributions to the value-added of selected sectors in the Vietnamese economy.[6] In the case of marine capture fisheries, the vast majority of value-added is generated by labour in rural areas (70.3 percent). The educational profile of workers is low compared to the economy as a whole, with most workers having primary or secondary education (up to grade 9). The remaining value added comes from capital (boats and gear). Due to their open access nature, no land or livestock has a contribution. Value-added from aquaculture is generated fairly evenly between (rural) labour and 'land and livestock' (respectively 43.7 and 50.0 percent). There is no significant difference between marine capture fisheries and aquaculture in the education levels of labour. Finally, the subsector is characterised by low capital intensity relative to the national average, though this is in-line with the agriculture sector as a whole.

Value-added from the fish processing sector comes from labour and somewhat more capital, reflecting the equipment and machinery used in this industry. Labour has a slight rural bias, but is quite evenly split between rural and urban areas, and education levels are low.

Table 2.2: Factor contributions to sectoral value-added (rows sum to 100%)

	Labour					Capital	Land & livestock
	Urban	Rural	Tertiary	Second.	Primary		
Total GDP	**21.3**	**31.2**	**23.6**	**24.4**	**4.5**	**41.0**	**6.6**
Agriculture	**4.9**	**46.6**	**6.5**	**34.1**	**10.9**	**6.3**	**42.3**
Crops	2.6	42.9	4.7	29.9	11.0	4.7	49.8
Livestock	**2.4**	**39.6**	**4.3**	**27.6**	**10.1**	**8.0**	**50.0**
Forestry	**14.7**	**75.8**	**17.7**	**62.5**	**10.3**	**9.5**	
Fisheries	**10.6**	**50.8**	**9.5**	**40.6**	**11.3**	**10.1**	**28.5**
Marine Capture Fisheries	14.7	70.3	13.1	56.2	15.7	15.0	
Aquaculture	7.6	36.1	6.7	28.9	8.1	6.3	50.0
Industry	**16.1**	**26.2**	**16.2**	**22.9**	**3.3**	**57.7**	
Mining	**4.0**	**4.4**	**4.6**	**3.6**	**0.2**	**91.6**	
Manufacturing	**17.8**	**26.1**	**18.0**	**22.1**	**3.8**	**56.1**	
Foods	**15.7**	**23.9**	**13.2**	**20.3**	**6.1**	**60.5**	
Meat processing	19.4	29.5	16.3	25.1	7.6	51.1	
Fish processing	16.5	25.2	13.9	21.4	6.5	58.3	
Vegetable/fruit processing	15.6	23.7	13.1	20.1	6.1	60.8	
Oils and fats processing	9.5	14.5	8.0	12.3	3.7	76.1	
Dairy	9.1	13.8	7.6	11.7	3.5	77.2	
Rice husking	4.5	6.8	3.8	5.8	1.8	88.7	
Other food processing	15.4	23.5	13.0	20.0	6.0	61.1	
Textiles and clothing	**24.7**	**36.3**	**24.3**	**34.1**	**2.7**	**39.0**	
Wood and paper	**18.2**	**35.0**	**16.2**	**31.8**	**5.1**	**46.8**	
Chemicals	**21.0**	**14.2**	**17.2**	**14.0**	**4.1**	**64.8**	
Machinery	**14.2**	**18.0**	**19.5**	**11.3**	**1.4**	**67.8**	
Other manufacturing	**16.6**	**35.6**	**16.1**	**30.8**	**5.3**	**47.8**	
Utilities	**27.6**	**14.2**	**32.3**	**9.2**	**0.2**	**58.3**	
Construction	**21.2**	**55.2**	**18.4**	**51.3**	**6.7**	**23.6**	
Services	**32.7**	**30.6**	**37.6**	**22.3**	**3.3**	**36.8**	
Private services	**31.4**	**28.3**	**29.1**	**26.2**	**4.4**	**40.3**	
Government	**36.6**	**37.9**	**64.8**	**9.7**		**25.5**	

Source: 2007 SAM

Note: 'Land & Livestock' includes aquaculture ponds

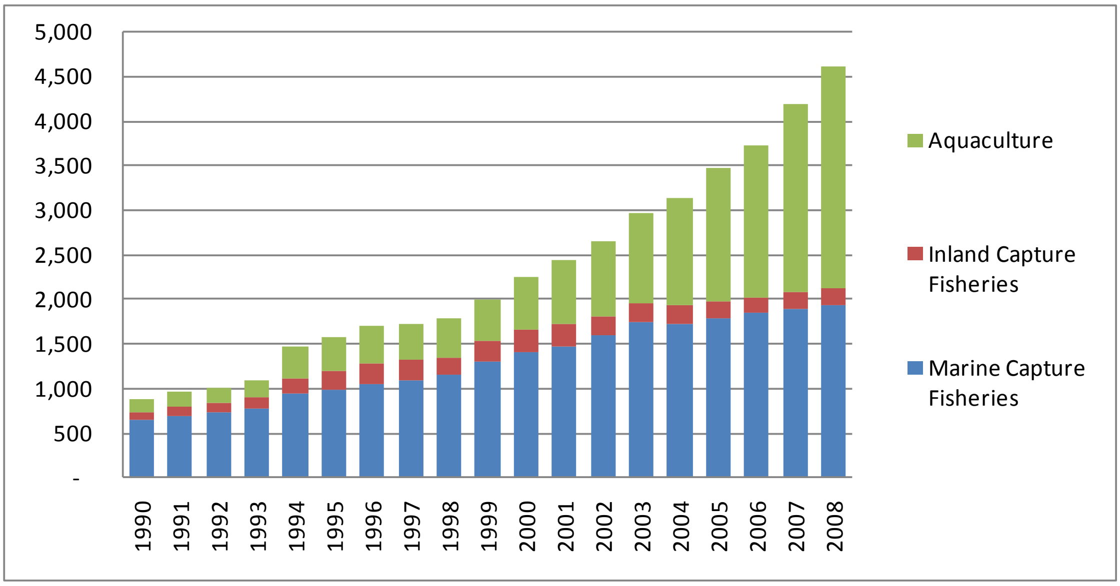
[6] Value-added refers to the contribution of the factors of production (land, labour, capital) to raising the value of a product (gross output minus intermediate consumption).

2.2 Production Trends

Many of the trends observed in Vietnamese fisheries mirror those observed at the global level. This is particularly apparent in the case of production. In that sense, much of the analysis and policy recommendations applied worldwide can, to a certain extent, be said to be relevant and applicable to Vietnam.

Figure 2.2 disaggregates production into the commonly-used three subsectors of aquaculture (farmed fish), inland capture fisheries (fish caught in non-marine open access/common property water bodies such as rivers and lakes), and marine capture fisheries (fish caught in the ocean).

Figure 2.2: Total Fishery Sector Production (tonnes)



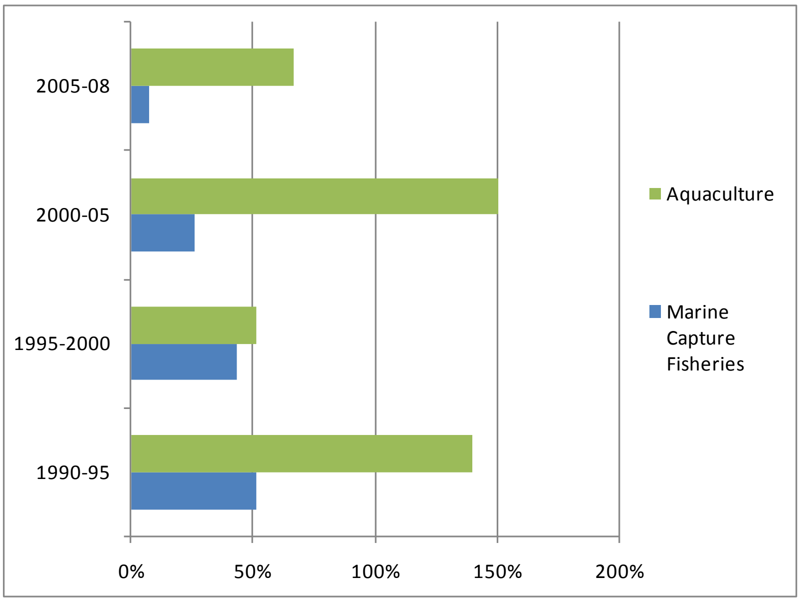
Source: Authors own calculations based on data from VIFEP

Production is thus split in roughly half between farmed fish and fish caught in the wild. Within the latter category, wild fish caught in *inland* water bodies and rivers accounts for a tiny share of the total.[7] Total production of the sector has been steadily growing over the past two decades, climbing to 4,582 thousand tonnes in 2008, representing an increase of 350 percent from 1990 levels. It is clear from the graph that much of this rise has been derived from the aquaculture subsector which has grown from almost nothing just twenty years ago.

Focusing just on the two main subsectors, Figure 2.3 clearly illustrates the divergent growth experience.

[7] The extent to which data on inland capture fisheries can be trusted will be analysed in more detail below.

Figure 2.3: Total Production Growth for Selected Time Periods (percent)

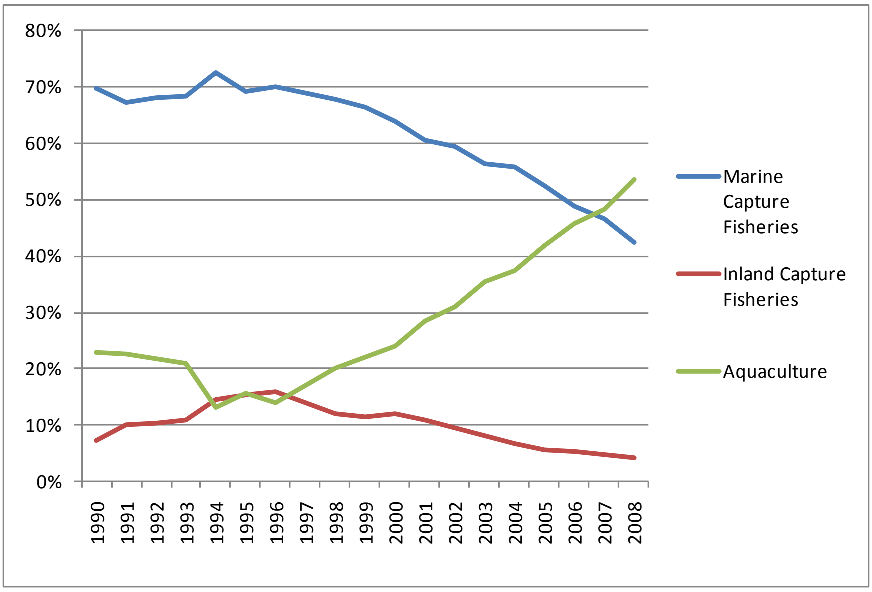


Source: Authors own calculations based on data from VIFEP

Growth in catch from the ocean has thus steadily declined through the nineties and the first half of the following decade. Growth in recent years has fallen dramatically, with catch growing under 8 percent from 2005 to 2008. Production from aquaculture has shown large increases since 1995, with a particular spurt coming from 2000 to 2005, when production almost tripled in the space of five years.

Figure 2.4 shows the shares of each fishery subsector in total production. As a result of the dramatic growth in production from farmed fish, over half of total fishery sector production now comes from aquaculture.

Figure 2.4: Shares of Total Fishery Sector Production (percent)

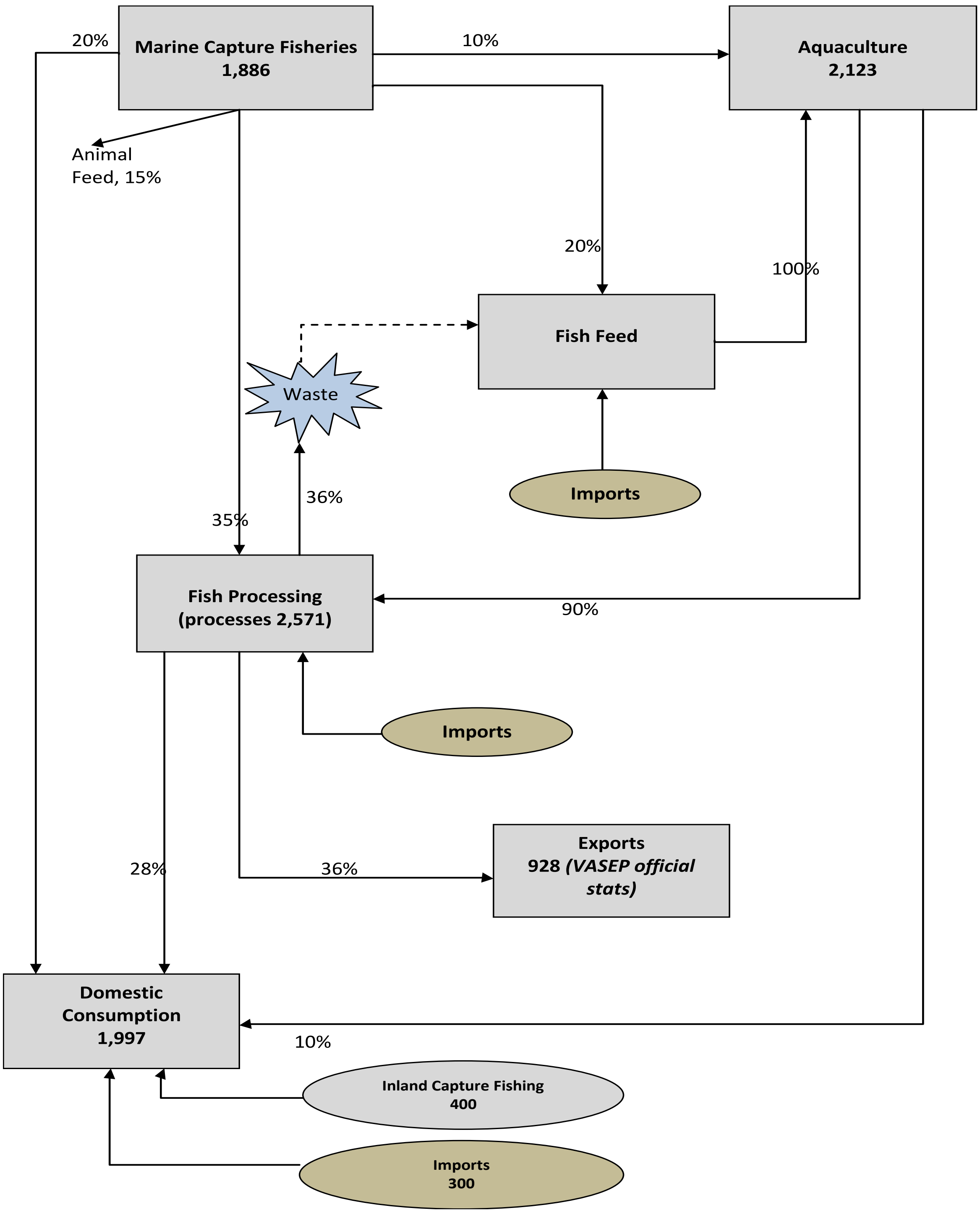


Source: Authors own calculations based on data from VIFEP

If the targets of the 2020 Strategy are realised, the trends shown in Figure 2.4 will continue. Total output of the sector is targeted to climb to 6.5-7.0mn tonnes by 2020. The upper range of 7mn tonnes implies an increase of 52 percent relative to current levels, and a compound annual average growth rate of 3.6 percent. Compared to the growth of recent years, this actually represents a deceleration of total sector output, though within this, aquaculture is targeted to account for 65-70 percent. This implies an aquaculture output in 2020 double that of today, amounting to 4.9mn tonnes. If these targets are realised, the corresponding output of marine capture fisheries output is 2.1mn tonnes, implying a *very slight* growth from current levels. The implications of this will be analysed in Chapters 3 and 6 of this report.

Figure 2.5 shows a schematic representation of the structure of the fisheries sector in Vietnam (2007 data used to be consistent with SAM- overall trends unchanged). Given the lack of consistency between data sources, there will inevitably be some degree of inaccuracy. Nevertheless, the numbers represent best guess estimates based on a number of sources and consultations with industry experts by the report authors. The following chapters of the report will dwell in detail on each of the subsectors and linkages, so it is presented here for reference.

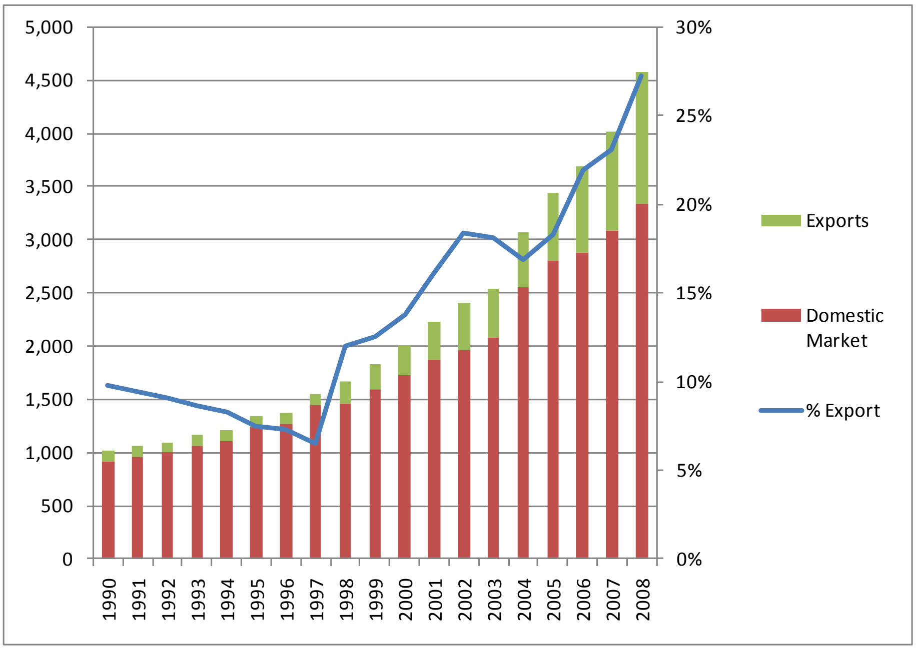
Figure 2.5: Fisheries Sector Structure (000 tonnes, 2007)



2.3 International Trade

Due to the globalization of markets for fish, some 37 percent of global fish production flows into international trade, making fish one of the most traded 'agricultural' commodities and accounting for up to 13 percent of global 'agricultural' trade.[8] 32mn tonnes were traded internationally in 2007; 20 percent more than in 2000 (FAO, 2009b). And while most fish caught or produced in Vietnam is currently consumed domestically, a significant and rising proportion (now over one quarter of volume) is exported (see Figure 2.6). This volume has risen exponentially since 2000, as has value, earning Vietnam over US$4.5bn in 2008. Vietnamese policymakers, as in some other countries, whether Chile (farmed salmon) or Thailand (farmed shrimp), have viewed aquaculture not only as source of rural livelihoods but also as an international tradable product, and a source of foreign exchange. Indeed, a significant factor in Vietnam's successful aquaculture expansion has been the cultivation of products destined for export (see Chapter 3).

Figure 2.6: Vietnamese Fishery Exports (tonnes and percent)



Source: Authors own calculations based on data from VASEP and VIFEP

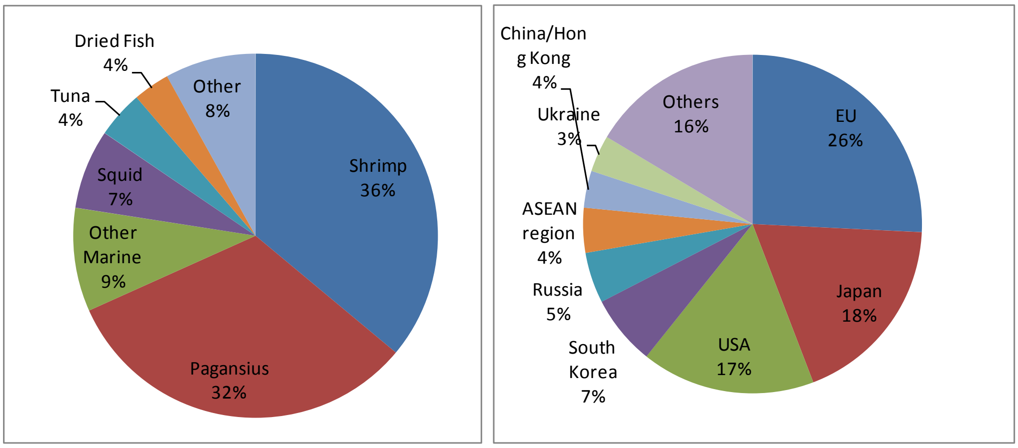
It is however important to highlight that net exports (exports minus imports) of seafood have not grown so rapidly. Rising domestic per capita consumption of seafood and population growth have induced seafood imports to increase from 7,950 tonnes in 2000 to 227,968 tonnes in 2007.[9] Taking these imports into account, net exports of seafood earned US$3.4bn in 2007. According to food balance sheets, all major fish products such as freshwater, crustaceans, cephalopods and molluscs continue to have a net export balance (FAO, 2010b). The only exception is marine fish with a negative trade balance (import tonnage is double that of exports).

The 2020 Strategy targets exports to reach US$ 8-9bn over the next ten years, implying a near doubling relative to current levels. Assuming a constant value per unit (tonne) of export, and a total output of the sector of 7mn tonnes (in-line with the 2020 Strategy), this would imply export volume rising to 2.3mn tonnes, representing 33 percent of total sector output.

[8] World Bank, 2009.
[9] A large part of these imports are processed in Vietnam before being exported.

Figure 2.6 shows the breakdown of exports by species and destination.[10] The rising export share of the sector is thus in large part directly linked to the growth in aquaculture over recent times, with Pangasius and shrimp accounting for the majority of export volume and value. The EU, Japan, and the US are the largest destination markets, though there is a long (and growing) tail of 'other' countries. Exporting to this latter group, due to their different, and often more lax standards and demands, may have significant implications for Vietnam- a detailed analysis of this is provided in Chapter 3.2.

Figure 2.7: Vietnamese Fishery Exports by Species and Destination (US$ value, percent)



Source: Authors own calculations based on data from VIFEP

2.4 Food Security

The population of Vietnam in 2009 was over 86mn, with growth at around 1.5 percent annually. While child survival is approaching replacement rate (2.1 children per woman), the young population and increasing life expectancy mean that continued growth is inevitable, with a projected population of around 105mn by 2025 (UN estimations). In addition to its population growth, disposable personal income levels are growing rapidly as a result of the well-documented strong economic growth. The number of households living in poverty is falling, meaning that the number of potential purchasers for fish and marine products will likely increase steadily. Health factors, with increasing awareness of the beneficial impacts of fish consumption will also promote domestic demand.

Southeast Asia relies heavily on fish for food and for protein. Table 2.3 presents average fish consumption and fish protein intake, as well as the contribution of fish to animal protein intake.

[10] Some care should be taken when using these figures, as short-term fluctuations, especially in the destination markets, can be large such that the pattern changes quite significantly from one year to the next.

Table 2.3: Selected Indicators of Food Insecurity 2007

	Population	Fish Consumption	FISH PROTEIN	ANIMAL PROTEIN	FISH / ANIMAL PROTEINS	FISH / TOTAL PROTEINS
	millions	kgs / person / year	grams / person / day		(%)	
VIETNAM						
2000	78.7	20.4	5.5	15.8	34.8	9
2003	81.3	24.1	6.6	19.3	34.2	9.9
2007	86.1	26.1	7.2	23.9	30.1	9.8
SE ASIA						
2003	523.5	26.2	8	17.9	44.7	15.9
2007	564	27.9	8.5	20.8	40.1	13.7
WORLD						
2003	6,198.0	16.1	4.4	29.1	15.1	5.8
2007	6,951.0	16.7	4.7	29.8	15.8	6.1

Sources: FAO, 2010b, Food Balance Statements 2007

As the table shows, per capita consumption of fish in Vietnam has been increasing sharply and by 2007, the gap from the Southeast Asia average was narrowing. The region of South East Asia as a whole has a per capita consumption of fish more than 60 percent higher than world consumption. The relatively high and rising fish consumption is combined with generally low levels of protein in Vietnam (80 percent of the world average of total protein). This finding reinforces the importance of fish as a source of nutrition in Vietnam. Whereas fish accounts for 15.8 percent of total animal protein globally, it accounts for 30.1 percent in Vietnam. The proportion of fish in animal protein is almost double the world average.

The above number of 26.1 kg/person/year implies a total Vietnamese domestic consumption of 2.2mn tonnes, somewhat less than the total national production number excluding exports, but as mentioned, a large proportion of marine production is currently utilised for animal and fish feed. It is noteworthy that the trend has been rising rapidly. The export targets cited above would imply non-exported fish tonnage to rise faster than export tonnage by 2020, so the expectation is clearly for the trends to continue. This total consumption numbers hides some regional differences within Vietnam. Similar to the regional production patters, the Northern provinces consume far less aquatic products than the South, and the 29 coastal provinces see higher consumption relative to the inland provinces in for example the Central Highlands.

Aquaculture's contribution to the growing per capita consumption of fish is unclear. According to FAO Balance Sheets, the majority of fish consumed in Vietnam is marine (12.1 kg per person per year), in which aquaculture has no role.[11] Moreover a significant proportion of Vietnam's aquaculture production is exported and therefore not available to the local population. Consumption of inland (fresh water) fish caught in non-marine open access water resources is also important, particularly in some provinces (see Chapter 5). Yet food security is not only about availability, but also accessibility, which reflects the purchasing power to purchase food, whether incomes are generated from employment or from profits. Vietnam's daily average intake of total protein has increased from 60.9 grams in 2000 to 73.7 grams by 2007, which reflects an improvement in overall living standards.

Table 2.4 presents the percentage of calorie intake *within* Vietnam, disaggregated by the source of the calorie (food type) and selected socioeconomic characteristics of households.

[11] Marine aquaculture products are consumed in Vietnam such as Cobia, Grouper and bivalve mollusks.

Table 2.4: Food and Calorie Intake, Vietnam 2006 (percent)

	Rice	Other staple foods	Meat	Fish	Vegetables	Fruits	Other food
All	68.7	6.2	13.1	2.6	3.1	1.1	5.2
Location							
Rural	71.4	5.9	11.8	2.4	3.0	0.9	4.7
Urban	60.6	7.3	16.9	3.1	3.7	1.4	6.8
Region							
Red River Delta	68.7	5.4	14.7	1.5	4.4	1.0	4.3
North East	70.0	6.4	13.8	1.2	4.0	0.9	3.8
North West	75.2	7.8	9.5	0.9	2.5	0.9	3.2
North Central	72.3	6.0	11.3	2.3	3.0	0.7	4.5
South Central Coast	69.3	7.2	11.3	3.2	2.5	1.2	5.3
Central Highlands	70.7	7.4	11.8	2.2	2.4	1.0	4.6
South East	61.4	7.5	15.2	3.5	3.1	1.5	7.6
Mekong River Delta	68.1	5.2	12.5	4.4	2.0	1.2	6.5
Income Groups							
Quintile 1	77.7	6.4	8.2	1.8	2.2	0.7	3.0
Quintile 2	74.1	4.8	10.8	2.4	2.9	0.8	4.0
Quintile 3	70.0	5.5	12.8	2.6	3.2	1.0	5.0
Quintile 4	65.5	6.5	14.7	3.0	3.4	1.1	5.8
Quintile 5	56.5	7.9	18.7	3.0	4.0	1.7	8.1
Ethnic							
Ethnic majority	67.7	5.9	13.7	2.8	3.3	1.1	5.5
Ethnic minority	74.1	8.3	9.7	1.4	2.5	0.9	3.3
Occupation							
Non-farmer	61.1	7.2	16.4	3.3	3.5	1.4	7.1
Farmer	71.6	5.9	11.8	2.3	3.0	1.0	4.5
Not growing rice	63.6	7.0	15.2	3.2	3.2	1.3	6.5
Growing rice	73.3	5.5	11.1	2.0	3.1	0.9	4.1
Poverty							
Non-poor	67.0	6.1	14.1	2.7	3.3	1.1	5.6
Poor	78.0	6.9	7.7	1.7	2.2	0.7	2.9

Source: Vietnam Household Living Standards Survey (VHLSS) 2006

As expected, rice remains the dominant source of calories in Vietnam. Next to this is meat, providing over 13 percent of calories at the national level. Fish lags far behind this at 2.6 percent. In-line with overall trends, consumption of fish is higher in urban areas, and the rich consume more (as they do meat). Regional consumption patterns are in-line with production patterns, with the North and Central Highlands particularly low, and the Mekong Delta high. In short, despite the high fish protein intake relative to international levels, there remains scope for further expansion in domestic fish consumption, particularly in certain regions and among certain socioeconomic groups of Vietnam.

All of these factors suggest that local demand for fish will grow strongly over the next decade at least. As will be outlined below, national production will almost certainly keep pace with domestic demand for the next few years, suggesting average real prices will remain reasonably stable.[12] However, the domestic preference is presently for marine/river fish, with almost all farmed fish exported (especially from the Mekong Delta). Indeed, there are even some imports of marine fish into Vietnam. As a professional and urban middleclass emerges, demand for processed farmed fish will probably increase. Until then, the preference for 'wild' fish is expected to persist.

[12] However, given the inelastic demand (see Chapter 3) substantial short-term price fluctuations are likely.

3 Aquaculture

Aquaculture is the world's fastest growing source of food. Already by 2008 more than a third (37 percent) of the world's seafood came from aquaculture, with tonnage having increased by more than 60 percent since 2000 (FAO, 2010a). However this aggregate figure does not tell the whole story. China alone accounted for almost two-thirds of global aquaculture output, with most destined for domestic consumption. In the developed countries of North America and the European Union (EU), aquaculture output has practically stagnated. Among the developed countries, only Norway has succeeded in expanding aquaculture output and value. Shortage of, and conflicts over, farm sites, lack of social licence, and problems with implementing regulations, are among some of the constraints.

One region which has succeeded in expanding aquaculture output is Southeast Asia. From 2.7mn tonnes in 2000, seafood aquaculture output more than doubled to 7.2mn tonnes by 2008. By 2008 the region's share of global seafood aquaculture output had increased to 13.7 percent compared to 8.0 percent in 2000. However, value did not increase as quickly (from US$7.5bn to US$12.7bn). As a result, the region's share in the global value of seafood aquaculture actually fell from 15.7 percent in 2000 to 12.9 percent by 2008. One of the principal reasons has been the decline of the region's share in high-value shrimp production. From supplying over half the world's farmed shrimp in 2000, the region supplied barely one-third by 2008. Shrimp output increased (more than doubled), but not as rapidly as in other countries and regions.

Vietnam's aquaculture experience is an exception in the region, for not only did volume increase rapidly, but also value. Moreover, Vietnam's aquaculture has diverged from global trends which have seen a deceleration in growth rates. Globally, aquaculture seafood production has grown at an annual average growth rate of barely 6 percent from 2000 to 2008 compared to 10 percent from 1990 to 2000. Aquaculture tonnage from Vietnam on the other hand has soared at an annual average rate of approximately 20 percent from 2000, exceeding that from 1990 to 2000 (see Figure 2.3). A similar scenario has occurred with aquaculture value. By 2008 Vietnam accounted for almost 5 percent of world aquaculture seafood output and value, triple that of 1990.

This chapter provides a microeconomic analysis of the aquaculture sector, which has been so successful in Vietnam, but which faces competition from other countries and other species. First, aquaculture in Vietnam is described, and it will be shown that Vietnam has been very successful promoting aquaculture as a source of foreign exchange and rural livelihoods. Second, developments of Vietnamese aquaculture within the broader context of governance are analysed, including the role of the state and the impact of health and safety controls in importing countries. A final section will illustrate farm budgets using a number of scenarios.

3.1 The Growth of Aquaculture in Vietnam

As shown in Chapter 2 of this report, while total fisheries output has increased steadily, a growing proportion of this output has come from aquaculture. By 2008, aquaculture seafood (total aquaculture minus seaweed), was almost 2.5mn tonnes worth US$4.6 billion. If targets of MARD are realized aquaculture output will increase by another million tonnes by 2015 accounting for 60 percent of Vietnam's total seafood production, and the 2020 Strategy sees aquaculture output doubling in ten years from now to 4.9mn tonnes

3.1.1 An Overview

As shown in Table 3.1, the expansion of aquaculture in Vietnam has been driven by two species, which dominate the sector; the freshwater Pangasius (*Pangasianodon hypophthalmus*) and the brackish water Giant Tiger prawn (*P.monodon*). The primary species in terms of volume and value is the Pangasius. Over the four years 2001-2004 the annual average growth rate in tonnage was 31 percent, over the ensuing four year period 2005-2008 the annual average growth rate was 70 percent. From zero tonnes in 1996 and 100,000 tonnes in 2000, output of Pangasius reached 1.25 million tonnes by 2008. Between 2007 and 2008 an additional 600,000 tonnes of Pangasius were produced and put on the market. This increase was greater than Vietnam's total aquaculture output in 2000. In 2008 Pangasius alone accounted for half Vietnam's total tonnage.

Table 3.1: Aquaculture Production of Giant Tiger Prawn and Pangasius (volume and value) 2000-2008

	2000	2001	2002	2003	2004	2005	2006	2007	2008
GIANT TIGER PRAWN									
Tonnes (000)	67.5	111.1	126.4	150.0	185.6	177.2	150.0	170.0	324.6
US$ (millions)	310.4	499.9	568.9	600.0	742.3	708.8	600.0	680.0	1,298.4
PANGASIUS									
Tonnes (000)	100.0	114.0	135.0	163.0	255.0	376.0	520.0	850.0	1,250.0
US$ (millions)	140.0	171.0	202.5	244.5	382.5	564.0	780.0	1,275.0	1,875.0

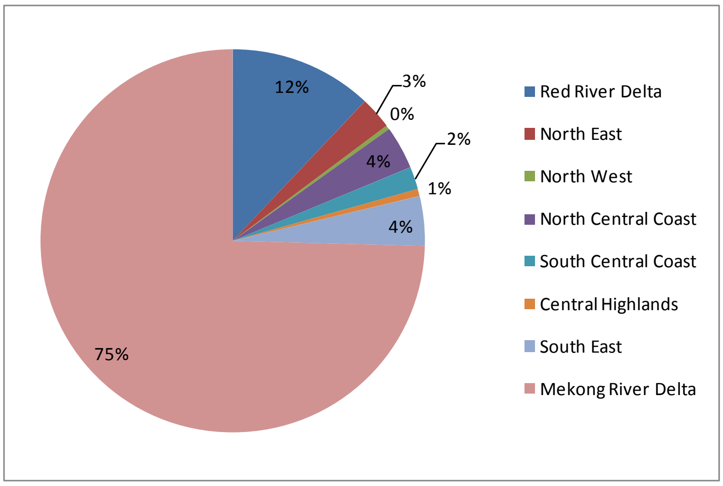
Source; FAO FishStats Plus

In terms of value, Pangasius accounted for more than 40 percent of Vietnam's total aquaculture value, with a farm gate value of almost US$2 billion (FAO, 2010). It has become the world's fifth most valuable cultivated species, after Whiteleg shrimp (*P. vannamei*), Atlantic salmon (*Salmo salar*), Nile tilapia (*Oreochromis niloticus*), and Giant Tiger prawn (*P. monodon*).

The other major aquaculture product is the Giant Tiger prawn which has expanded rapidly in Vietnam (although not at the same rate as Pangasius). As shown in Table 3.1, tonnage more than doubled between 1990 and 2000 and more than quadrupled again between 2000 and 2008 (FAO, 2010a). Its annual average growth rate by volume from 2001-2004 was 19 percent and 20 percent from 2005-2008. The farm gate value of production of Giant Tiger prawn in 2008 was US$ 1.3 billion. The value of its output has grown faster than volume reflecting strong market conditions. This contrasts with Pangasius whose increase in value has been lower than the increase in tonnage. In 2008 the Giant Tiger prawn accounted for 13 percent of Vietnam's total aquaculture seafood tonnage and 28 percent of total value.

Together Pangasius and the Giant Tiger Prawn dominate Vietnam's total aquaculture volume and value, accounting for about two-thirds of total aquaculture seafood production (64 percent) and value (68 percent) in 2008. Moreover this species dependence has increased. In 2004 the two accounted for only 36 percent of volume and 46 percent of value. Production is also concentrated geographically, with the vast majority of aquaculture production coming from the Mekong Delta area of Vietnam, and in particular the provinces of Dong Thap, An Giang and Ca Mau (Figure 3.1).

Figure 3.1: Aquaculture Production, regional split (percent)



Source: Authors own calculations based on data from VIFEP

3.1.2 Aquaculture Environment

As Table 3.2 illustrates, the explosive expansion of freshwater Pangasius has increased the importance of the freshwater environment of aquaculture, particularly in volume but also in value. Output from freshwater was predominant even in 1990 but the volume of freshwater output increased faster than brackish water output, particularly since 2004, and the relative weight of freshwater output increased. The share of marine species in total tonnage increased dramatically from 1990 until 2004, though remains small in comparison.

Table 3.2: The Contribution of the Three Environments to the Volume of Vietnamese Aquaculture

	1990		2000		2004		2008	
	tonnes	%	tonnes	%	tonnes	%	tonnes	%
Brackish	42,746	26	93,502	18	339,555	28	515,700	21
Freshwater	111,330	69	365,015	71	703,827	57	1,771,000	71
Marine	8,000	5	55,000	11	185,235	15	210,700	8
Total	**162,076**	**100**	**513,517**	**100**	**1,228,617**	**100**	**2,497,400**	**100**

Source; FAO FishStats Plus

Table 3.3 indicates that there has been little species diversification in brackish water. Of the few species, Banana prawn (*Fenneropenaeus Merguiensis*) and crustaceans experienced volatile output between 1990 and 2008 and whiteleg shrimp between 2004 and 2008. Only the Giant Tiger Prawn has shown consistent expansion since 1990. On the other hand there appears to have been some diversification in the production of freshwater species. The common carp (*Cyprinus carpio*), cyprinids, pirapatinga (*Piaraclus brachypomus*) and tilapia were reported as being produced in 2008 (although not in 2007). It will become clear in the future whether the sudden appearance of these species is merely due to past data omissions, or reflect a long-run strategy by farmers to experiment with different species. The marine environment has the smallest tonnage, although output of molluscs and seaweed (*Gracilaria*) has consistently expanded.

Table 3.3: Total Aquaculture Volume by Species (tonnes)

	1990	2000	2004	2008
BRACKISH				
Banana Prawn	6,550	18,002	40,000	8,100
Crustaceans	10,000	3,513	6,247	7,100
Fish nei			57,739	127,300
Giant tiger prawn	24,560	67,486	185,569	324,600
Indian white prawn	1,636	4,510	10,000	10,000
Whiteleg shrimp			40,000	38,600
Total	42,746	93,502	339,555	515,700
FRESH WATER				
Carp				75,000
Cyprinids				340,000
Fish nei	111,330	265,015	448,827	340,000
Pangasius		100,000	255,000	1,250,000
Pirapatinga				6,000
Tilapia nei				50,000
Torpedo shaped catfish				10,000
Total	111,330	365,015	703,827	1,771,000
MARINE				
Fish nei				5,000
Molluscs	6,000	40,000	155,235	170,000
Seaweed (Gracilaria)	2,000	15,000	30,000	35,700
Total	8,000	55,000	185,235	210,700

Source: FAO, FishStats Plus. Fish nei: fish not elsewhere included (FAO statistical notes)

As presented in Table 3.4, when one compares the three different environments for value rather than volume, there is some difference. By 2008 the value of freshwater species exceeded that of brackish water. The value of Panagasius alone surpassed that of all brackish water species combined (FAO, 2010a). The share of the marine environment was even more marginal in value than in volume reflecting the 'low-value high bulk' nature of the principal marine products, molluscs and seaweed.

Table 3.4: The Contribution of the Three Environments to the Value of Vietnamese Aquaculture

	1990		2000		2004		2008	
	US$000	%	US$000	%	US$000	%	US$000	%
Brackish	222,357	56	440,297	44	1,232,614	50	1,765,850	38
Freshwater	166,995	42	511,021	51	1,055,741	43	2,656,500	58
Marine	6,900	2	47,500	5	170,235	7	195,350	4
Total	**396,252**	**100**	**998,818**	**100**	**2,458,589**	**100**	**4,617,700**	**100**

Source; FAO FishStats Plus

Panagasius is a relatively low value species compared with the high value Giant Tiger prawn. Prior to the cultivation of Pangasius, most of aquaculture value came from the brackish water culture of prawn and other crustaceans (even though tonnage was much lower than that of freshwater). In 1990 brackish water prawn and other crustaceans accounted for more than the value of output derived from freshwater. However, with the explosion in output of the freshwater Pangasius the situation has been reversed: its relatively low unit value compared with shrimp was more than compensated by the increase in volume. This is particularly apparent after 2004.

3.1.3 Diversification of Species

The narrow dependence on two species for production and rural livelihoods has enabled the aquaculture sector to specialize, but it has negative implications for economic risk and regional equity. Economic risk due to lack of diversification exists because of production and market shocks. Disease is perhaps the most likely and detrimental negative production shock, but others could be inefficient feed and therefore high Feed Conversion Ratios (FCR), inbreeding of Pangasius broodstock and consequently high mortality rates, or water quality. Exogenous shocks such as global warming and climate change could also adversely affect production (FAO, 2008).

Market shocks could occur if Pangasius output continues to grow due to increased production not only in Vietnam but also from other low-cost producers such as Bangladesh,[13] inducing a collapse of prices and of revenues in markets where there is inelastic demand. Frozen Tilapia could be a threat to frozen Pangasius exports as they appear to have positive cross-elasticity indicating that they are substitutes (see below for further detailed analysis).[14]

There could also be a loss of market access because of stricter import standards or tariffs. The countervailing duties imposed on Pangasius imports to the US in 2002 cost about 8,000 farm jobs in Vietnam and 10 percent of processing jobs (Bush, et. al., 2009). Now the US Farm Bill of 2008 has designated catfish as an "amenable" species, which means mandatory inspections. How this will affect Pangasius imports into the US is unclear, but the Food Safety and Inspections Service (FSIS) may demand stricter controls. The FSIS has indicated that it will take into account the conditions under which catfish are raised and transported to processing plants (Jacobs, 2009). A further shock could come from media information about the use of antibiotics. This occurred in the US and farmed salmon from Chile; the result was that major US retailers such as Safeway boycotted Chilean salmon. Giant tiger prawn may be less

[13] There are a number of countries that have relatively recently started to produce Pangasius. Many of these countries, such as Bangladesh, have lower labour costs and are therefore likely to undercut Vietnamese prices.
[14] In 2005, global exports of frozen Tilapia exceeded US$ 300 million (FAO, 2010a).

vulnerable to market shocks, but negative media reports could damage the market in favour of whiteleg shrimp. Diversification is therefore one strategy to minimise both production and market risk.

A further reason to diversify is to spread the benefits of aquaculture to all regions of Vietnam. At present, all Pangasius production and about 75 percent of shrimp production occurs in the Mekong Delta. There are a number of other species that could be cultivated successfully in other regions of Vietnam, some with a comparative advantage that could provide export opportunities; others would be more a means of providing livelihoods and of protein (Hambrey Consulting, 2005). Here the focus is on just a selected few other species to consider.

Freshwater

Tilapia has become an important farmed species in most countries of Southeast Asia worth about US$1bn a year. Its output has more than doubled since 2003 with most of the growth occurring in Indonesia, the Philippines and Thailand. The predominant strain is the Nile tilapia (*niloticus*) which accounts for about two-thirds of the region's total Tilapia output. As with Panagasius, it is a low value fish with white flesh. Its cultivation in Vietnam would not compete with Pangasius because the latter can only be produced in a small area in the Delta. Tilapia can in this sense be considered as an alternative freshwater species for other parts of Vietnam. The relatively small quantities will not offer the economies of scale of other producing countries and this will place exports at a comparative disadvantage. However, it could be a source of fish for the domestic market as the population becomes more prosperous.[15]

Marine

Finfish such as cobia, sea bass and grouper offer considerable potential if feed and seed constraints can be overcome. Siganids, as low trophic species also offer potential. Trash fish from the ocean for use as feed is ecologically unsustainable and could engender disease. Seed acquired from wild broodstock is also unsustainable. Vietnam has placed marine finfish as an aquaculture priority, with inducements to investors in feed mill and with incentives to promote marine seed production.

The advantage of marine finfish aquaculture is that it relieves land use pressures on the coast. It could also be a means of import substitution. Marine fish are the preferred fish in Vietnam (accounting for almost half total per capita consumption of seafood). As noted above, marine fish cultivation in Vietnam is currently quite low in Vietnam, so to meet demand Vietnam has to import. Net imports of marine fish were about 300,000 tonnes in 2007, so domestic farming could substitute for those imports (FAO, 2010a). Marine fish are also high value, and can be very profitable. While not representative of all possible systems, Table 3.5 illustrates this with some examples from extensive marine aquaculture systems:

Table 3.5: Profitability of Marine Aquaculture in Indonesian Silvo-Fish Culture (Rupees 1000)

	Milkfish	Seabass	Tilapia	Shrimps	Crabs
Investment	540	873	523	873	46
Production cost/crop	1356	2036	1882	2077	320
Return/crop	1852	4320	2800	4950	331
Profit/crop	496	2284	918	2873	96
Annual profit	1488	4568	2754	5746	864

Source: FAO, 2009a

[15] The 2020 Strategy cites the development of Tilapia culture by 2020 as a major project over the next ten years. The former-MoFi had a project targeting the development of Tilapia culture which encountered some difficulties associated with a high feed transfer rate and inadequate scale. Results and lessons learnt from this project should be taken into account in any future Tilapia strategy.

As the above table (reproduced from the FAO 2009 study) indicates, profitability is highest with shrimp, followed by sea bass, tilapia, milkfish (in brackish water ponds) and crab. These returns explain in part the increased output of shrimp, and the decline in output of milkfish in brackish water in Indonesia (and also perhaps in the Philippines).

The table also shows that capital and operating costs are directly correlated with profitability; high costs do not themselves diminish profits if costs are more than offset by high revenues. This suggests that if poor farmers can be given access to credit for investment and operating costs, one policy to reduce poverty might be to encourage the poor to farm high-value species in low quantities.[16] The annual profit from farming sea bass is three times higher than milkfish. Marine finfish (sea bass) offer returns only slightly lower than shrimp, and offer very attractive investment potential particularly for those without land. The greater returns from farming high value species has also been demonstrated in the Philippines (FAO, 2009). To earn US$ 2,000 a year a farmer needs 30,000 milkfish but only 2,000 grouper. Moreover, the total investment is half.

Seaweed

Seaweed has not developed in Vietnam to anywhere near the extent of neighbours such as Indonesia or the Philippines. At the macroeconomic level, seaweed farming is a source of foreign exchange. Vietnam in 2008 only produced 35,700 tonnes in 2008 worth US$18mn. That is low compared with some other countries of Southeast Asia. In Indonesia, seaweed output in 2008 was over 2.1mn tonnes worth US$300mn and in the Philippines over 1.6mn tonnes worth US$291mn. Lack of processing capacity may be a constraint, although there are anecdotal reports of foreign companies willing to locate in Vietnam if supplies of the raw material were sufficient. A further constraint could be market opportunities; seaweed cultivation did not occur in Malaysia because investment opportunities were more attractive elsewhere.

Seaweed cultivation can be very simple as in Zanzibar, Tanzania where the only capital required is string for attaching the young plants to the soil, and about 90 percent of the seaweed farmers are women. There is considerable evidence that seaweed farming can be a profitable venture for coastal households: a 1,000m^2 seaweed farm in the Philippines is sufficient to maintain a family (Crawford, 2002). In the Philippines there are also pilot projects at Integrated Multi-trophic Aquaculture (IMTA) sites where seaweed or oysters are grown in conjunction with other farmers who grow the finfish. The advantage is that inputs for seaweed and mollusc are low which makes their cultivation attractive to the poor and landless ex-fishers. There are also ecological benefits from IMTA in the absorption of nutrients. IMTA is also at an experimental stage in inland waters. However, seaweed is a high bulk low value commodity whose farmers are subject to monopsony power of processors and middle-men. Instead of encouraging seaweed farming as an alternative occupation for impoverished coastal households, an alternative strategy might be to encourage seaweed farming as a part-time or supplementary source of income.

Algae

Algae fuel is a biofuel which is derived from algae.[17] Described by its proponents as the 'fuel of the future' the cultivation of algae for production of algae-derived biodiesel may have great potential in Vietnam. The technology is already largely developed, and a number of companies have been established with the aim of creating an economically viable fuel from algae. One of the attractions of algae is its simplicity, renewability and environmentally-friendly aspects. Developments by Australia's Aurora Biofuels show that production of biodiesel from algae has a low environmental impact. The cultivation of algae and its subsequent use in biofuel production has the potential to be a 'win win' policy for Vietnam. Nevertheless, the area is quite new, and there are industry experts who are cautious. Further investigation is recommended.

[16] With high returns come potential high risks. Given high levels of poverty and vulnerability, care should be taken to ensure high risks are managed. Farming such high value species in low quantities could be one solution.

[17] See http://www.oilgae.com/ for a good overview of the technology.

Ornamental Fish
Ornamental fish is an attractive opportunity for tropical countries. Vietnam belongs to one of the three hubs in the global production of ornamental fish; South America, Africa and Southeast Asia (Hung, et. al, 2004). The market is growing with rising incomes and indications are that Vietnam (and in particular its main production centre, HCMC) enjoy a comparative advantage. Most of respondents surveyed in the production and retailing of ornamental fish were confident about the future, anticipating further growth (Hung, et. al, 2004). HCMC has promoted the industry with tax concessions and assistance with trade missions, but a perceived weakness of industry participants was the absence of any coordinated national policy. In addition, quality control is an issue. About a quarter of production is exported but the primary actors are middlemen and not producers, and this could jeopardize the reputation of Vietnam exports. In addition to ornamental fish, ornamental plants are becoming popular in HCMC, and Thailand could be a source of technical information.

3.2 Exports and International Trade

As noted in Chapter 2, a significant factor in Vietnam's successful aquaculture expansion has been the cultivation of products destined for export. Vietnamese policymakers, as in some other countries, whether Chile (farmed salmon) or Thailand (farmed shrimp), have viewed aquaculture not only as source of rural livelihoods but also as an international tradable product, and a source of foreign exchange.

3.2.1 Role of International Trade in Vietnamese Aquaculture

Vietnam has a comparative advantage in the production of Pangasius; such as climate and water availability, and has the advantage of cultivating Giant Tiger prawn rather than the lower value whiteleg shrimp (Hambrey Consulting, 2005). Together, the two species, Pangasius and Giant Tiger Shrimp, account for about two-thirds of aquaculture seafood's contribution to foreign exchange.

The ability of Vietnam to continue as a net exporter of fish depends in part on its comparative advantage. This is derived from its natural advantages and economic conditions. Among the natural factors are: climatic regime (water temperature, rainfall and flooding, salinity); water fertility and pond soil quality; pond soil permeability; salinity regime; elevation and tidal regime, shelter and suitable site availability. Factors determining Vietnam's economic advantage are low capital costs: land (cost/rent, taxes), construction, equipment; low input costs: seed, feed, labour, chemicals; skilled management and husbandry; skilled product handling and product quality; low cost distribution to processors and onward to markets; good market intelligence; adaptability to new products and markets and lack of economically viable alternatives

As shown in Chapter 2, the principal markets for Vietnamese seafood exports are Europe, Japan and the US. While according to some (e.g. INFOFISH) the natural growth of the European market appears to be nearing its peak now, the EU market does for the moment continue to show healthy growth, especially in the case of shrimp. Japan is also a big importer, but aggregate demand there is now flat. Vietnamese shrimp exports to Japan have thus been falling relative to other importing countries (though this could improve in the short run with the recent appreciation of the Yen against the Dollar). The US used to be very important for Pangasius until the 2002 anti-dumping duty on imports forced exporters to diversify markets. Recent indications, however, are that 2009 exports to the US are almost double those of 2007 and 2008 (FAO, 2010,c). Vietnamese shrimp exports to the US grew steadily from 1997-2007, but recent trends are of a slowing of demand, with some concluding that the market has now peaked (MARD, FSPS II, 2009).

Short-term ups and downs of export volumes to these markets, as well as price fluctuations, are inevitable[18], but it is likely that these markets will remain important importers for many years to come.

[18] The recent fall in exports to Europe due to the depreciation of the Euro against the Dollar is one example, with anecdotal evidence that some European importers have been pressuring Vietnamese exporters to lower prices, and

Having said this, the volatility of exchange rates and the threat to limit market access (as Russia did in 2009) does highlight the need to diversify to new export markets and into value-added products. This is particularly the case if the basic trend is one of contracting markets in Europe and the US. The 2020 Strategy touches on this, citing the objective to target 'other' markets such as China, Korea and the Middle East. Diversification in this sense certainly makes sense, though the implications for quality and value due to the differing standards of these new importing countries need serious consideration (see below). In the meantime, the long tail of 'other' importing countries continues to rise- at present, approximately 80 percent of exports goes to eight countries, with the remaining 20 percent (valued at over ¾ of US$1bn) going to a long tail of 'other' importers.

A positive side-effect of the anti-dumping duty in the US was that it forced seafood companies to seek new markets, and now Vietnam exports to more than 100 countries. An increasing proportion (17 percent in 2008) of Vietnamese fish is now being exported to a long tail of 'other' countries. While this diversification is welcome, in many cases these importers impose less stringent import requirements, bringing a danger of Vietnamese producers pursuing those markets as the easy option (we look into this issue in more detail below).

New markets could include India and other countries in Asia where demand is also rising. India has recently experienced large increases in demand from hotels and restaurants, causing prices to rise. Other Asian countries are also starting to import more, and this could represent an opportunity for Vietnam in the context of slowing demand elsewhere. There is also the domestic market. At present, the Vietnamese consumer preference is for fresh whole fish rather than processed frozen fillet, which penalizes Pangasius consumption. This may change over time, as a young urban professional class emerges, but for the near to medium term, frozen white fish fillets are likely to remain uniquely for export.

Vietnam faces stiff competition in the international seafood market in what will be an increasingly competitive market. This competition will come primarily from Thailand, Indonesia, Malaysia, Myanmar, Bangladesh and India (Hambrey Consulting, 2005). China represents both a threat as an efficient and cheap producer; and an opportunity as a huge and expanding market. China is an increasingly efficient producer and has low production costs. In 2008 China exported US$12.5mn worth of Pangasius to the US. This is addition to US$40mn of catfish (*ictalarus)* based on imported broodstock from the US (Jacobs, 2009). However, Vietnam can and should be able to compete well for two main reasons:

- It has a comparative advantage in terms of climate, resources, and low labour costs. It is well placed regionally to access markets and especially Chinese markets- Vietnam's proximity to China is a distinct advantage.
- While Chinese production costs are low at present, environmental degradation is becoming severe, disease is chronic, and disease management and biosecurity are poor. If Vietnam can manage disease and environmental quality better it will be well placed to compete.

Thailand could be a competitor to Vietnam's second largest export seafood export; the Giant Tiger Prawn. Production costs of shrimp in Thailand are low, and Thailand represents serious competition. However, they have already largely switched to whiteleg shrimp – a relatively low value product, leaving the opportunity for Vietnam to take the initiative with respect to larger high quality tiger shrimp. In many markets globally, white leg shrimp has gradually been gaining market share. Despite, or perhaps because of, this, a price premium has emerged for the black tiger shrimp. There is also a domestic market for crustaceans in Vietnam and almost half of all production is consumed locally. This contrasts with Pangasius of which almost 100 percent is exported.

International trade does, however, bring 'losers' as well as 'winners'. Compliance can be very difficult, jeopardizing export opportunities, particularly for developing countries and small-scale farms (Bagumire et.

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exporters have obliged to maintain competitiveness. The currency volatility/uncertainty has also induced reluctance on the part of European importers to commit to long-term contracts.

al., 2009). Market access becomes difficult except for the very largest producers. One option is for national organisations to act as 'chain upgraders', providing technical assistance for small-scale producers so that they meet international standards. Another option is to encourage nucleus farms which would provide similar support to their satellites, as in Indonesia. In Vietnam the export of the two principal aquaculture products has led the domestic value chain to adjust. Traceability requirements and stringent drug restrictions in importing countries has forced greater control of the whole process encouraging vertical integration. The details and implications of this important recent trend are analysed in more depth below.

3.2.2 Pangasius Exports

Almost 100 percent of Pangasius production is exported, generating more than US$1.0bn a year in foreign exchange. Total export volume was lower in 2009 than in 2008 (by 5 percent), and the value declined by 7 percent to US$1.342 billion (FAO, 2010c). The decline in value greater than volume reflects the decline in average export prices (US$2.20 kg compared to US$2.25kg in 2008). The range in prices varied from US$3.20 in the United States to US$1.65 in Russia and Ukraine (with the US purchasing higher value-added products such as breaded fillets). As a low-end whitefish, Pangasius is vulnerable to oversupply, and appears to be in a poor bargaining position in importing countries. In the case of Pangasius, it is felt by some industry insiders that an opportunity was missed 4-5 years ago to increase prices when Vietnam was really leading the worldwide production of the fish. Now there are many new entrants, and price is low. Vietnam's first mover advantage has in all probability now passed.

A Pangasius Price Floor

At the time of writing of this report, it was announced that from the beginning of 2011, minimum export and procurement (for fish producers) prices would be set for Pangasius of US$2.80 and US$1.00 respectively for all export markets apart from the US.

Assuming the level is set above the current equilibrium price, a price floor has the effect of reducing quantity demanded and increasing quantity supplied, potentially resulting in a surplus. Pangasius appears to have inelastic price elasticity of demand (see below calculations, Section 3.2.2) implying that the price rise would in theory offset any fall in quantity demanded leading to a rise in revenues for the processing companies. This of course assumes there are no competitive substitutes such as tilapia or cod, which is a reasonable assumption in Europe. But, with increasing numbers of low-cost producers of Pangasius entering the market and the generic nature of Pangasius, Vietnam should be careful not to price itself out of the market.

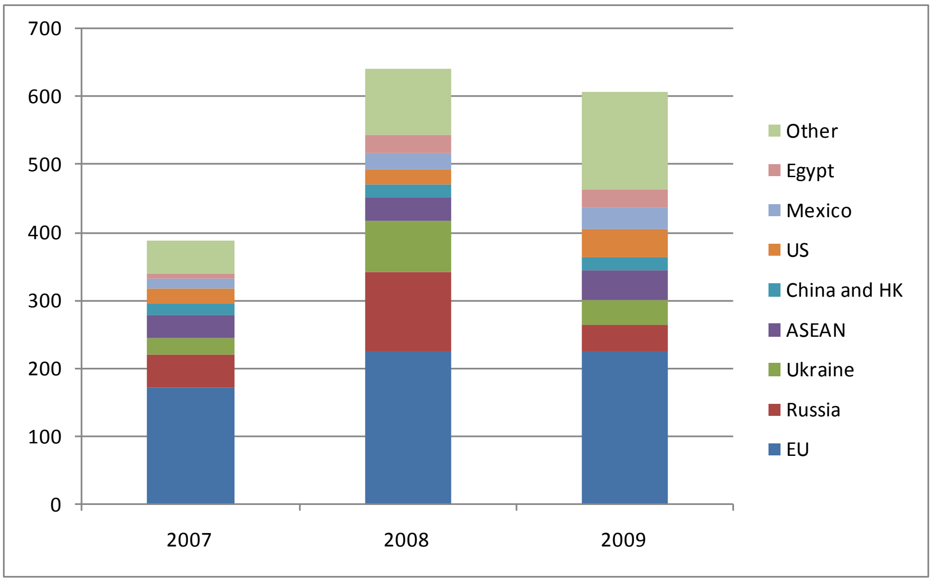
This type of policy is commonly seen in agriculture where a government may wish to maintain high prices of agricultural goods to sustain high agricultural employment. To limit the surplus, however, governments often pay some farmers not to plant crops (this can be known as a subsidy check).

The predominant form of Pangasius export is frozen fillets but frozen steaks are increasing (about 15 percent of the total). The growing output and share of frozen steaks may be due to market demand and only temporary, given that their unit value is half that of frozen fillets (FAO, 2010a).

The destination of Pangasius exports is shown in Figure 3.1. The primary destination is the EU (in particular Spain and Germany) but Russia in 2008 was the single most important country until it closed its market to Vietnamese catfish at the beginning of 2009 (FAO, 2010c). This resulted in a 66 percent decline in imports. Similarly, Ukraine was also a significant market until imports fell sharply in 2009 because of its economic environment.[19]

[19] Such trends are clear illustrations of the vulnerability of Vietnamese Pangasius exports.

Figure 3.2: Exports of Pangasius from Vietnam by Destination, 2007-2009 (tonnes)



Source FAO: GlobeFish , 2010c

A destination that has recently surged has been the US. It has now become Vietnam's fourth largest importing country of Pangasius. Vietnam is the main supplier of catfish to the US, supplying about 65 percent of total imports (FAO, 2010c).

Pangasius to the US

Catfish (Pangasius), Atlantic cod, haddock and tilapia all belong to the whitefish category, which dominates the value added seafood market in the US. According to market projections, population growth and shifting demographics will create a strong demand for seafood in the US over the next 20 years. At current total seafood consumption levels of 7.5 kg per person, population growth alone will require an additional 445,000mn tonnes of seafood by 2025 (Olin 2006). The population increase will be combined with shifting demographics. One variable that explains the increasing per capita consumption of food fish, and is expected to have an even more significant impact in the future, is the aging of the population in North America. The USDA has estimated an increase in per capita consumption of seafood of 6.6 percent by 2020, which is largely driven by the age factor. Whitefish will likely be the core of the seafood restaurant market in the US because it meets the main requirements of American seafood consumers; a white fish with little flavour.

Of the four main whitefish species consumed in the US (catfish, haddock, pollock and tilapia), catfish consumption is largely stable at about 0.5kg per capita. Pollock consumption is higher (0.8kg per capita in 2008) but has been declining. The most dramatic increase is the consumption of tilapia. It was not among the top ten species consumed in 2001 but by 2006 reached number five (relegating catfish to sixth position). In 2008 per capita consumption was 0.65kg.

Tilapia is now a global commodity produced in every region of the world, and in more than 80 countries (including Canada and the US). Annual production is now about 3mn tonnes annually with one-third produced in China. Imports into the US are segmented into fresh and frozen. Latin America sells predominantly fresh while Asia sells frozen. China is the dominant exporter of frozen whole and fillets to the US with about 60 percent of the total. Fillets, both fresh and frozen are the main form, and the fish is low-value. Frozen tilapia is therefore the principal fish substitute in the US for Pangasius.

By 2020, it is estimated the top four fish species consumed in the US – shrimp, salmon, catfish and tilapia- will all come primarily from aquaculture. In addition, a variety of cultured fish will be offered interchangeably to satisfy white fish demand. On the product side, age-related opportunities may include functional seafood with added health and nutritional properties, such as vitamins and fish oil. It is also anticipated that this older demographic will demand smaller, more packaged portions, and be willing to pay more for upscale, value-added products.

All this is important for Vietnamese exporters to the US. At present Pangasius is essentially a generic low value-added product, with demand based almost entirely on price (subject to quality standards being met). With plans to increase Pangasius output by another 600,000 tonnes, price inelasticity indicates total revenues will fall unless there is greater emphasis on value-added and shifting the demand curve for Pangasius. In addition to increased processing, another strategy is to shift the demand curve for Vietnamese Pangasius by generic marketing. This was the successful strategy adopted by salmon farmers when there was a glut; Norwegian, Chilean and Canadian salmon exporters collaborated to sell the health merits of farmed salmon as a commodity. This did not preclude a farm (or producer association) pursuing its own individual brand marketing. If Pangasius processors could collaborate with exporters of tilapia, the potential exists to sell the merits of whitefish as a whole.

So, if quality, and thus value, are to become more of the focus in Vietnamese aquaculture, then branding is clearly key. The growth in exports of Pangasius and shrimp has been healthy. At the same time, it is felt that Vietnamese export produce is still not sufficiently 'visible' on the international market. For example, in the case of shrimp, competitors such as Thailand are more easily recognised. Furthermore, Vietnamese exporters are often targeting the lower end of the market and compete more on price rather than quality. To some extent, this has led to an image problem in that buyers in the main markets associate Vietnamese shrimp with lower price rather than high quality. Although traders may know Vietnamese produce, they may not associate it with high levels of quality. In short, it is important to improve Vietnam's image as a reliable producer of good quality seafood products. This, in turn, will improve buyers' confidence in seafood products from Vietnam. In this context, the development of a shrimp brand name (quality mark) forms part of the wider seafood export promotion strategy of the country. Value addition is another element of the strategy.

Branding

The first sentence of the 2020 Strategy states the intention to develop fisheries in Vietnam into an industry with a 'prestigious brand'. Nobody would claim this to be an undesirable aim. The question is, how best to achieve this?

In recent years, two comprehensive reports have been written on the subject of branding of Vietnamese seafood produce; both commissioned by the Danida FSPS II programme (POSMA). Firstly, in October 2007, a report looking at the issue of branding of Vietnam's seafood produce was launched. In June of 2009, a second report, looking at the development of a national strategy to enhance trade opportunities for Vietnamese shrimp was finalised. Both of these reports look in detail at issues to do with branding, and the reader is encouraged to refer to them for a thorough analysis and set of recommendations.

The first report concluded that the majority of (processing) companies in Vietnam have already established their own brand names and are promoting them in one way or another. As a consequence, they were found to not be keen on giving these up. As a result, the report recommends:

- At the national level, a trademark or seal of quality guaranteeing high quality seafood (i.e. shrimp or tuna) from Vietnam. As the report notes, this would allow exporters to keep their own brands but use the national quality mark if they meet the requirements.
- At the provincial level, in particular for producers of fermented products, some form of geographical indication distinguishing between provinces having a reputation for certain traditional products, but allowing producers to keep their brand.
- The promotion of organic, environmental and ethical certification, in particular for those fisheries planning to target this niche market. The report notes that at present there seems to be no national body coordinating ethical and organic certification, and acting as a recognised information provider in this respect.

The second report focuses on the branding of shrimp products, primarily those destined for export. The report recommends developing a national shrimp brand based on having a 'quality mark' assuring buyers that shrimp produced in Vietnam is of a high standard. It is noted that Vietnamese producers often target the lower end of the market, competing on price rather than quality. As a result, the report states, Vietnamese shrimp suffers from an 'image problem' vis-à-vis certain of its competitors in, for instance, Thailand.

The report recommends a national brand name (e.g. 'Quality Assured Shrimp from Vietnam'), that will not replace the brand name or trademark of individual companies (thus in-line with the first report's recommendations). Rather, it will act as a quality seal, and could have some degree of regional image identification. Many potential certification schemes exist, and a detailed consideration of some of the voluntary aquaculture standards is set-out in the Appendix to this report.

Price Elasticity Estimates

As noted above, the US has now become the fourth largest importer of Pangasius. Using data of catfish in the US from 1990-2008, the elasticity of demand for Pangasius is estimated here using the equations shown in the Appendix to this report. Cod and tilapia are included as potential fish substitutes for Pangasius, while chicken is used as the meat substitute. Real per capita income is the income variable. Table 3.6 indicates the results for the two fish substitutes; cod and tilapia

Table 3.6: Elasticity Estimates: Regression Results of Model

Version	Dependent Variable	Intercept (B_0)	P (B_1)	P_{sf} (B_2)	P_{meat} (B_3)	I (B_4)	R_{adj}^2	DW
1 (sf= Cod)	ln q	-151	-2.38	0.408	-1	0.148	0.75	1.49
		(-3.35)	(-3.49)	-1.26	(-0.64)	-3.22		
		***	***			***		
2 (sf= Tilapia)	ln q	-91	-2.35	-0.487	0.8	0.858	0.81	1.44
		(-2.16)	(-4.31)	(-2.55)	-0.63	-2.01		
		**	***	***		*		

Source: Authors' own calculations

The regression results are quite robust despite the relatively small sample size. The overall fit of the models indicated by the adjusted R square is quite satisfactory. The price and per capita income have the expected signs and are statistically significant. Meat as a substitute has not performed well perhaps due to a weak linkage between the two food items- the meat price has been much higher than the price of catfish for the entire sample period. Cod as a related good has come up with a positive sign implying, as expected, that the two species are substitutes, but the coefficient is significant at only about 78 percent level (this must be viewed taking in consideration the limited data points).[20] Tilapia as a related product shows a negative sign meaning these two are complements indicating people who like tilapia also like catfish. This conclusion has to be viewed with caution- intuitively Pangasius and tilapia should be substitutes and one reason for the anomalous results would be highly fluctuating price of tilapia during the sample period.

Table 3.7 indicates that own price elasticity (of Pangasius) is inelastic and that income elasticity is positive. The positive coefficient for income elasticity shows that Pangasius is a normal (and not inferior) good, which is a good omen for the future of the market in the US. Markets in Europe, particularly Spain where per capita consumption of fish at more than 45kg is almost double that of Vietnam and six times higher than the US, probably have even higher income elasticity coefficients.

[20] The price of cod far exceeds the price of Pangasius, and in that sense Pangasius is a possible substitute. It is less likely that Pangasius is substituted by cod.

Table 3.7: Estimated Price Elasticities

Equation	Price Elasticity	Income Elasticity	Cross Elasticity (fish)	Cross Elasticity (meat)
1	-2.38	0.148	0.41	-1
2	-2.35	0.858	-0.49	0.8

Source: Authors' own calculations

Inelastic price elasticity is common with food products, and suggests that an increase in the supply of Pangasius would have a detrimental impact on revenues. This reinforces the need to shift the demand curve, either by a generic marketing campaign to encourage more consumption of (white) fish or higher value-added products.

3.3 Aquaculture Governance

The rapid expansion of Pangasius in Vietnam is unprecedented in the history of global aquaculture (and perhaps in food production). Moreover, unlike other species, production of Pangasius is geographically concentrated within one country (and even one region of that country). That gives a unique opportunity for coordinated governance to ensure that continued expansion will be sustainable. Too often environmental concerns have only become a focus after a price has been paid for aquaculture development.

Parallels with South America

Chile and Ecuador are examples of aquaculture "successes" whose environmental problems were addressed only after an outbreak of diseases that could have been prevented.

As with Pangasius in Vietnam, output of farmed salmonids in Chile expanded rapidly, growing from about US$1bn in 2000 to more than US$4bn by 2007. As with Pangasius, Chilean salmon are primarily exported. Becoming the second largest source of foreign exchange earnings for Chile, the industry was largely unhindered by government regulations in order to encourage its growth. Moreover, the few regulations were mostly unenforced (Pinto, 2007). As a result, the desire for short-term profits encouraged poor husbandry, which in turn contributed to the spread of infectious salmon anaemia (Valenzuela, 2009). Some two-thirds of salmon producers reported the virus at 200 sites by 2009.

Projections suggest that Chilean salmon output in 2010 will be half that of 2007, and that salmon output will not return to 2007 peaks until 2014 at the very earliest. Producer debts to banks and feed suppliers could exceed US$4bn (Borquez, 2009). Belatedly the Chilean authorities have reacted with enforceable regulations, but the cost has been lost employment for up to 50,000 workers in the salmon farming regions of Chile.

Another example is Ecuador, and the loss there of about half a million jobs in the shrimp farming industry due to the white spot virus. Only by 2005 did output of (whiteleg) shrimp recover to pre-2000 levels.

The goal of aquaculture policy must be sustainability. Sustainability incorporates the usual three aspects; economic viability, environmental integrity, and social licence. Not only must aquaculture operations be profitable over time, and competitive, but negative impacts must be mitigated. Environmental concerns also influence consumer acceptance of farmed products. Social licence; the degree to which aquaculture is accepted by neighbouring communities and the wider society, is an integral part of governance and will become an increasingly critical sustainability factor, determining where aquaculture development occurs, if at all (FAO, 2009c). Not only do perceptions of aquaculture affect demand for farmed products, but when adjacent communities oppose aquaculture activities, they also impact on supply.

Aquaculture policy should therefore aim to provide an enabling situation for aquaculture operations while simultaneously mitigating market failures, particularly negative externalities. An enabling situation can encourage a "virtuous cycle". This virtuous cycle creates higher productivity over time (Lio and Liu, 2008). Countries with good governance initially have greater output with a given input, but they also have higher investment and capital accumulation. Over time therefore with higher capital-labour ratios the initial divergence in productivity between countries continues to widen. Even the dissemination of new research and technology, and hence long-run factor productivity, depends on administrative and institutional frameworks (Hirtle and Piesse, 2007). Recognizing the importance of governance in productivity, the World Bank increasingly focuses on supply and demand governance reforms (World Bank, 2008a).

Aquaculture Governance Models

Governance models in aquaculture can be classified into three main types, although in practice governance regimes are fluid and mixed, with no clear-cut demarcation between them (Gray, 2005).

At one extreme is "hierarchical governance" which is somewhat similar to "government"; this is top-down with little, if any, consultation with stakeholders. A second form of governance is market oriented, as exemplified by early-movers in aquaculture in Southeast Asia (the Philippines and Thailand) where laissez-faire resulted in mangrove destruction, disease and social unrest. In Europe where this form of governance predominates, market excesses are mitigated by domestic regulations on environmental protection, health and food safety (Stead, 2005). The third type of governance is participatory and extends from industry self-regulation, co-management of the sector by industry representatives and government regulators, community partnerships, to "environmental stewardship". In aquaculture, participatory governance is increasingly the norm particularly in countries where democratic values are widespread.

Vietnam's governance model appears to be a blend of hierarchical and market. The lead agency of aquaculture, the D-FISH within MARD, sets targets and strategies in ten year plans that are modified each five years. These are largely top-down although they are reconciled with departmental and provincial priorities. There appears to be some inter-provincial competition in the aquaculture sector with provincial officials extolling the comparative advantage of their respective province while ignoring similar attributes in neighbouring provinces.

Aquaculture targeting is largely expressed in tonnage with little apparent interest in value except where it can be expressed as exports and foreign exchange. From an economics point of view, it is in fact profitability and efficiency that matters. These may well be, and probably are, maximized at production levels lower than current levels. This is reflected in an (over)emphasis on Pangasius and tiger prawns with their beneficial impact on the balance of trade. To this extent, the model is similar to Chilean and earlier Thai experience. However, it appears to be to the detriment of species diversification, particularly into low-value species (such as crab and seaweed) that may be viable only for the domestic market.

Vietnam does acknowledge the need for local participation in resource governance, and Thailand's evolution may be indicative of the future in Vietnam. Thailand used to have hierarchical governance in aquaculture with a focus on (shrimp) exports. However, enforcement was inadequate and producers non-compliant (Stead, 2005). There has since been devolution to industry, with more self-regulation using voluntary Codes of Conduct. It should be noted that Thailand is the world's largest shrimp producer, and 80 percent of farms are less than two hectares. Codes of conduct, therefore, can be effective even with family-owned and small-scale operations. Enforcement of regulations is a problem for Vietnam, so learning from the Thai experience with more participatory forms of governance, and codes of conduct, would be invaluable.

3.3.1 The Role of the State

The role of the state in Vietnam has been both enabling and promotional. As a new sector, aquaculture rarely has dedicated laws, rules and norms, but is often regulated under provisions of a fisheries act, functioning within complex provisions, related to property law, environmental law, planning law and regulations for animal health and welfare among others. This is the case in Vietnam where aquaculture is administered under the 2003 Fishery Law (17/2003/qh 11), and where sections for aquaculture stipulate waste water use, marine leases and feed standards (Article 35).[21]

Legislation and regulations exist to provide an orderly and sustainable development of aquaculture; either by reducing negative externalities such as pollution or conflicts over land rights, or by encouraging positive externalities such as Indonesia's policy of promoting small-scale aquaculture operations around one large farm. There is the danger that regulations can be overly cumbersome, discouraging investment into the sector; however that does not appear to be the case in Vietnam. Regulations over land provide long and renewable leases, which provide some security for farmers. Also land conversion into aquaculture is possible if approved at the local level. If anything there is an absence of regulation in the absence of aquaculture licenses. Vietnam is now one of only a few countries where no aquaculture license is required. Licenses or permits are means of controlling the industry in a sustainable manner. The absence of aquaculture licenses for farmers also handicaps the gathering of data and the level of technical knowledge, since some countries use licensing as a means of obtaining production data or stipulating a minimum technical expertise

The greater danger for Vietnam is the lack of capacity to monitor and enforce existing regulations. Monitoring is costly and time-consuming. Because human and financial resources are unavailable, regulations appear to be largely ineffective: in fact the lack of enforcement of existing regulations (because of resources) may be more important than weak legislation in explaining unsustainable practices in aquaculture. In Vietnam for example, the prohibition in the 2003 Law against "the *discharge of water and waste water from aquaculture sites, hatcheries, preservation units and processing units without treatment or disqualified treatment into the surrounding environment*" (Article 6) is critical for the continued health of the Pangasius industry, but there is little compliance because internalizing the external benefits of sediment ponds has a high opportunity cost for farmers. The regulation is poorly enforced. A mandatory appraisal process prior to enactment would ensure that implementation is considered before and not after enactment; it would also prioritize regulations.

The promotional role of the state in Vietnam has been evident in the provision of fingerlings for marine species, encouraging students to study seed production abroad, and by exempting foreign feed companies from taxes. There are dangers of public intervention; public sector provision may be ill-timed (as with a public seed hatchery in Indonesia which was made redundant by private hatcheries), or inefficient with perverse incentives (public tilapia hatcheries in the Philippines with subsidised seed of questionable quality that undercut private hatcheries) (FAO, 2009). The World Bank also argues for limiting supply-side strategies because of the potential for corruption: "*the more the state is involved in supplying inputs such as fertilizer and credit....the greater is the potential for corruption*" (World Bank, 2008a p 254).

The effects of government intervention to date, in fact, appear to have been positive- but there are questions about the future, particularly as further expansions of Pangasius and tiger prawn are envisaged in national plans. Environmental impacts of aquaculture are unclear because of the unknown carrying capacity of the Mekong, which provides the water and receives the effluents from Pangasius farms. Negative environmental effects could severely affect supply through disease; they could also dampen foreign demand through negative media reports or failure to meet certification.

[21] Vietnam has also agreed to abide by the FAO 'Code of Conduct for Responsible Fisheries'.

Seed and Drugs in Vietnamese Aquaculture

Seed

To ease concerns over seed availability, quality and regional imbalance, Vietnam has implemented a number of successful initiatives. To cope with shortages and regional imbalances of shrimp seed, it imports shrimp seed from other countries under strict quarantine and quality controls and permits the transport of shrimp seed from one region to another. It encourages shrimp seed production in the North where shrimp seed production is less developed. For shrimp hatcheries there is preferential credit for household farmers and large scale farms, and results have been impressive, even in the North. The number of hatcheries has increased sharply to almost 3,000 by 2003/2004 with more than 85 percent for shrimp (FAO, 2009a). In terms of fish seed, when destined to remote and mountainous regions, freshwater seed has a transport subsidy, and price support.

Marine fish seed is insufficient in Vietnam, and comes from the wild or from imports. A national marine development strategy has been developed that will focus on seed production. A National Centre for Marine Seed in the North conducts research on marine seed and provides broodstock for different hatcheries throughout the country. Vietnam has specific incentives for those producing marine seed. Under regulation 103 in 2000, about 1,000bn VND of government money was allocated to seed production during 2000-2005 in the form of soft loans. Credit was available for five years with collateral only required for loans of more than 50mn VND. For priority marine species such as grouper, cobia and milkfish where demand for seed exceeds supply, there are also tax exemptions for imported seed, broodstock, and material for hatcheries and farms. Foreign companies investing in marine seed production were exempt from VAT; they also enjoyed reduced land taxes.

Other seed policies are also possible that involve little cost. Indonesia and Thailand have attempted to improve linkages in the value chain between seed producers and growers, reducing the role of fry traders. Indonesia has organised regular private/public seed markets. Similarly Thailand has developed information centres with data bases by hatcheries and species to connect seed producers and fish growers.

Drugs

In Vietnam there is little regulation over the prescription of medicine to animals. It is relatively easy to open a retail store selling medicine, and retailers' only technical knowledge may come from training courses given by pharmaceutical companies. A farmer with disease problems may contact an agent of a pharmaceutical company who will give advice or else contact the retailer directly. Both parties have an incentive to over-prescribe. The retailer is not obliged to report the prescription. The result is overuse of drugs and chemicals[22]. Evidence showing a positive contribution of such (legal) additives to fish growth and health is scarce, yet they comprise up to 5 percent of Pangasius variable farming costs.

Such overuse jeopardizes the profitability of marginal farmers. It also threatens market access because of food health and safety standards if the species is exported and the health of seafood consumers if sold domestically.

The importance of transparency in drug use is demonstrated by the differential use of antibiotics in salmon farming in Norway and Chile. In Norway, antibiotics must be prescribed by a veterinarian, and since 2002 it has been mandatory to report the amount of antibiotics with a record of the prescriptions. The data reported by the industry can then be verified by cross-referencing the number of prescriptions and the national amount of antibiotics used in aquaculture.

In Chile, on the other hand, there was a report in the New York Times in the spring of 2008 about excessive use of antibiotics, suggesting that antibiotic and hormone residues could make Chilean salmon unsafe to eat. The US Federal Drug Administration visited salmon operations in the salmon farming region to check. The problem, however, lay with the National Fisheries Service, the government regulator. Since it kept no

[22] Chinh (2005) reports there are 394 anti- and pro-biotic products available on the market.

national register of the quantity of antibiotics administered to salmon, it was unable to disprove the claim by the New York Times. The result was a sharp loss of consumer confidence (including boycotts) of Chilean farmed salmon.

One policy option for Vietnam would be to have strict drug regulations as in Norway. There the Food Safety Authority addresses aquatic animal health with disease prevention measures and hygiene standards. The use of unauthorized drugs is forbidden, and records must be kept on the use of all veterinary drugs. Withdrawal periods are specified and must be adhered to. The frequency of in-house and public veterinary inspections is mandated, and a veterinarian must be called if there is suspected disease. Daily enumeration of the fish in each salmon cage, its biomass, losses and feed consumption is required and must be reported to the Directorate monthly.

However lack of capacity to enforce makes such regulations impracticable in Vietnam. Instead, processors anxious to export must act as enforcers. Restricting the right to import raw materials to pharmaceutical companies could control drug abuse; at present any company can import and trade these raw materials (Dutch Min. of Agriculture, Nature and Food Quality). It is also likely that technical education combined with self-interest in reducing costs will produce more efficient husbandry practices including less drug use. This occurred in Norwegian salmon farming (Asche, et al, 2008). In Norway the amount of antibiotics used in salmon farming in 1987 was 8,570kg (for 60,000 tonnes of salmon); by 2008 that had fallen to 641kg for 379,000 tonnes. Measures included vaccination and swift removal of mortalities and reduced feed waste.

Feed

Feed is the most significant component of aquaculture operating costs, accounting for upwards of 80 percent of variable costs. The price and quality of feed are therefore critical.

Historically, homemade feeds made from caught inland and marine (‘trash’) fish have predominately been used by fish farms. In recent years a shift in favour of manufactured feeds has been observed, due to increased availability of the latter as well as increased concern about quality and efficiency- homemade (wet) feeds have FCRs almost twice that of (dry) manufactured pellets. However, given their lower cost, and the fact that homemade feed can sometimes yield higher returns, it is estimated that at least one in four producers continue to use homemade feed (Phuong et al, 2007; Tran, 2005).[23] Considerable uncertainty does nevertheless remain regarding the exact division between homemade and manufactured pellet feeds in Vietnam, and the extent to which farmers reallocate depending on availability and relative prices is also not clear.

Until recently, up to 90 percent of manufactured feed was imported (Edwards et al, 2004). The number is now closer to two thirds (maximum) as new domestic feed manufacture capacity has been developed (thanks in part to tax holidays and other investment incentives) in-line with increased demand given the large production increases. Nevertheless, imports are still significant, and international prices remain therefore important. Moreover, Vietnam is a net importer of soy and corn; ingredients in animal feed. The government has eliminated import duties on raw material in feed, but fluctuations in world prices can have dramatic consequences on small-scale farming given the slim operating margins.

Given the above trends, domestic feed manufacture capacity now far outstrips the availability of its primary input (namely, marine ‘trash’ fish).[24] Chapter 4 describes the marine capture fisheries subsector in detail, but to the extent that there is overfishing and a low supply of marine (trash) fish to be used as an input for fish feed, there is a constraint to the further development of the domestic feed manufacture industry and therefore aquaculture production more generally. The domestic feed manufacture industry is thus currently operating at very low levels of capacity utilisation, and to that extent, the efficiency and

[23] A study of An Giang province for instance (MARD/FSPS II, SUDA Component, 2009) found that over half of fish producers continue to use primarily homemade feed (though this was found to be declining).

[24] Fish offal, from processing companies’ waste following the processing procedure, could be used more it would seem, however the scope is limited somewhat due to its low protein content and the potential danger of disease.

profitability of the industry, and the continued planned growth in aquaculture production, faces a constraint in the form of a high and increasing dependence on low value marine trash fish. These issues will be compounded because, as supply constricts, prices will rise, eating into already slim operating margins.

The issues facing the marine capture fisheries subsector are thus inextricably linked to the aquaculture subsector as shown in Figure 2.5. The consequences of this interdependence are examined in detail in Chapter 6.

One concern of farmers is the lack of credibility of manufactured feed contents (and labelling). An FCR of 1.8 compared to 1.5 in Pangasius culture can mean a loss rather than a profit. This is a problem of asymmetrical information between feed companies and farmers. It may be difficult for a buyer to judge the quality of purchased feed, and costly for each farmer to carry out the necessary checks. One policy option for the Vietnamese government would be a requirement for the seller of the (feed) product to accurately disclose ingredients with heavy penalties (even criminal penalties) for serious breaches of this requirement. Alternatively, government bodies, or trusted private bodies, could test and certify products. This state certification; reduces production risk. Indonesia for example has legislated minimum ingredient requirements for different species, and Inspections. Thailand has a Feed Quality Assurance Board (FAO, 2009a).

3.3.2 The Role of Standards in Importing Countries

As noted above, aquaculture in Vietnam has been driven by the profitability of two export crops; Pangasius and giant Tiger prawn. Europe, Japan and the US have been the traditional markets, although more recently new markets such as Russia and the Ukraine have been developed. Increasingly, regulations concerning food safety and animal welfare are becoming more stringent and enforced. Food safety and animal welfare standards in importing countries may be perceived as non-tariff barriers, but countries wishing to access those markets must abide by them. There is no price premium for meeting standards; instead the cost must be borne by exporters.

In addition, market access is becoming difficult except for the very largest producers. Small-scale farms may lack the technical knowledge and financial depth to adapt their production. Despite these difficulties, meeting food health and safety standards is a prerequisite for access to importing countries. Standards and certification are likely to become more rather than less stringent.

Consumers are not only requiring greater assurances about food safety but also about the environmental and social impacts of production. These consumer concerns are increasingly transmitted to exporters through retail chains. These retail chains are ‘buyer-driven’ setting quality and sometimes husbandry standards downstream to producers and processors. Some chains with large market share are ‘lead drivers’ setting standards that other retailers must follow to remain competitive. Carrefour for example sends inspectors on a regular basis to producers and processors to ensure that they satisfy its 85 page manual (Phyne, et. al., 2006).

In Vietnam traceability requirements and stringent drug restrictions in importing countries have forced the domestic value chain to adjust. The processing companies have driven the process, acquiring grow-out farms (particularly Pangasius) and establishing feed mills. The motivation may be partly to control costs but the primary concern appears to be the need to meet health and food safety standards. Such aquaculture certification schemes, with their obligation to focus on quality and sustainability, may be costly to exporters in the short run, but can bring important social benefits. Environmental protection and social well-being may be the result of meeting standards. The effect of food safety standards and certification in importing countries is to diminish the role of the state. Where there is little state capacity for enforcing regulations as in Vietnam, in effect the government has delegated the certifying agency through the processor to regulate the industry. Even where there is capacity, globalisation of standards becomes the driver with domestic regulations having to adapt to meet those standards.[25]

Vertical Integration

At present, the production chain of Pangasius and shrimp consists of numerous actors and middlemen. There are many different actors conducting rather niche / specific activities, particularly in shrimp culture, and this inevitably causes inefficiency because of higher transactions and transportation costs. Processing companies are clearly the most sophisticated and powerful actors in the production chain, capturing almost three quarters of the total net value added in the chain (Bush, et al 2009). It is here that margins are highest, and they are the price makers.

An example from the present illustrates this well: even with some overcapacity in processing (50 percent by some estimates), farmers appear unable to negotiate a higher price for their product or find a higher price by 'shopping around' to different processors. Furthermore, processing companies interviewed report that they are unable to satisfy demand in some of their major export markets due to a lack of raw material.[26] Given that a reported 40-50 percent of Pangasius farmers have (temporarily) suspended production due to low prices and rising costs, it is surprising that prices have not risen. The poor linkage between farmer and processor is acknowledged by local government to be a problem, and there is a MARD five-year program being initiated to look at aquaculture production chains. It is important to note here that a considerable part of the raw material input to many processing companies is imported from abroad. Processing capacity far exceeds fish production/catch such that capacity utilisation rates are low (some estimations put this at just 50 percent). As such, processors (and VASEP) have been lobbying for a reduction in, or even an elimination of, the import duties on raw fish. While this policy would clearly lead to a rise in efficiency and profitability of the processors, any reduction of tariffs would have to be managed such that domestically produced fish is not substituted in favour of foreign imports.

In addition to a shortage and/or variable supply (some of which can be attributed to seasonality and climate) of raw material, a perceived variable quality of raw material, fluctuating prices, and no alignment between supply (from farms) and demand (from importing countries) are constraints often cited by processing companies. Given this, there are a number of (recent) cases in Vietnam of processing companies consciously aiming to exert greater control over the production chain, including the grow-out farmers, the nursery/hatcheries, and the feed manufacturers. Production is, in other words, being integrated down the value chain in a process initiated and managed by, and therefore happening on the terms of, the processing companies.[27]

This vertical integration driven by processors is clearly just an emerging trend at this point[28], but to the extent that it is profitable[29] and viewed as worthwhile by the processing companies, large integrated companies including feed manufacture, grow-out fish farms, and processing activities producing fish products ready for export are likely to increasingly dominate the aquaculture sector (for all exported products) in the Mekong Delta.

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[25] A detailed analysis and set of recommendations of voluntary certification schemes for aquaculture in Vietnam is provided in the Appendix to this report.

[26] At the time of writing, this is particularly so in the case of shrimp in the Mekong Delta. Many farmers have harvested their product earlier this year (2010) in order to take advantage of high prices, causing a shortage now. Some processors, for example in Soc Trang Province, report operating at fractions of their capacity due to a shortage of the raw material.

[27] Vertical integration of the production chain has happened in other similar contexts (for example, salmon farming in Chile) but the impetus has in fact come from large farms and/or feed companies rather than the processors.

[28] No firm statistics exist regarding the extent to which this has happened, but anecdotal estimates are of circa 40 percent of the production chain integrated fully, 25 percent formal linkages (contracts) between grow-out farmer and processor, and 35 percent small scale farming without any formal linkage to the processor.

[29] To the extent that margins are slim at each stage of the production chain, accumulating them into one clearly makes sense for a profit-maximizing entity.

While the impetus for this integration is coming from the processing companies *within Vietnam*, the process in fact is being driven by consumers and retailers *outside of Vietnam* in the importing countries. Consumers, and therefore retailers, have increasingly stringent demands for quality standards and transparency regarding the quality of produce and it is currently hard for the processing company to control what happens at the farm level (especially in the case of shrimp where the number of small farms is large) and thus guarantee certain best practices. Controlling the entire production chain is seen as the best way to deal with this.

Small-Scale Farms

The definition of small scale varies by species and who you speak to. In a survey of the Mekong Delta the distribution is heavily skewed with 72% of farms less than 5 ha (Phan, et. al., 2009). Such farms are largely farmer owned and managed. There is a clear difference in Vietnam between Pangasius and shrimp: for the former, the area required to produce a given tonnage is far less than is the case for the latter, so with low densities, a Pangasius pond of 1,000m^2 can harvest between 100 to 200 tonnes per cycle. This means that Pangasius farms are, in effect, easily replaceable by the processing companies, as the amount of land required is low and processing companies can in principle simply build their own ponds close to the processing plant. For shrimp farming, this is not the case, and contracting with the many small-scale producers is therefore a necessary arrangement if traceability is to be ensured. Indeed, the processor has an incentive to work with the small shrimp farmers and to make sure they operate at positive and sustainable margins. Given the above trends, small-scale Pangasius farms would appear increasingly unviable unless they enter into some form of structured partnership with a processing company.

For the reasons stated above, it is inevitable that processing companies will continue to seek ways to integrate down the production chain. Given the potential efficiencies this could bring, integration is probably the right thing to happen for the industry. It would therefore be important for the authorities to accept and understand this trend, and consider ways to manage the process in an efficient and equitable manner. This is particularly important vis-à-vis the producers (grow-out farms) who are in general smaller and more vulnerable than the other actors.

One could think of three possibilities with respect to the grow-out farmers:

(i) Processing company contracts the grow-out farmer.

(ii) Processing company builds its own production capacity (thus effectively replacing the existent farmer).

(iii) Processing company buys the land from the grow-out farmer (farmer thus becomes employee of processor).

For Pangasius, the last two options are the most likely as mentioned above, but the third option is undesirable to the extent that it would leave the farmer landless. For shrimp, the first option is most viable. It is important to carefully manage the process of contacting farmers and for the contracts to be monitored and controlled so that the farmer, who in general is less educated and unfamiliar with the intricacies of contracts (asymmetric information), is not exploited. Indeed, at present the vast majority of farms in the Mekong Delta are privately owned by farmers who have developed their production skills through experience rather than any formal training (Bush et al, 2009). Monitoring and inventory keeping of inputs and farming practices is not, therefore, happening in a systematic way in the majority of cases. Compliance with the increasingly tough standards and certification schemes of the (European) importers is likely to be highly problematic, especially in low margin Pangasius farming (Ababouch, 2008). Those unable to generate positive profits (or unwilling/unable to contract with processing companies) may seek to sell to processors looking to exploit this tail of smaller, and less stringent, importing countries.

The Role of Producer Associations

Globally, producer associations take many forms. They vary from local institutions, sometimes called "One-stop Aqua Shops", to sophisticated national organisations. In most countries, aquaculture does not have the economic weight of agriculture or even the capture fisheries. Thus, its interests are often overlooked and producer organisations can be useful just as a lobby group. Also, they are frequently used as a means of exchanging information and diffusing technical knowledge. They can also be marketing agents, and monitors for environmental self policing, as with the Chilean Salmon and Trout Growers' Association. They have also been effective in promoting Best Management Practices (BMP) (FAO, 2006). This is critical because not only do BMPs reduce negative externalities but they can increase profitability: this was demonstrated in Vietnam's shrimp industry where shrimp yields were up to four times higher than non-BMP ponds (FAO 2006 p 107).

In Vietnam there appears to be a reluctance for farmers or processors to cooperate, whether with technical advice, joint purchasing of inputs or with marketing. An Giang Fishery Association (AFA) is a provincial branch of VASEP, and is the only current association for Pangasius. Some other growers associations that provide technical training, and disseminate marketing information do exist, with a very small annual fee, but their role is limited. Part of the reluctance may be due to historical experience of cooperatives and part due to a legal requirement that associations must be formalized. In general farmers prefer to work alone or with family members, reflecting a lack of trust in neighbouring farmers.

One option is to encourage small-scale farmers to form "clusters" through which BMPs can be disseminated. Such a designation would avoid the unpalatable word "cooperatives" and obviate the reluctance of farmers to form formal associations, and yet would obtain many of the same benefits, such as dissemination of technical information. Clusters have been successful in small-scale shrimp farms in India. The dairy cluster of families with just a few cows has been so successful that India has become the world's largest dairy producer. Shrimp farms are also "clustered" and have provided a template of how small-scale farms can compete by raising yields through BMPs (Umesh, et. al., 2010). A 'shock' may be the necessary catalyst to force consideration of the idea among (reluctant) farmers in Vietnam. In Indian shrimp farming the shock was disease; in Vietnamese Pangasius farming it could be lack of profitability.

3.4 Aquaculture Farm Budgets: A Scenario Analysis

In this section, an enterprise model is developed that conforms to existing bio-economic data for an average farm of the two species of Pangasius and Giant Tiger Shrimp in the Mekong Delta. This data was obtained from a survey carried our as part of this report in a number of Mekong Delta provinces looking at the aquaculture value chain.[30] The model is then applied to simulate possible impacts of climate change on financial variables. Climate change scenarios are taken from a recent detailed report looking at climate change impacts in the Mekong Delta by the World Fish Centre (2010).[31]

The enterprise model can be used to analyze options open to farmers as well as policymakers. For example, a farmer might be interested in reducing stocking rates; the model would immediately indicate the effect on profitability. In Madagascar and Zambia, government officials are mandated to assist farmers with business plans so that they can access credit. An enterprise budget such as this would be applicable (perhaps also with cash-flow added) in this situation. Government officials in Vietnam could also quantify how policy options could impact farmers' financial situation. For example, feed costs to farmers could be reduced by improved feed labelling or guaranteeing feed quality; the impact on profits of these two options could be compared. It could also be adapted for small-scale farms to see how these options would affect their financial viability.

Baseline Models

Table 3.8 gives some production data obtained for different sized Pangasius and shrimp farms. The shrimp sample is composed equally of Extensive farms and Intensive and Semi-intensive (SIS) farms but for this

[30] The survey was carried out by Dr Le Xuan Sinh and his team at the College of Aquaculture and Fisheries of Can Tho University.

[31] Economic Study of Adaptation to Climate Change: Vietnam's Fisheries and Aquaculture Sectors, World Fish Centre (2010).

study only SIS farms were analyzed.[32] From the sample, comprehensive and detailed production and financial data was used to develop baseline models of hypothetical farms.

Table 3.8: Pangasius and Shrimp Production Parameters

Pangasius	Small-scale	Medium Scale	Large Scale	Total
	< 0.3ha	0.3-2.0 ha	> 1.0 ha	
Average grow-out area (ha)	0.2	0.7	6.7	3.7
No of crops per year	1.1	1.4	1.4	1.3
Grow out time (months)	7.8	7.6	7.3	7.5
Average no. of ponds	1.2	2.4	9	5.6
Average FCR	1.8	1.7	1.7	1.7
Hired and family labour	2.8	5.6	24.7	18.2
Shrimp	**< 0.5ha**	**0.5-2.0 ha**	**> 2.0 ha**	**Total**
Average grow-out area (ha)	0.4	1.2	3.0	1.5
No of crops per year	2.6	2.3	2.6	2.4
Grow out time (months)	4.7	5.2	4.6	4.9
Average no. of ponds	2.7	3.5	10.1	6.2
Average FCR	1.3	1.5	1.5	1.5

Source: Authors' own calculations based on data collected as part of report (Can Tho University)

No aquaculture farm in Vietnam is large enough to influence prices, so the average farm is a price-taker in a competitive market. According to the sample data for Pangasius, average total costs per kg do not vary significantly by size of farm. This is contrary to most species, but can be explained by the very low fixed cost as a proportion of the total (average fixed costs are only 0.5 percent of average total costs). With shrimp there are some economies of scale, in part because of the larger share of fixed costs (2.1 percent of average total costs). However, the great majority of farms lack sufficient market power to influence farm gate price.

Because price is given to farmers, the critical decision to maximize profits for the farmer is the quantity of output. In theory this is when the cost of producing the last unit (marginal cost) is equal to the price set by the market. If farmers are unable to produce enough to cover costs, they will be forced to find alternative activities. Pangasius is a relatively low value species with a farm-gate price less than one seventh that of shrimp (average prices in the sample are 16,003 and 120,400 VND/kg respectively), so farmers must produce a lot to cover costs; the average farmer in the sample used here sells 304,300 kg/ha/crop. This contrasts to shrimp where the average output is only 4,133 kg/ha/crop.

For both species fixed costs are a very small percentage of total costs. For Pangasius, the proportion was only about 0.5 percent; for shrimp 2.1 percent of total costs. Variable costs are therefore dominant. The most important components of variable costs for Pangasius farmers are feed (89.9 percent of the total), seed (6.0 percent), medicine (2.3 percent) and pond remediation (0.6 percent). Electricity / fuel, labour and transport account for the remaining 1.2 percent. Factors or policies that affect the cost of feed such as FCR, the price of feed, and survival rates, are therefore critical for profitability. For shrimp farmers, feed is less important, but is still the predominant expense accounting for 67.9 percent of the total. Among the rest, medicine is 9.2 percent, electricity and fuel 5.9 percent, labour (including family labour) 4.2 percent and seed 3.9 percent. There are also other variable costs such as pond preparation, interest and transport.

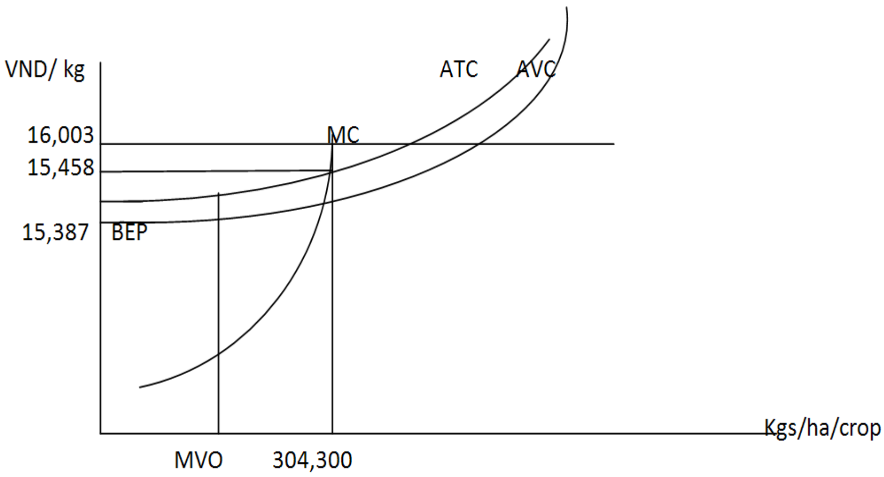
Profits are the difference between revenues and costs. Total revenue of an average Pangasius farmer in the sample used here is 4.9mn VND/ha/crop, and for shrimp 0.49mn VND/ha/crop. Despite revenues ten times higher in Pangasius than shrimp farming, the former's costs are proportionally higher. Therefore, returns

[32] The reason being that with international competition and improved techniques, more farms are likely to adopt SIS husbandry practices.

(with total costs excluding the owner's opportunity costs) in a hypothetical Pangasius farm are 165.7mn VND/ha/crop compared with 190.6 VND/ha/crop for a similar shrimp farm. The difference is compounded by the longer crop season for Pangasius (7.5 months/crop), compared with shrimp (4.9 months/crop), so the differential in *annual* revenues is still bigger.

The difference in profitability between Pangasius and shrimp is even more evident when analyzed by kg rather than per ha per crop. Figure 3.3 illustrates a typical perfectly competitive Pangasius farm.

Figure 3.3: Baseline Model for Pangasius Farm (VND/kg).

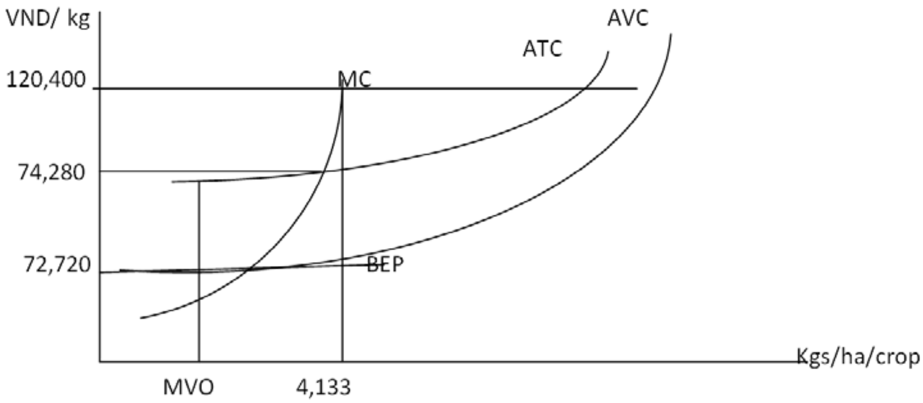


As can be seen, the average farm-gate price in the sample of 16,003 VND/kg[33] produces very small profits of 545 VND/kg (equating to the difference between 16,003 VND and the Average Total Cost (ATC) of 15,458 VND/kg). If price falls below the ATC at 15,458 VND/kg, farmers make a loss and will leave Pangasius farming either immediately or in the long run. If price falls further, to 15,387 VND/kg, the bottom of the Average Variable Cost (AVC) curve, farmers will immediately cease operations. This is the Break-even Point (BEP) under which day-to-day operating costs are not covered and immediate losses are incurred.

A similar exercise for shrimp farms shows two significant differences. Firstly, the gap between ATC and AVC is greater. This is because the gap reflects Average Fixed Costs and these are almost negligible for Pangasius farming; 71 VND/kg in the Baseline farm. Average Fixed Costs for shrimp on the other hand are 1,560 VND/kg. The other more important difference is the gap between price and ATC, which illustrates profit per kg. While profits per kg are only 544 VND in Pangasius farming, they are 46,120 VND for shrimp. These differences are illustrated in Figure 3.4

[33] It is noteworthy than the average price in our sample is thus significantly less, on current exchange rates, than the proposed USD 1 price floor (see previous sections). Should the price floor be introduced, it will therefore have a strong positive impact on those farmers selling produce ultimately destined for US export.

Figure 3.4: Baseline Model of Shrimp Farm (VND/Kg).



If price cannot be affected by an individual farmer, the model allows an estimate of the minimum output needed for profitability. With the parameters of the baseline farm, the minimum volume for the Pangasius farmer to cover all costs (except own-salary) is 293,947kg. This is the Minimum Viable Output (MVO). Farmers unable to produce the MVO will find alternative activities in the long-run because their output and hence revenue is not sufficient to cover total costs. If farmers are unable to meet even variable costs, which in the baseline scenario (at BEP) are 292,587kg, they will *immediately* cease operations. For shrimp, the MVO for the farmer to cover all costs (except own-salary) is 2,550kg. The BEP for the Baseline shrimp farm is 2,496kg.

Scenario Analysis

The importance of variable costs and in particular feed costs can be demonstrated by simulating a decline in variable costs. One option to lower feed costs is to decrease the FCR, perhaps through policies such imposing feed quality assurance standards, or requiring clarity in labelling. Another option would be to reduce feed prices (for example by eliminating tariffs on ingredients). Both these options will be simulated individually comparing financial results with the Baseline model, and cumulatively. Their impact is shown in Table 3.9. Given the very large weight of feed in total costs and also the large volume, any impact or policy that affects feed costs has a major effect on profits per kg.

Table 3.9: Impact on Pangasius Costs and Profits of Reduced Input Costs

	MVO	ATC	PROFIT	
	kg	VND per kg	VND per kg	% increase
Baseline farm	293,945	15,458	545	-
5% decrease in FCR	281,473	14,803	1,200	120
5% decrease in feed price	280,849	14,770	1233	126
Cumulative impact of both	268,998	14,147	1856	241

Source: Authors' own calculations

The impact of lower feed costs on total costs is therefore significant. The ATC per kg declines, and with a given price, profits per kg more than double. Most important of the two options is the reduction in feed prices. The lower MVO suggests that some of the vulnerable farms will be able to survive.

A similar scenario can be simulated for shrimp. One policy option is to improve the use of medicines. Their cost in the average ISI shrimp farm is over 11 percent of variable costs. Another option is to lower feed costs either by reducing FCRs or decreasing feed prices as with Pangasius, or raising survival rates (improving the quality of seed and encouraging Better Management Practices). The potential impact of these policies is shown in Table 3.10. As the table shows, the most effective policy in pure profitability terms is to lower feed costs, which is not surprising given the weight of feed in total costs.

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Table 3.10: Impact on Shrimp Costs and Profits of Reduced Input Costs

	MVO	ATC	PROFIT	
	kg	VND per kg	VND per kg	% increase
Baseline farm	2,550	74,280	46,120	-
10% lower cost of medicine	2,527	73,621	46,779	1.4
10% lower feed costs	2,381	69,352	51,048	10.7
Cumulative impact of both	2,358	68,683	51,717	12.1

Source: Authors' own calculations

Climate Change

Both Pangasius and Giant Tiger Shrimp are primarily produced in the Mekong Delta which because of its topography will be particularly affected by climate change. Higher water levels and storm surges will require higher dikes; increased salination will impede the growth and survival of species and warmer weather could engender more disease outbreaks. Both costs and revenues of farmers will be adversely affected.

Figures 3.3 and 3.4 also illustrate the implications for profits if costs increase in the context of constant output prices. If AVC and ATC for example increase above the given sales price, farmers will be forced out of business. This is one of the possible consequences of climate change, which is projected to have (potentially highly) damaging consequences on Pangasius and shrimp production costs in the Mekong Delta: work done the World Fish Centre (WFC) (2010), for example, suggests that over the next ten years climate change will cause both fixed and variable costs of producing Pangasius and shrimp to increase. In this section, the likely impacts of climate change on the Baseline farms are illustrated.

Grow-out Pangasius ponds in four provinces (Dong Thap, Can Tho, Ben Tre and Soc Trang) and in three provinces (Ben Tre, Soc Trang and Ca Mau) for shrimp in the Mekong Delta were sampled as part of this survey. Most of these sampled provinces will be subject to flooding due to climate change according to projections made by the WFC. By 2050, the average area flooded is projected to be 40 percent in three of the sampled catfish provinces as Table 3.11 indicates, and about 47 percent on average in the shrimp provinces.

Table 3.11: Flooding due to Climate Change in the Mekong Delta in 2050

Province	Total area (km^2)	Area flooded (km^2)	Proportion of flooded area (%)
Ben Tre	2,257	1,131	50.1
Long An	4,389	2,169	49.4
Tra Vinh	2,234	1,021	45.7
Soc Trang	3,259	1,425	43.7
Tp. Ho Chí Minh	2,003	862	43
Vinh Long	1,528	606	39.7
Bac Lieu	2,475	962	38.9
Tien Giang	2,379	783	32.7
Kien Giang	6,224	1,757	28.2
Can Tho	3,062	758	24.7
Total	**29,827**	**11,474**	**38.5**

Source:WFC (2010)

Apart from a simple loss of land, flooding may also bring negative effects such as a faster water- salination which will slow growth, or more diseases which will increase drug use**.** The FCR ratio is projected to increase because of climate change, which will affect also feed costs and fuel costs. Table 3.12 below presents some selected effects of climate change on Pangasius costs.

Table 3.12: Possible Impacts of Climate Change on Pangasius Production Costs

Impact	Total Change in Costs during next Ten Years	Contribution of Climate Change (CC)	Impact on Baseline Budget due to Climate Change
Water level rises by 20-30cm (FC)	Dike costs increase by 2.5 times	Dike costs increase 40% due to CC	TFC increases by 35%
Pond preparation	Costs increase by 30%	30% due to CC	Costs increase by 9%
Feed costs increase	FCR increases from 1.68 to1.75	40% due to CC	FCR increase by 1.44% to 1.71.
Feed costs increase	Feed prices increase by 1.5 times	40% due to CC	Feed prices increase by 60%.
Cost of medicines	Costs increase by 2.5 times	25% due to CC	Increase by 62,5%
Fuel, electricity	Costs increase by 20%	30% due to CC	Costs increase by 6%
Crop duration	Length increase by 1.5 months (27%)	30% due to CC	Length increases by 1.8 weeks
Survival rate	Falls from 95% to 85% (10.5%)	30% due to CC	10% decline

Source: WFC (2010)

To analyze the effect of these climate change impacts on the financial situation of the hypothetical farm, each change due to climate change is compared individually against the financial results of the Baseline model presented above. Results are presented in Table 3.13.

Table 3.13: Impact of Climate Change on Costs and Profits of Pangasius

	MVO	**ATC**	**PROFIT**	
	kg	**VND / kg**	**VND / kg**	**% decrease**
Baseline farm	293,945	15,458	545	-
Dikes - TFC increases by 35%	294,357	15,480	523	4
Pond costs increase by 9%	294,091	15,466	537	1.4
FCR increases to 1.71	298,652	15,706	297	4.6
Feed prices increase by 60%	452,099	23,776	-7,773	>100%
Medicine costs increase by 62.5%	298,261	15,685	318	41.2
Cost of fuels increases by 6%	293,954	15,459	544	0.2
Survival rate falls by 10%	375,600	19,753	-3,750	>100
Cumulative effect of all	**585,786**	**30,806**	**-14,803**	**>100**

Source: Authors' own calculations

As the table shows, the most dramatic effect of climate change will come via rising feed prices, producing a substantial decline in profits and causing big losses. A decline in the survival rate also generates negative profits because of the dual effect on feed costs and fingerling costs. Other individual cost impacts are less dramatic, particularly rising fuel costs, but higher medical expenses (because of increased disease) almost half profits per kg. The total cumulative effect is however very troubling with a loss per kg of almost 15,000 VND. When estimated by ha/crop rather than kg the impact of climate change is even worse: the hypothetical farm loses more than 1.5bn VND/ha/crop. The impact of climate change is to almost double ATC, which implies that farm-gate prices of Pangasius would also need to double for profitability.

Tables 3.14 and 3.15 repeat the above exercise for shrimp farms.

Table 3.14: Possible Impacts of Climate Change on Shrimp Production Costs

Impact	Impact on Costs	Contribution of Climate Change (CC)	Impact on Baseline Budget due to Climate Change
Water level rises by 20-30cm	Fixed Costs (TFC) increase by 2.5 times	40% due to CC	Increase by 35%
Feed costs increase	FCR and feed prices increase	20% due to CC	FCR and feed prices increase by 2.6%
Cost of medicines increase	Costs double	35% due to CC	Increase by 35%
Survival rate rises	Overall rise (due to technology) but:	10% decline due to CC	10% decline
Cost of fuel increases	Costs rise by 20%	40% due to CC	Increase by 8%

Source: WFC (2010)

As with Pangasius, each change in a parameter due to climate change is compared individually against the financial results of the Baseline model. The possible cumulative effect is then illustrated.

Table 3.15: Impact of Climate Change on Costs and Profits of Shrimp

	MVO	ATC	PROFIT	
	kg	VND / kg	VND / kg	% decrease
Baseline farm	2,550	74,280	46,120	-
TFC increases by 35%	2,569	74,826	45,574	1.2
FCR increases by 2.6%	2,595	75,606	44,794	2.9
Feed prices increase by 2.6%	2,591	75,466	44,934	2.6
Medicine costs increase by 35%	2,630	76,609	43,791	5
Survival rate falls by 10%				
Additional fingerlings	2,555	74,425	45,975	0.7
Additional feed	2,636	76,791	43,609	5.4
Total survival effect	2,641	76,936	43,464	5.8
Cost of fuels increases by 8%	2,561	74,619	45,781	0.7
Cumulative effect of all	**2,818**	**89,092**	**38,308**	**17.0**

Source: Authors' own calculations

Among the individual impacts of climate change, the most damaging to the financial health of the hypothetical ISI farm is the decline in survival rates because of higher feed and fingerling costs. Lower survival rates attributable to climate change mean that more fingerlings must be bought and fed to obtain the same output; profits are 5.8 percent lower than the Baseline model. The next in terms of magnitude is medicine due to disease outbreaks; profits are 5.0 percent lower.

In Figure 1 the cumulative effect of climate change is to shift up the AVC and ATC curves. The AVC per kg has increased from 72,720 VND in the Baseline model to 79,986 VND in the Climate Change model, and the ATC per kg has increased even more because of the higher fixed costs. Overall the farmer faces a decline in profits of 17.0%- noteworthy, but far less severe than in the case of Pangasius.

Summary

The impact of climate change will be detrimental to continued production of both Pangasius and shrimp in the Mekong Delta, but will be particularly devastating for Pangasius. Margins per kg are already very low for Pangasius, such that higher costs will threaten the survival of many farms. Shrimp farms may cope by consolidation given that some economies of scale exist, but that option is not available to Pangasius farmers, as mentioned above. Options facing farmers are thus limited. They can pre-emptively build up dikes and can anticipate disease outbreaks by reducing stocking rates, but most of the shocks are outside their control. For this reason the government has a role to play. The government's proposed policy to set price floors for Pangasius is a possibility here (though with the caveats highlighted in previous sections). Limiting output with a species that has inelastic own-elasticity would actually raise revenues- and processors may have an incentive to pass-on some of the higher price to farmers to ensure raw material. This pass-through is even more likely if the process of vertical integration continues such that processors own farms themselves

Further options could be to influence the cost of feed to farmers. This was discussed in the main body of the report. Feed is such a critical cost for farmers (particularly Pangasius farmers) that any action that reduces feed costs could offset some of the damaging effects of climate change. As with feed, the cost of medicine is also important. Compared with other countries, medicine is over-used in Vietnam which may be due to poor husbandry practices, perverse incentives by pharmaceutical agents and retailers, or declining quality of fingerlings. There are policies that governments can implement to encourage better management practices (such as clusters), reduce the over-prescription of drugs by ensuring (improved training of retailers and mandated recording of drug use and drug sales), and improve the quality of fingerlings (establish seed standards and monitor hatcheries). Even maintaining the cost of medicine at its already high level would be a meaningful policy objective in the face of climate change. Some form of technical training on medicine use, to encourage responsible use, should also be implemented.

4 Marine Capture Fisheries

4.1 Profile of Sector

Vietnam has 3,260 km of coastline, and an exclusive economic zone (EEZ) of approximately 417,663 km^2.[34] On this basis, ocean area exceeds land area by about 30 percent. The coast of Vietnam is divided into four main zones for fishing, namely the Gulf of Tonkin in North Vietnam, Central Vietnam, Eastern South Vietnam, and the Gulf of Thailand, and there are fifteen main fishing grounds, twelve inshore (less than or equal to 24 miles from shore), and three offshore. There are 29 coastal provinces, accounting for just over half of the total population of Vietnam.

The major types of fishing gears are trawling (30 percent), purse seine (26 percent), gill net (18 percent), lift net (5 percent), long line (6 percent), and others for example, fixed net and push net (15 percent).[35] No statistics exist on final uses of production, but marine finfish catch is estimated to be used for export (15 percent), fresh human consumption in Vietnam (20 percent), animal feed (livestock, aquaculture) and fish meal (35 percent), and fish sauce (30 percent) (see Figure 2.5).[36]

Two quite distinct (though interlinked) fisher groups can be identified within the subsector:

- Inshore fishers exploiting coastal and near-to-shore (NTS) resources. This group is generally characterised as small-scale and relatively poor, with a high proportion of catch used for own consumption and/or ‘trash fish’.
- Medium/large-scale fishing vessels with capability for offshore (OS) fishing. Almost all catch is sold commercially, some of which goes for export.

In this sense, the marine capture subsector can be characterised as highly segmented, something that is clearly important for policy design. The proceeding analysis will wherever possible draw distinctions between these two, though the picture is muddied somewhat by a lack of accurate data.[37]

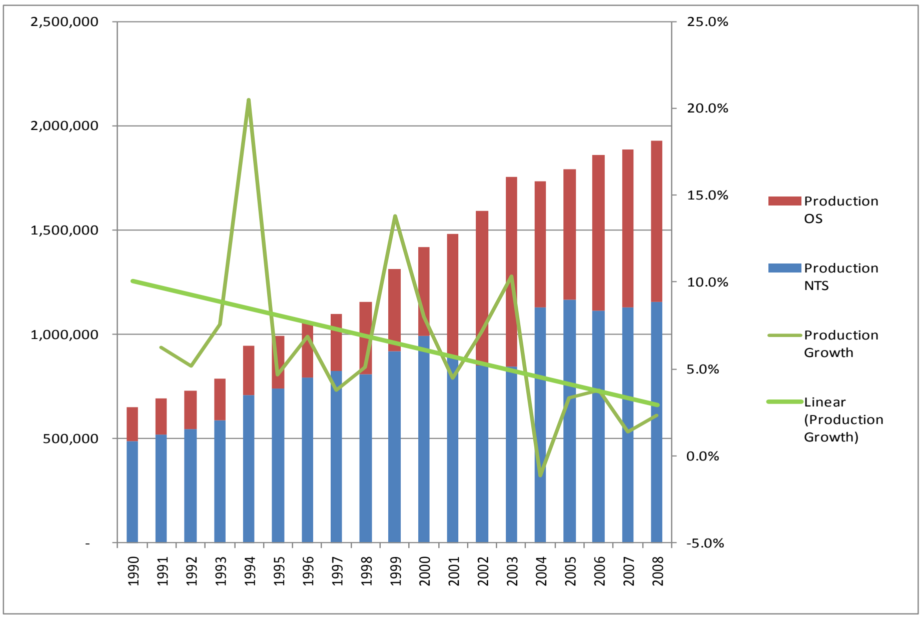
Vietnamese marine fisheries are regulated according to the size of the boat engine and the location of fishing activity (Decree 123/2006/ND-CP, Article 5). Specifically, vessels (i) without an engine or with engines less than 20hp should operate between 1-6nm from the shore, (ii) with engines between 21–90hp should operate in areas 7-24 nm from the shore, and (iii) with engines over 90hp should operate in areas 25-350nm from the shore. Moreover, vessel operators should obtain marine fishing licenses depending on where they wish to fish (near-to-shore vs offshore), the size of the boat engine, the gear type employed as well as other things. The fee levied is proportional to the engine size of the vessel. Vessels under 0.5 tons, representing an sizeable part of the total fleet, are exempt from any license payment, and many fishers whose vessels are liable for a license payment (i.e. over 0.5 tons) chose not to comply with the regulations.[38] The procedure for license applications is widely considered to be relatively straightforward, and a license application generally leads to a license being granted. In this sense, Vietnamese marine capture fisheries can be said to be ‘open access’.[39]

[34] Vietnam’s EEZ is often said in fact to be in excess of 1mn km^2, due to the inclusion of the disputed Paracel Islands.
[35] VIFEP estimations.
[36] FSPS II estimations, 2009
[37] Both near-to-shore and offshore fisheries in Vietnam are multidimensional, and as such, defining them is not straightforward. Pomeroy and Nguyen (2009) suggest that offshore fishing can be differentiated as fishing vessels with an engine capacity of more than 90hp; *and/or* registered for operating offshore; *and/or* Vessels fishing in waters ‘*bordered by a 30m deep line from the shore onwards or the Tonkin Gulf waters, East and South West waters, and Thailand Bay, and by a 50m deep line from the shore onwards from the Central Coast.*’ Data constraints mean that inshore and offshore are almost always proxied by the first of these.
[38] See Circular No 02/2006/TT-BTS (20 March 2006) for more detailed information here.
[39] Pomeroy & Nguyen (2009), p423.

4.1.1 Production

As Figure 4.1 illustrates, while marine production does continue to rise, the catch is gradually stagnating reflected in the steadily declining growth rate to levels just above zero. If current trends continue, one would expect production to plateau and even possibly decline (negative growth) in the near term. While official statistics (such as those used in Figure 4.1) show catch to be in the region of 2mn tonnes, many industry insiders believe the true level to be much higher- the Danida funded Assessment of Living Marine Resources in Vietnam (ALMRV) project, for instance, estimated marine capture fisheries production of about 2.5mn tones in 2004.

Figure 4.1: Marine Capture Fisheries Production (tonnes and percent)



Source: DECAFIREP, compiled and checked by VIFEP

The figure splits total production into NTS and OS. As noted, given data shortages disaggregating production in this way is highly imperfect, as many OS boats stray into NTS waters. Nevertheless, it does give some indication of the split.[40]

As noted above in Chapter 2, the 2020 Strategy does not explicitly state a target for marine catch. Nevertheless, one can imply an objective of 2.1mn tonnes from the overall production target and proportion of aquaculture stated in the document. On this basis, marine catch growth will be close to zero over the coming decade. This will be returned to in the analysis below.

Marine Species and Trash Fish

The so-called 'trash fish' represents the most important marine fish product in terms of both volume and value in Vietnam (Edwards et al, 2004). This in part is due to the fact that catch of high value species is growing more slowly, or even declining in some cases, such that an increasing part of marginal production is comprised of trash fish.

The problem of conflicting marine catch data is particularly acute for trash fish landings. Nevertheless, it is estimated that while trash fish used to comprise about one third of the catch from trawling (RIMF, 2001), this has risen to an estimated 50 percent and even up to 80 percent in some regions such as Kien Giang in the southwest of Vietnam. According to RIMF, there was a total of 0.93mn tonnes of trash fish produced in

[40] Split is based on DECAFIREP/VIFEP estimations.

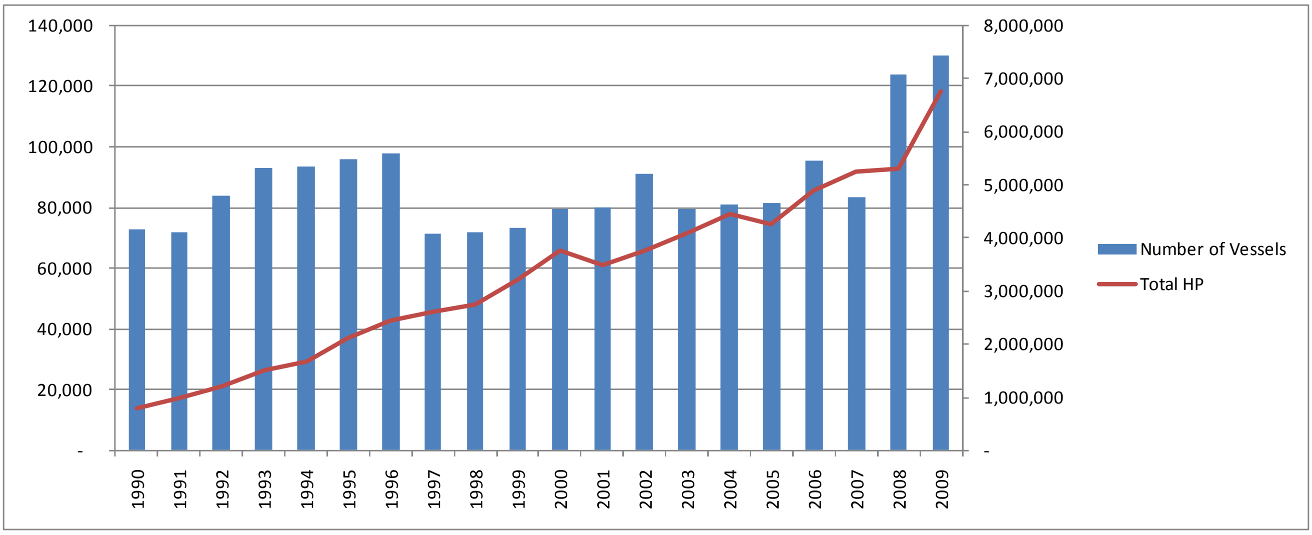
2001, equating to over 60 percent of total marine catch. Disaggregating by region, the Southeast and Southwest account for the bulk of this, producing almost two thirds of the total.[41]

The major trash fish species by area are anchovy in the centre and southwest, lizard fish in the north, centre and southeast and pony fish in the centre and Southwest. The relative abundance of trash fish is also highly seasonal. Trash fish, therefore, comprises mainly demersal species but pelagics may be used when fish landings exceed local marketing or fish processing capacity. Spoiled higher value species may also be used as trash fish. In general, however, there is no special fishery for trash fish. Trash fish is therefore often simply a by-product of fishing for higher value fish with non-selective gears.[42] The price of trash fish varies depending on location and season, and due to its non-homogeneous quality. Significant price rises have been experienced recently, most likely due to the increasing demand for feeding farmed fish and livestock, and to a lesser extent, fish sauce. To the extent that trash fish is often comprised of juveniles and prices are low, it is important to view trash fish as an undesirable element of catch in the medium to long term. This could be achieved by a better management of gears used and a focus on catch quality and value.

4.1.2 Fishing Effort

Fishing effort is a composite (multidimensional) indicator of fishing activity, including many aspects of the capacity of vessels, gear, and labour. Effective effort is therefore extremely difficult to accurately quantify, and no comprehensive global or Vietnamese statistics are available.[43] In the analysis below, effort is therefore proxied by vessel numbers and their engine capacity. This is clearly somewhat of a blunt measure; nevertheless, the trends are clear from Figure 4.2:

Figure 4.2: Marine Capture Fisheries Capacity (number vessels and HP), 1990-2008



Source: DECAFIREP, compiled and checked by VIFEP

The number of vessels fishing Vietnamese waters has thus risen substantially over the past two decades to approximately 130,000. Moreover, the average vessel has also become more powerful, such that average HP per vessel has risen from 10.9 CV to 52.1 CV over this 20-year period. Aggregate fishing effort, as proxied by the total HP of the fleet has therefore risen by a factor of seven over the past two decades.

[41] There is relatively little trash fish landed in central Vietnam because mainly selective fishing gears are used in deeper water (Edwards et al, 2004).

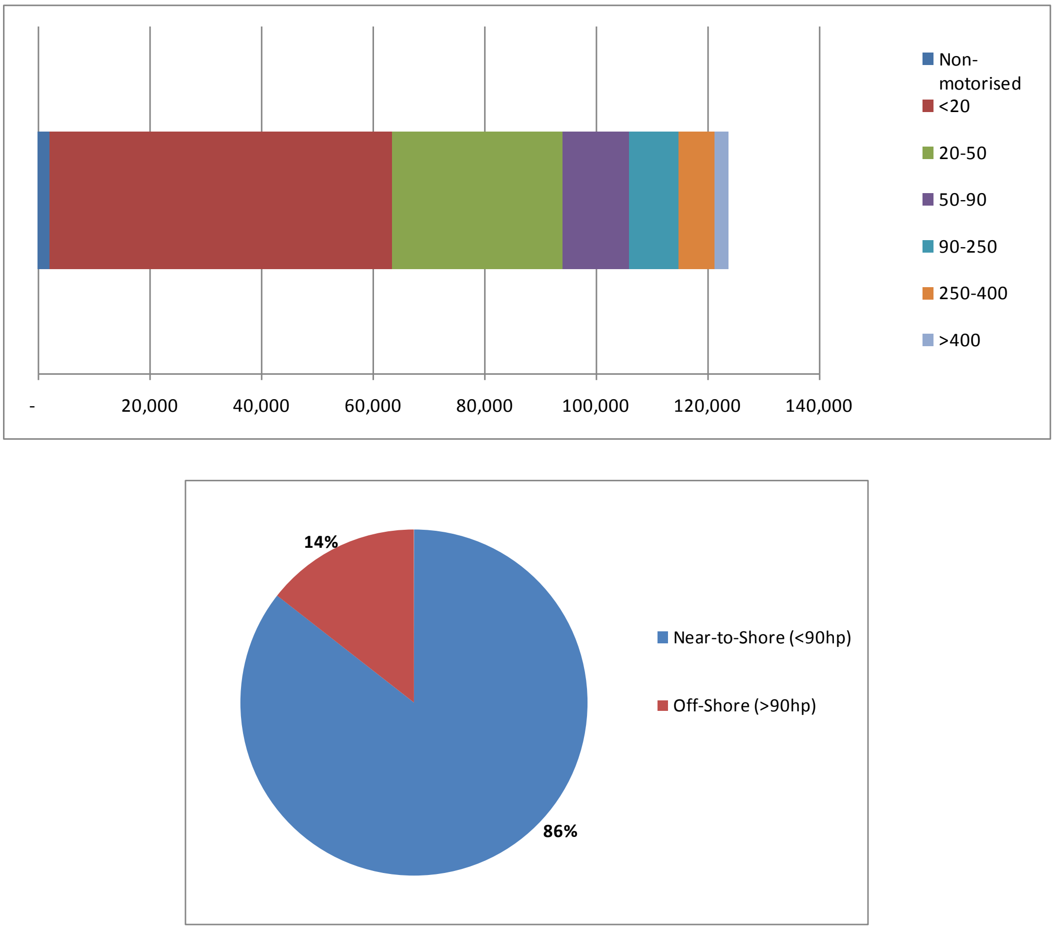
[42] The single exception was a report on the recent establishment of a fishing fleet at Cat Lo near Vung Tau in southeast Vietnam, where trash fish is the main target as it is more economic than fishing for larger species.

[43] Data in Vietnam is not of sufficient detail to allow for the separation of engine size and gear type by species caught, for instance.

Great care should be exercised when using the vessel number statistics.[44] Firstly, official vessel numbers such as those used above exclude the very smallest of boats (under 0.5 tons) that are not required to register (Fisheries Law, Article 16.1). Such vessels are widely believed to account for a significant proportion of total marine capacity, and the vessel numbers presented above and below should therefore be taken as underestimations of the true amount of capacity, especially in inshore waters. Secondly, the sudden rise of vessels in 2008 is not due solely to new capacity entering the water. Rather, it is due to the conditions associated with the fuel price subsidy of 2008 causing a registering of incumbent capacity of an estimated 30,000 boats. Rebasing all previous years by a maximum of 30,000 would clearly show a rather more flat trend in the number of vessels, however the impact of aggregate HP would be negligible.

Figure 4.3 provides a snapshot of the profile of the Vietnamese marine fishing fleet in 2008, with the above caveat regarding the likely large underestimation in official statistics of small non-motorised vessels.

Figure 4.3: Marine Capture Fisheries Capacity 2008 (number of vessels)



Source: DECAFIREP, compiled and checked by VIFEP

At least half of the fleet is thus comprised of vessels of less than 20 CV, and 86 percent of vessels can be classified as near-to-shore (<90 CV). Despite recent rises (and indeed policy efforts) [45], only 14 percent of vessels are currently offshore.

There has thus been an sevenfold increase in horsepower from 1990-2008, accompanied by just a threefold rise in production over the same period. The implication is big inefficiencies- production does continue to climb, but this is in the context of a substantial swelling in the amount of effort used to produce this catch. The result, as illustrated in Figure 4.4, is a declining catch per unit of effort (CPUE).

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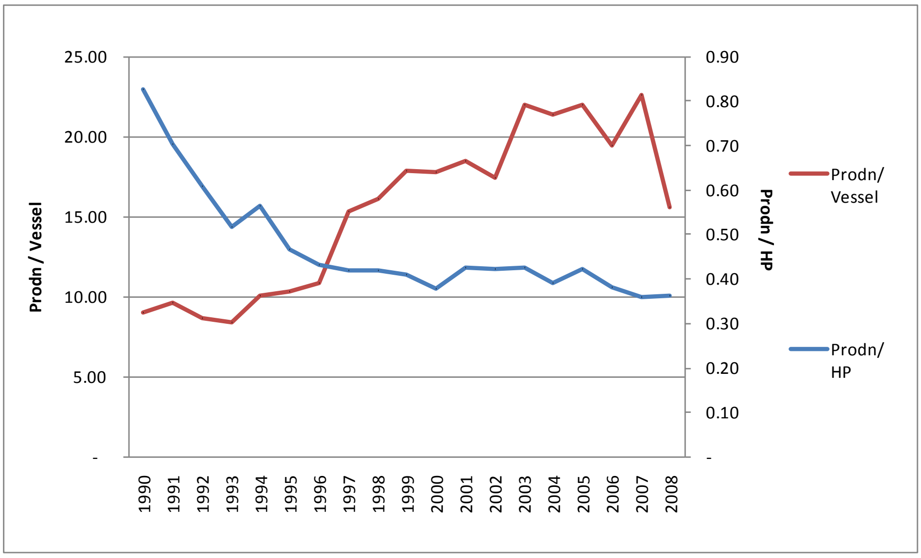
[44] The fluctuations shown in Figure 4.2 are testament to this.

[45] This is in the context of policy to incentivise fishermen to upgrade boats to move offshore (Decision no.289, 1997).

Figure 4.4: Marine Capture Fisheries Catch per Unit of Effort (CPUE)



Source: DECAFIREP, compiled and checked by VIFEP

In summary then, while capture yield (total catch) and capture yield per vessel have continued to rise (the latter less rapidly due to more boats), marine capture productivity (average CPUE), as measured by production/aggregate horsepower, has been falling for some time. The decline in CPUE demonstrates the falling harvesting productivity of Vietnamese marine fisheries. In short, there are clear inefficiencies present in marine capture fisheries, and while the situation is not new, it continues to worsen each year.

Furthermore, this most likely represents an underestimation of any productivity declines, given that improvements in gear technology, changes in gear intensity use (small mesh), and the likely underestimation of vessel numbers, are not taken into account in the analysis. Any productivity gains that may have been derived from technological improvements in Vietnamese fisheries, for example, may not have been fully realised as there would need to be a concomitant fall in the number of vessels in order to see improved productivity.

4.1.3 Near to Shore Fisheries: *A Case Study of Anchovy*

This section considers the value chain of small-scale marine fisheries. Specifically, a small survey was carried out as part of this report in Khanh Hoa province looking at the anchovy value chain.[46] Reflecting the structure of the value chain, interviews were held with 46 anchovy fishing households, two primary middlemen, one secondary middleman, two fish sauce companies, and three fish processing companies (one exporting, two domestic). A stratified sampling methodology was employed such that two fisher groups (based on vessel size) were interviewed in Cam Ranh and Nha Trang districts of Khanh Hoa Province.

Description of Value Chain

The anchovy value chain (presented in Annex) consists of three sets of actors: the fishermen, the middlemen, and the processors. The presence of middlemen is a common characteristic in all Vietnamese marine value chains. In the case of anchovy, there are 'primary' middlemen who operate on the water, buying directly from the vessels, and 'secondary' middlemen operating on land who buy from primary middlemen. The middlemen are the price makers vis-à-vis the fishers. Three main reasons are behind this balance of power: First, fishers often borrow money from the middlemen; second, due to a lack of preservation ability/technology and high costs associated with travelling to and from land, fishermen prefer to (perhaps forced to) transact at sea (with the primary middlemen); and third, fishers are often reluctant to deal directly with processors given the administrative demand that this can entail.

[46] The survey was carried out by Dr Nguyen Kim Anh and her team at the Economics Faculty of the Nha Trang University.

The number of anchovy boats in the sample sites has actually decreased somewhat since 2005. However, the capacity has not been removed altogether; rather it is lying dormant, such that fishing could be restored to previous levels with relative ease. New entrants in the middleman segment are unlikely. This is a closed market, with high barriers to entry, including a requisite high capital amount to allow lending to fishers and the close and long-established relationships between fishers and incumbent middlemen. As shown in the diagrammatic representation of the value chain, most product (75 percent) goes to small-scale processors who manufacture fish sauce. Despite relatively simple production technologies and limited investment costs, there are few new entrants here, perhaps reflecting the saturation of the market. While production remains largely small-scale, the scale of operations is rising and competition is increasing as a result.

The changing face of the fish sauce industry in Vietnam

'*I used to think that with rice and nuoc mam, and a little opium for treatment, one could take a trip around the world- and I still think so.*' Pierre Schoendoerffer, The Paths of the Sea.

Small-scale manufacture of fish sauce at the household level is a traditional practice throughout coastal Vietnam. Looking at the fish sauce value chain below, it is evident that the manufacturers/processors earn healthy margins. Given the relatively small investment requirements and apparent low barriers to entry (easy process in theory to make fish sauce), it is thus surprising that there are not more new entrants into the market, more competition, and thus an erosion of margins. The answer firstly lies with the fact that consumers tend to prefer known (branded) products, and will switch rarely. Secondly, while the manufacturing process is in principle quite easy, the experience and know-how to make a product that satisfies the discerning Vietnamese customer is not so straightforward. Often products are the result of years of experience, even across generations. Barriers to entry are in fact quite high.

The recent entry of Massan Group (www.massangroup.com) into the fish sauce sector will continue to bring large changes to the shape and dynamics of the industry. Its branded products, Nam Ngu and Chin Su, are increasingly available on the market, and are plied through intensive and professional advertising campaigns through many media forms. All indications are that they are gaining market share at the expense of the smaller producers. The consequences of this should be closely monitored.

Price setting power rises as the actor gets closer to the final consumer. The processors set the price with the middlemen, and the middlemen set the price for the fishers. There is some seasonality however, with middlemen holding more bargaining power with the processors in the low season, and vice versa in the high season. The bargaining power of fishers is low. They lack information, and are powerless given their inability to preserve catch and their indebtedness to the middlemen.

Table 4.1 presents prices, costs, and profits at the various stages of the anchovy value chain for three 'types' of anchovy (that destined for export, that destined for the domestic market, and that manufactured ultimately into fish sauce). More detailed numbers, disaggregated cost data, is presented in the Annex. The table clearly shows that anchovy destined for export commands the highest price (41,167 VND/Kg) and thus the highest profits for all actors in the value chain- this is particularly apparent for the fishers where a price of 20,000 VND/Kg is earned, more than four times the price of fish sauce anchovy. It is noteworthy that in our sample, those fishers supplying the fish sauce industry (via middlemen) currently make a loss.

It is important to note here that while there are many different kinds of anchovy (including Spined and Commerson's) that command different prices in themselves, *quality of the catch*, regardless of the particular species, can also be a key determinant of price. Quality can depend on many factors, many of which are under the control of the fisher- such as gear used to land the catch and preservation of the catch once it is caught, and it is significant that regardless of the type or quality of catch, production costs are the same.

Table 4.1: Anchovy Value Chain- Costs and Profits

		Incremental Cost	Total Costs	Sale Price	Profit Margin	Profit Margin : Total Cost	Profit Margin : Inc'l Cost	Share of Value
		VND/kg						
Export	Fishers		4,578	20,000	15,422	337%		49%
	Primary Middleman	300	20,300	22,000	1,700	8%	567%	5%
	Secondary middleman	350	22,350	24,000	1,650	7%	471%	5%
	Processor	6,667	30,667	41,167	10,500	34%	157%	42%
Domestic	Fishers		4,578	10,000	5,422	118%		60%
	Primary Middleman	300	10,300	11,000	700	7%	233%	6%
	Secondary middleman	350	11,350	12,000	650	6%	186%	6%
	Processor	3,667	15,667	16,667	1,000	6%	27%	28%
Fish Sauce	Fishers		4,578	4,500	(78)	-2%		23%
	Primary Middleman	300	4,800	5,000	200	4%	67%	3%
	Secondary middleman	350	5,350	5,500	150	3%	43%	3%
	Processor	14,000	19,500	20,000	500	3%	4%	73%

Source: Authors' own survey and calculations, Nha Trang, 2010

According to the table, most benefits are concentrated with the fishers and the processors- regardless of the 'type' of anchovy. The middlemen appear to capture very little of the value added of the whole chain. This may seem to contradict earlier comments, and the answer lies in the fact that the above figures represent VND amounts *per kg*. Taking the industry as a whole, there are numerous fishers, each catching a relatively small amount. Thus, while fishers may earn a high amount *per kg* for non-fish sauce anchovy, their total profits are low. In contrast, there are relatively few middlemen and processing companies and they therefore manage/process quite large volumes. Profits are correspondingly high- especially for the processing companies.

The intermediary system of (sometimes multiple) middleman is often maligned due to the reasons outlined above. However, it should be acknowledged that as things currently stand, the system would not be able to operate without the services of middlemen. Nevertheless, the value chain is highly imbalanced, and policies can be implemented to attempt to redress this. In particular, specific attention should be paid to supporting the fishers. Creating the possibility and helping fishers to organise themselves into groups such that they interact with the supply chain in a collective way would be one option. Providing alternative credit sources and introducing initiatives to teach and finance preservation systems on board vessels would also help to reduce fishers' dependence on middlemen (in addition to the environmental benefits). The majority of anchovy caught is processed into fish sauce. Destructive ways of fishing (and poor post-harvest preservation) causing a poor quality of caught fish is a major reason for this. Table 5.1 clearly illustrates the quality vs quantity trade-off, such that 'low quantity higher quality' catch is not only more sustainable, but also actually more profitable, than the status quo.

4.1.4 Offshore Fisheries: *A Case Study of Skipjack Tuna*

This section analyses the value chain of offshore fisheries. Specifically, a small survey was carried out as part of this report in Khanh Hoa province looking at the value chain of skipjack tuna (Katsuwonus pelamis).[47] Reflecting the structure of the value chain, interviews were held with 41 tuna fishing households, two large traders in the main trading harbour of Hon Ro, four dealers, three retailers, and one processing company. A stratified sampling methodology was employed such that interviews were held in the two wards of Vinh Phuoc and Xuong Huan, where the vast majority of vessels (96 percent) are based.

[47] As with the anchovy analysis, the survey was carried out by Dr Nguyen Kim Anh and her team at the Economics Faculty of the Nha Trang University.

Description of Value Chain

All fishing households interviewed use vessels with more than 90hp using gillnetting. The mean engine size of the survey was 291.5hp (ranging from 90 to 450hp), the average length is just under 17 metres, the average vessel age is 6 years, average total fishing days per annum is 236, and the average crew size ranges from nine to twelve. The value chain of tuna is highly segmented, with numerous actors (see diagrammatic representation in Appendix). The vast majority of tuna is sold from the fisher to the processing company (via traders) for export.

The annual skipjack tuna yield depends on a number of different factors (including fish stocks, aggregate fishing effort, and climate). Among surveyed vessels, the average yield was 84 tonnes (range 40 – 121 tonnes) in the 2008-09 season. Despite large investment and operating costs required to fish offshore waters, there are a large number of tuna fishers in Khanh Hoa province (178 vessels). Fishers tend to sell to the same traders with whom they have established relationships, trust and mutual support. Traders buy from the fishers in bulk. There are six large traders based at Hon Ro Harbour (two of whom were interviewed as part of this study). As with anchovy, barriers to entry are high, given the capital needed to buy the large quantities of tuna, and the established relationships that all actors clearly value. Traders sort and classify the fish and transport it to the processing companies and thus have high capital resources to preserve and transport the raw fish. There are just a few large processing companies in the Nha Trang area. Competition is not high, and they are the price makers, essentially controlling the chain down to the fisher. For the domestic market, intermediate dealers enter the chain. Quantities purchased are often quite small, and they are often relations of the traders.

Given that almost all skipjack tuna is exported, the price received by exporting processors depends almost entirely on world prices. The price that the importing country sets determines the price that the processor pays the trader, and in-turn the price paid to the fisher. Fish quality is also important, based on the colour and quality of the meat. The average price during the 2008-09 season was 14,000 VND/Kg.

Table 4.2 presents prices, costs, and profits at the various stages of the tuna value chain for fish destined for export market and for the domestic market (in-line with the paths illustrated in the Annex). More detailed information on costs is provided in the Annex.

Table 4.2: Tuna Value Chain- Costs and Profits

		Incremental Cost	Total Costs	Sale Price	Profit Margin	Profit Margin : Total Cost	Profit Margin : Inc'l Cost	Share of Value
		VND/kg						
Export Market	Fishers		13,592	14,000	408	3%		53%
	Traders	602	14,602	16,000	1,398	10%	232%	8%
	Export Processors	2,473	18,473	26,218	7,745	42%	313%	39%
Domestic Market	Fishers		13,592	14,000	408	3%		47%
	Traders		14,000	18,000	4,000	29%		13%
	Dealers (1st level)	246	18,246	21,500	3,254	18%	1323%	12%
	Dealers (2nd level)	600	22,100	25,000	2,900	13%	483%	12%
	Retailers	150	25,000	30,000	4,850	19%	3233%	17%

Source: Authors' own survey and calculations, Nha Trang, 2010

In the 2008-09 season, total production costs (facing fishers) were 13,592 VND/Kg, of which variable costs accounted for 60 percent. The price of tuna clearly varies considerably, reaching a low of 12,500 VND/Kg in July 2009- implying a loss for fishers. The average price over the period in question was 14,000 VND/Kg and this is the price used in the above analysis. Margins are thus slim (just 3 percent), and any adverse fluctuations, even quite small, in the price of tuna or the cost of inputs (such as fuel) will potentially result in losses being incurred. For the traders, margins are also slim, although this depends significantly on whether they sell direct to processors (low price of 16,000 VND/Kg) or to dealers (18,000 VND/Kg). Margins are clearly highest at the export processing companies (43 percent).

Domestic prices are far higher than export prices, allowing for more steps in the value chain, such that two additional intermediaries capture some of the value added. Two reasons are behind this. Firstly, despite the high domestic demand for tuna given its popularity among Vietnamese households, supply is restricted due to the dominance of the large exporting processors who purchase tuna in extremely large quantities. Despite the higher sales price, traders prefer to cultivate relationships with the exporting processors who they are sure will provide a steady demand and trustworthy and convenient payment procedures. As in the case of anchovy, it is the fishers that appear to have the highest value added (54 and 47 percent for the export and domestic market respectively). This is despite of the low profit margin to total cost ratio.

Given the export orientation of the supply chain, ensuring quality of the fish is critical. Again, quality remains generally quite poor primarily due to inadequate post-harvest activities.

Quality Issues: A better quality boat will lead to a better quality catch

Many offshore vessels are old and wooden without brine tanks. They are thus not only unsafe, but also inefficient and difficult and costly to maintain. Moreover, poor quality ice is used as the primary preservation mechanism, which can get further contaminated from sea water that can leak into wooden boats if build quality is poor. Some fishers have invested and upgraded their boats to modern vessels, but this remains quite rare. Efforts have been ongoing for many years to try to persuade fishers to replace their old wooden vessels with the more modern (fibreglass) models, but there is some resistance from the fisher community. It is doubtful that cost is the main issue, as banks appear aware of the more attractive prospects of using the new vessels, and credit is thus often not a binding constraint. Rather, anecdotally one hears that it is more often than not simply a case of fishermen being too attached to the traditional ways of fishing, and unwilling to make the leap. A more serious constraint could be the fact that domestic construction of fibreglass vessels in Vietnam is limited to just one company, namely the East Sea Fisheries Cooperation (ESFICO). This company enjoys good links with the Japanese sashimi market, and the manufactured boats have sophisticated chilling technology onboard. Tuna landings are consequently 95 percent export quality (compared to as low as 20 percent for the traditional wooden boats) according to some reports. For the same size, wooden vessels are not significantly cheaper than fibreglass.

An assessment of the viability of decommissioning old wooden boats and incentivising fishers to upgrade to more modern vessels would thus be welcome. The sector Strategy 2020 would appear to acknowledge this, referring to the need to devise a suitable roadmap to quickly transfer wooden vessels to steel vessels with new materials (Section III.1) and citing the need to introduce policies that will encourage investment in the modernisation of vessels (Section IV.6). Purchasing second-hand boats, still well within their lifespan, from other countries would also represent a viable strategy. Modern non-wooden boats from, for example, Japan, are often seen for sale at reasonable prices. Given the likely high social (as well as private) benefit of vessel upgrading, some form of government support to the (private) costs to the fisher of upgrading would seem advisable.

In addition, it is a common concern that fishers have low knowledge of hygienic handling techniques. There is often no gilling and gutting at time of capture, and consequently the tuna caught is not of good quality. Tuna exports to EU have also been suffering recently. Tuna fishers in some areas of Vietnam are no longer able to comply with certain EU regulations, and are therefore being forced to export to elsewhere.[48] In this sense, there are parallels with the above discussion surrounding aquaculture exports, where a long tail of 'other' (less stringent) countries are increasingly becoming the destination for Vietnamese exports. In the

[48] EC Directive 1005/2008, introduced in September 2008, sets out strict regulations and requirements regarding the import of fishery products into the EU. The directive came into effect at the start of 2010 and had dire consequences for Vietnam's tuna exports to the EU as all stakeholders, including tuna fishers and the fisheries authorities, were unprepared to implement an appropriate administrative response. Tuna sales to the EU initially dropped 20 percent in early 2010 due to postponed shipments.

short-term this may keep export volumes moving upwards, but legitimate questions about the long-run sustainability and profitability of this approach can be raised.

Finally, many (fisheries analysts and those working in the industry itself) believe Vietnam would benefit from being a full member of a regional body such as the Western and Central Pacific Fish Commission (WCPFC)[49] which would 'force' improvements in data collection, resource research and management, and would also be beneficial in terms of market access.

4.1.5 Fishing costs and Productivity: *Modelling Fuel Price Fluctuations*

There is no representative global data set on the costs of fishing, nor is there such a database for Vietnam.[50] This can in large part be attributed to the variation in costs by the type of fishery, the locality, specific fishing conditions and so on. Nevertheless, case studies do exist (including those presented as part of this report above), allowing for some degree of generalization. In general, the major variable cost components are:[51]

- labour (30–50 percent of total costs);
- fuel (10–25 percent);
- fishing gear (5–15 percent);
- repair and maintenance (5–10 percent); and
- capital costs, such as depreciation and interest (5–25 percent).

As the above analyses demonstrate, margins for fishers are slim, and any adverse change in any one of the above cost components can potentially bring dire consequences. This section will consider the potential impact of fuel price rises on marine fishers.

Fuel Prices

Fuel accounts for a significant chunk of total marine fishing costs.[52] Table 4.3 shows the initial refined fuel share in total cost for the six most fuel-intense sectors in the Vietnamese economy (in 2007) as well as for aquaculture and fish processing.

Table 4.3: Initial Refined Fuel Shares of Total Cost (percent)

Sector	%
Refined Fuels	67%
Marine Capture Fishing	45%
Transport	30%
Mining	12%
Crude Oil	9%
Coal	9%
Aquaculture	*2%*
Fish Processing	*1%*

Source: Vietnam Social Accounting Matrix 2007 (DERG et al, 2009)

Next to the nascent domestic refined fuel sector itself, the marine capture fishery sector thus uses refined fuels most intensively, and any change in fuel prices will, therefore, have a marked impact on the performance of the sector.

[49] See http://www.wcpfc.int/. Vietnam is currently a cooperating non-member of the WCPFC.
[50] See Data section in Appendix of this report for more detail.
[51] Author's own survey and calculations, checked for consistency with World Bank, 2009. Note that the available cost data must be treated with some degree of caution, as the data do tend to be confounded by taxes and subsidies.
[52] The price of fuel will not only directly impact on operational (day to day) costs, but also indirectly through increasing the cost of equipment such as fishing nets, and the costs of vessel construction and repair.

In order to illustrate this more clearly, we model here the potential impact of the imposition of a proposed environmental tax in Vietnam on refined fuels (at the time of writing, an environmental tax law is in draft form, awaiting approval by the National Assembly of Vietnam). Specifically, a simulation analysis using a Computable General Equilibrium (CGE) model of the Vietnamese economy is used to model the impact of the environmental tax.[53] The CGE model is calibrated to the 2007 SAM as introduced in Chapter 2. The simulated tax amounts below are the actual proposals stated in the draft law, of 300 VND per litre (minimum) to 3,000 VND per litre (maximum). Applying the proposed levies (or, more specifically, their ad valorem equivalents of 4.6 and 15.2 percent respectively) to the fisheries sector, gives the following impacts on real output:

Table 4.4: Simulation of Environmental Fuel Tax Impact on Real Output (percent)

%	Low	High
Marine Capture Fishing	-1.8	-7.4
Aquaculture	-0.9	-3.9
Fish Processing	-2.8	-11.6

Source: Authors' own calculations

The impact of a relatively small change in the fuel price is thus potentially quite large. Table 4.4 also demonstrates the presence of strong downstream linkage effects associated with the cost increases and resulting shrinkage of the domestic marine capture fisheries sector, with the contraction of the fish processing sector actually the most severe (11.6 percent reduction in real output in the high tax scenario).

From a purely environmental perspective, the above contractions might be considered as a beneficial side effect of the environmental tax, as the contraction of capture fishery relative to the baseline growth path reduces the pressures on fragile marine ecosystems. However, clearly the contraction would also bring adverse consequences for those working in the industry. Thus, in the simulation scenario reported below, the introduction of the environmental taxes on fuels and coal is combined in the model with a hypothetical production subsidy for the fishery sector. The subsidy rates that are applied to the value of gross output of the fishery sector are set at 1.8 percent for the 'Low' and 7.7 percent for the 'High' scenario. These rates are set approximately equal to the increases in the producer price for fishery output, so that the subsidy compensates the sector for the tax-induced fuel cost increase.

The simulation results confirm that this complementary policy measure would serve to eliminate the fishery producer price increase completely – indeed the producer and user prices for fishery output decline slightly by 0.1 to 0.2 percent relative to the CPI in presence of the subsidy. Table 4.5 reports the output effects for selected industries in the presence of the subsidy, and for comparison also the previously reported effects without subsidy.

Table 4.5: Real Output Effects with a Simulated Production Subsidy (percent)

%	With Subsidy		Without Subsidy	
	Low	High	Low	High
Refined fuels	-87.3	-97.5	-87.3	-98.8
Coal	-2.5	-10.9	-2.5	-10.8
Road transport	-1	-4	-1.2	-4.7
Air transport	-5.8	-21.1	-5.9	-21.2
Other transport	-0.8	-3.3	-0.9	-3.6
Marine Capture Fishing	-0.1	-0.8	-1.8	-7.4
Fish processing	-0.1	-0.6	-2.8	-11.6
Aquaculture	-0.1	-0.6	-0.9	-3.9
Textiles and clothing	1.4	5.2	2.5	11.1

Source: Authors' own calculations

[53] See DERG et al (2010) mimeo, for a detailed description of this work.

As can be seen, the subsidy is effective in reducing the adverse output effects for the marine capture fishery subsector and related sectors considerably. In this scenario, the assumed employment home for displaced fisheries workers, the textile sector, expands far less than in the previous analyses, because far fewer fish industry workers are 'forced' to become textile workers. The fiscal budget cost of the government subsidy to the fishery sector amounts to 6.8 percent of the environmental tax revenue in the 'Low' and 7.4 percent in the 'High' scenario.

The impact of the fuel price rises in 2008 confirms the above discussion. During this time[54], some 30-40 percent of vessels remained off the water (VIFEP estimations) illustrating clearly the slim operating margins and vulnerability to cost fluctuations facing a large part of Vietnam's fishing fleet. Simply put, fuel prices rose faster than fish prices, resulting in a profit squeeze. Fuel price inflation therefore naturally led to a reduction in fishing effort as operating margins became negative and fishermen opted to stay on shore. The response by authorities was a fuel subsidy offsetting the rise in fuel prices such that fishing became economically viable once more. The subsidy is outlined in more detail below. The government's response of a fuel subsidy is fully understandable from a social point of view. However, one could also posit, perhaps, that the events represented an opportunity for the authorities to make the most of this exogenously-induced reduction in fishing effort and look at utilizing the subsidy funds to support alternative livelihood options for the marooned fishers.

4.2 Overfishing

'The ocean's greatest predator is the commercial fisher' [55]

Many of the trends outlined above will come as no surprise to those familiar with the sector. As such, there is a broad recognition across all stakeholders that there is overfishing in Vietnamese marine waters.[56] The high marine fisheries capacity, and its continued expansion, clearly represents the major contributing factor. In short, and very much in-line with global trends[57], there is a consensus that there are simply too many fishers chasing too few fish in Vietnam.

4.2.1 Measuring Overcapacity

In Vietnam, as in many countries, the concept of Maximum Sustainable Yield (MSY) has been used in the past as a benchmark through which to monitor production of marine capture fisheries. MSY represents the highest theoretical equilibrium yield that can be continuously taken (on average) from a stock under existing (average) environmental conditions without affecting significantly the reproduction process.[58] MSY numbers should always be treated with some degree of caution given the substantial data requirements needed for an accurate calculation (see below). Nevertheless, for what it is worth, a 2005 study (RIMF, 2005) estimated the stand-biomass of Vietnam's EEZ to be just over 5mn tonnes with a MSY of 2.1mn tonnes. In addition, a separate assessment of marine fisheries in Vietnam showed the MSY for waters of less than 50m depth to be 582,212 tonnes, and in 2004, marine fish stocks in Vietnam's EEZ were estimated to be 4.2mn tonnes (Globefish, 2004), with an annual MSY of 1.7mn tonnes. Clearly on the basis, marine fishing is close, if not over, sustainable levels especially in the near-to-shore areas.

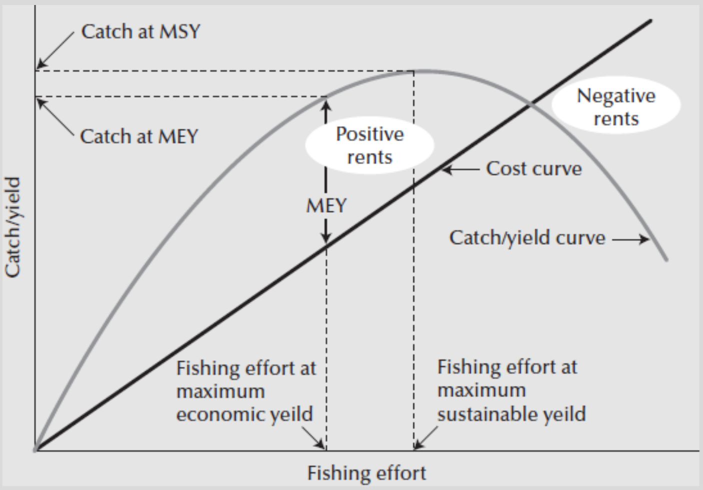
[54] Fuel prices in Vietnam rose significantly in this period, sometimes up to 16,200 VND per litre (almost a doubling).
[55] Grafton, 2006. Page 1.
[56] It is interesting, however, that neither the 2020 Strategy or the MARD master plan *explicitly* mentions this. Rather, it is *implied* in both documents, in the former due to the implied zero output growth target, and in the latter given the reduction of boats and alternative income choices recommended.
[57] It is commonly accepted that a large proportion of the world's marine fisheries resources are being fished at unsustainable rates. Numerous empirical findings confirming this can be cited. Garcia and Newton, for instance, estimated that in 1989 fishing capacity reflected an overcapacity of 25-53 percent with respect to the maximum economic yield (MEY).
[58] OECD Environmental Accounts definitions.

The complexity of accurately calculating MSY is well-known and documented. Indeed, for MSY to have any meaningful application, highly detailed data is needed- something that is particularly difficult given the multidimensionality of Vietnam's fisheries sector. In the past, Total Allowable Catch (TAC) numbers were calculated (by RIMF), based off the MSY, but this is no longer widely used in Vietnam. Today, production targets are set out in development plans led by the provinces that place heavy weight on economic growth. Consistent increases in harvest *volumes* are thus planned in the (misguided) belief that this will lead to economic growth.

Independent of these legitimate concerns surrounding MSY, the more appropriate target from an economic standpoint is the Maximum Economic Yield (MEY) - see box. MEY is attained at a level of fishing effort where marginal costs of fishing are equal to marginal fishing revenues. At this level of fishing effort, the difference between total revenues and total costs of fishing, including the cost of labour and capital with all inputs valued at their opportunity costs, is maximized. In the absence of an accurate MEY number, one cannot say with absolute certainty that economic overfishing is occurring. Nevertheless, one can use other (quantitative and qualitative) indicators as outlined below.

Beyond Maximum Sustainable Yield

The diagram below[59] illustrates that while the yield from a fishery will increase as fishing effort increases, it will eventually reach a maximum. This is the MSY, and from that point onwards, catch declines.



The yield from the fishery can also be expressed in Dong rather than tonnes (represented by the cost curve). When fishing effort is relatively low and biomass is high, the catch per unit effort (CPUE) and profits are high. As fishing effort increases, so does the aggregate cost (of catching the finite supply of fish) of that effort. As fishing effort further increases and biomass and yield decline (past the MSY), the profit margin between the cost line and the yield in Dong line becomes smaller. Eventually, cost increases and yield declines to a point of zero profit/economic rents. Any further increase in fishing effort beyond this point will cause the yield from the fishery to decline further and profits to become negative. This point is called the 'Open Access Equilibrium' and demonstrates the self-regulating nature of fisheries.[60] As effort further increases, the natural fish capital will tend to decrease, further reducing the net benefits from the fishery resource.

In contrast, the point of maximum profit occurs to the left of the MSY, at the MEY. The maximum profit from a fishery is actually obtained when the fishery is kept at relatively low levels of effort compared to the open access equilibrium and the MSY. When relating total revenues from fishing to total fishing effort (and assuming surplus production), MEY is attained at a level of fishing effort where marginal costs of fishing are equal to marginal fishing revenues. At this level of fishing effort, the difference between total revenues and total costs of fishing, including the cost of labour and capital with all inputs valued at their opportunity costs, is maximized.

[59] Often referred to by economists as the Gordon-Schaefer Fishery Production Function. Figure copied from WB (2008).
[60] Grafton, 2006.

Within this framework, the economic objective is to maximise the net economic benefits (sustainable rents) from the fisheries sector. In that sense, the economic performance of Vietnamese marine fisheries can be measured as the difference between maximum rents attainable from the sector (at the MEY) and the actual rents currently being obtained.

It is evident from the above discussion that a large part of fishing effort, and therefore cost, is currently being wasted- the slim operating margins for both the anchovy and tuna fishers would certainly imply a level of fishing above the MEY. A more valuable catch could be obtained with less effort and less cost, and the excess inputs used to catch fish could in theory be used rather to produce other valuable goods and services. A common misconception is that if production is still rising (as it currently is in Vietnam), then there is no immediate need to hit the panic button. This reflects a misunderstanding of the problem. The fact is that even though production is rising (albeit at a declining growth rate), economic losses are now in all probability already being incurred.

Ideally a target capacity level based off the MEY would be defined and adopted in Vietnam such that progress could be transparently monitored. Given the range of gears, species, fisher characteristics and seasonality present, especially in small-scale Vietnamese fisheries, setting a quantitative path is however highly problematic.[61] Nevertheless, for the purposes of defining policy, simply establishing a desired direction, with a step-by-step approach, is probably sufficient.

A changing catch composition is also indicative of overfishing. Marine production may be continuing to rise, but it is important to draw the distinction between the quantity (volume) and the quality (value) of this catch. Production may be rising in volume terms, but in value terms this is unlikely to always be the case, especially in near-to-shore waters where a higher volume of lesser value fish species is being landed. As a result, fishing down the value/food chain is occurring- this is observed most easily by the declining average size of fish landed. In particular, the rising proportion of catch comprised of trash fish as detailed above should be highlighted, as well as the increasing prevalence of squid in the harvest. As Pomeroy and Nguyen (2009) note, *'... many high value fish resources have declined to a low level. Catches of lower value species have increased and these are also being depleted.'*[62]

The depletion of fish wealth, natural capital, does not appear in the national accounts of most countries, including Vietnam. One reason is that because of weak property rights in fisheries, as well as difficulties in establishing market prices for these resources, fisheries assets fall outside the asset boundary of the System of National Accounts (SNA) 1993. It has thus been possible to run down fish resources and thus (temporarily) increase catch rates, which appears as an addition in the national accounts, without having to subtract the corresponding reduction in fish stock capital. The Box below considers the implications of this in more detail.

Accounting for Fisheries Resources in the National Accounts

The United Nations System of National Accounts (SNA) is an international statistical standard governing the compilation of national accounts. In line with best international practice, the General Statistics Office (GSO) of Vietnam uses the SNA in the compilation of the Vietnamese national accounts.

Within the SNA, the using up of produced capital is called consumption of fixed capital and is recorded as a cost of production. The SNA includes a range of natural assets (generally recorded as non-produced assets) on its balance sheet. However, the SNA does not record the using up of these natural assets as a cost against the production of the harvesting unit. Therefore, changes in the stock of farmed fish (aquaculture) are accounted for in the SNA production account; however this is not the case for wild fish stocks in rivers

[61] Many industry insiders see any attempt at accurate measurement of MEY as futile.
[62] Pomeroy and Nguyen (2009), p425.

and oceans. This means that the SNA includes the value of harvested (farmed) fish in its calculation of value added for aquaculture. But the reduction in value of wild fish stocks due to economic harvest is not recorded as a cost of production for the harvesting unit.

Value added of the (marine) fisheries sector continues to grow strongly (albeit slightly less than the economy-wide growth rate over the last ten years). But this is not taking into account the fact that some of the natural capital of fish stocks is being used up in the process of generating this VA. In many ways, fish stocks are more complicated than other resources to value, as stocks can of course replenish. But a strong case can be mounted for the view that the value add numbers for fisheries in standard national accounts (SNA) represent overestimations of the true levels, due to overfishing. The question is how to value the resource and its depletion.

The '*Handbook of National Accounting: Integrated Environmental and Economic Accounting*' (2003), referred to as SEEA 2003, is a satellite system of the SNA. It brings together economic and environmental information in a common framework to measure the contribution of the environment to the economy and the impact of the economy on the environment (UN, 2003).

The SEEA 2003 comprises various categories of accounts, including flow accounts for pollution, energy and materials, and environmental protection and resource management expenditure accounts identifying expenditures incurred by industry, government and households to protect the environment or to manage natural resources. Natural resource accounts, recording stocks and changes in stocks of natural resources such as land, fish, forest, water and minerals are also included.

Unlike the present SNA, a depletion-adjusted value-added derived from natural fisheries resources in open access marine and inland water bodies could therefore be included in a SEEA for Vietnam. This could be in the form of separate fisheries (satellite) accounts to the SNA.

Mainstreaming SEEA into the ongoing statistical national accounts system is clearly challenging and a big step (technically and strategically) for any country. Nevertheless, the GSO, in conjunction with CIEM, is taking the very first steps at looking at the SEEA as a viable complement to the SNA currently in use in Vietnam. If the depletion of natural fisheries resources can be reflected in Vietnam's national accounts, this combined with some basic physical information on fish stocks, fish harvest and natural regrowth of fish provides a far more accurate reflection of the real performance of the fisheries sector.

4.2.2 Overfishing in Near-to-Shore Waters

As noted, the challenge of reducing capacity is particularly acute in small-scale near-to-shore fisheries where the problem of overfishing is arguably at its most severe. To summarise the results presented above, there is a high concentration (density) of vessels in near-to-shore areas, and low capture yields result: approximately 60 percent of the total catch is caught, and 86 percent of vessels operate, in near-to-shore areas representing only about 25 percent of the total EEZ of Vietnam.[63]

Small-scale fisheries communities in Vietnam can be characterised as having expanding populations (of labour and capital), of being relatively poor (compared to the larger offshore fleets), and having relatively high levels of un- and underemployment. Many small-scale fishers also have a high dependence on fisheries resources for their food and livelihoods, and operate close to or at the subsistence level. Furthermore, in small-scale Vietnamese marine fisheries, fishermen are not generally qualified to do anything else, and fisheries capital such as boats and gear clearly often cannot be easily converted into performing another

[63] This compares to a finding that total catch from coastal waters (defined as 50m depth) accounts of 82% of total national marine catch (Pomeroy et al, 2009 p420, using data from RIMF).

duty. Labour and capital (fishermen and their boats), in this sense, are non-fungible, and any removal of them from the industry can be expected to be a difficult and lengthy process, and should necessarily be accompanied by supporting policies (see below).

Coastal Poverty and Vulnerability

It is commonly thought that poverty in Vietnam is primarily found in the mountainous North and Central Highlands. In fact, poverty rates in the 29 coastal provinces are very similar to the average for Vietnam as a whole. But this hides some inter-provincial differences: Provinces such as Thanh Hoa, Nghe An, Quang Ngai, and Tra Vinh suffer from relatively high poverty rates and absolute numbers of poor people, while other provinces such as Da Nang, Binh Thuan, Khanh Hoa, and Long An are relatively wealthy. In absolute number terms, there is roughly a 50/50 split of poor people in coastal/non-coastal provinces.

Having said this, following the Vietnam Poverty Line level change in 2006 (Decree 171/2005, MoLISA), relative poverty in coastal provinces fell compared to non-coastal areas, implying that a large number of people in non-coastal communities were 'nearly poor'. Furthermore, a detailed analysis of district level poverty numbers by the research team for this report yielded similar results to the above provincial-level commentary.

However, while coastal provinces are not necessarily the *poorest*, they may be among the most *vulnerable*. 'Vulnerability' is a relatively new concept in Vietnam. As of now, there is no legal document providing the definition of 'vulnerability', though certain documents identify vulnerable groups as those facing a higher risk of falling into poverty, hunger and social exclusion compared to the general population. The official and popular concepts used (in Vietnamese government documents) are of 'social target groups', 'social target groups with difficulties', 'social protection target groups' and the 'near poor'[64]. This latter group includes those households whose maximum average income per capita is equivalent to 130 percent of the national poverty line. On this basis, coastal vulnerability is relatively high.

With complete labour mobility (socially, economically, or across skills for example) people will in theory compare incomes across sectors and locations, and fish if it is profitable to do so. However, labour is clearly not mobile in any of these senses in many coastal communes in Vietnam. Moreover, there is a lack of alternative sectors in which to find employment. Small-scale fisheries may therefore appropriately be described as 'employers of last resort' in Vietnamese coastal communities.

Common policy actions around the world to address overfishing have included the restriction of access to fishing grounds and the limitation of the TAC. In addition, many countries (including Vietnam) have adopted policies aimed at limiting the growth of fishing capacity. The Vietnamese preference for policies encouraging *offshore* capacity are clearly relevant here (more on this below). But given the continued rapid expansion in near-to-shore capacity, it is fair to say that such policies have on the whole proven difficult and costly to implement. And even when the number of vessels has been successfully controlled, it is often the less efficient vessels that tend to exit, which, coupled with a rise in technical efficiency, causes a reduction of fishing effort that has not always fallen proportionally.[65] Moreover, the more regulators attempt to keep catch down, the more elaborate ways are found by fishers to circumvent rules, essentially by engaging in illegal, unreported and unregulated (IUU) fishing. Anecdotal evidence abounds here (see, for instance, Nguyen and Pomeroy, 2009).

In short, measures (in Vietnam like elsewhere) aimed at reducing overfishing by reducing fishing capacity in near-to-shore waters have broadly failed to stop 'effort creep'. Vessel numbers and aggregate capacity in Vietnam have continued to rise at the rapid pace illustrated in previous sections. These new entrants are

[64] Decision No. 117/2008/QD-TTg by Prime Minister on August 27,2009; Circular No. 25/2008/TT-BLDTBXH by MOLISA dated October 21, 2008
[65] Curtis and Squires, 2007.

poor (hence unable to invest in larger boats) and lack alternative livelihood possibilities. As such there is a certain inevitability that child will follow parent to the waters.[66]

The core of the issue thus comes down to incentives and discount rates. There is a persistent lack of incentive to stop fishing (or to fish sustainably and within the rules) due to a lack of alternatives. And a high discount rate on the future means that it is all about today not tomorrow. A classic tragedy of the commons situation therefore emerges, causing as Boonstra and Nguyen (2010) put it, a 'race to fish', and overfishing to be the intractable issue that it is. The problem is best illustrated through the framework of the tragedy of the commons (see Box). For an individual fisher, when deciding whether to fish or not, clearly it makes sense to look at the value that he himself will derive from fishing, and compare it to the cost of a boat and operating expenses. But what he is ignoring in this calculation is the fact that his extra boat will reduce the catch of *other* boats. He is ignoring the social cost of his fishing, and too many boats will enter the fishing grounds as a result. In this sense, there will be overfishing unless there is a mechanism in place to restrict use. The externality needs to be internalised.

The Tragedy of the Commons

The 'tragedy of the commons' describes a situation in which multiple individuals, acting independently, and solely and rationally consulting their own self-interest, will ultimately deplete a shared limited resource, even when it is clear that it is not in anyone's long-term interest for this to happen. The original theoretical example given was of cows grazing common land[67], but it is equally as applicable to fisheries.

The best way to demonstrate the core ideas and implications is to compare two allocation mechanisms: (i) private ownership where someone controls (an area of) the sea and decides how many boats can fish there, and (ii) the sea is controlled in common by fishers, and access to it is free and unrestricted. The latter describes the status quo for the vast majority of Vietnam's EEZ.

Given that fisheries resources are not characterised by an infinite supply, how many fish a boat catches depends on the number of other boats fishing the same waters. With b boats fishing, and defining f(b) as the value of the fish catch, the value of fish per boat is f(b) / b. This is the average product. How many boats should fish if maximizing the total wealth of fishing community is the objective? If fishing costs amount to 'VND a', then this would require maximizing the following condition: f(b) – (a x b). Maximal production (catch) will thus occur when the marginal product of a boat is equal to the cost of fishing [MP(b*) = a]. In other words, if the marginal product of one additional unit of fishing is more than its cost (VND a), it would pay to put another boat onto the (common) water. In contrast, if the marginal product is less than the cost, then it would pay to remove fishing capacity.

If the waters were owned/controlled by someone who could restrict access to them (the first allocation mechanism outlined above), this is indeed the solution that would result: The owner could in theory allow just the correct amount of capacity (number of boats in this simple example) to fish in order to maximize total profits. But what happens currently, when individual fishermen decide whether or not to fish (the second allocation mechanism)? In reality, each fisher in Vietnam can him/herself decide whether or not to fish, and it is profitable to fish if the output generated (catch) exceeds the costs of fishing. If the average product of the (additional) catch [f(b+1) / b+1] is more than the cost of a boat, then they will fish. So fishermen will chose to fish until the point at which the average product is driven down to the cost of a boat. In summary, fishing will take place if it is profitable to do so, and fishing will stop (no more capacity added) only when the profits have been driven to zero.

To put it another way, the joint profits of fishers with coordination will most likely exceed the sum of the profits without coordination. If property rights are well-defined, there will be no problem with production externalities. The marine fisheries sector thus suffers from a common pool problem in the sense that each fisher is using a common resource in which the yield, at a given stock size, is more or less fixed. The problem essentially stems from (i) the absence of property rights over the resource, (ii) the absence of

[66] There is some anecdotal evidence that fishers are starting to realize that a future livelihood in fishing and a stable income for their children is far from certain. There are, therefore, some (rare) cases of fishers actively encouraging their children to seek livelihoods elsewhere- in different sectors, and in different regions of the country.
[67] Garrett Hardin, 1968.

effective management of the resource, (iii) the absence of cooperation among harvesters, and (iv) 'free' entry into the fishery.

High Future Discount Rates

It is interesting at this point to highlight that fishers, on the whole, will be well aware of the broad relationships and framework described above. Indeed, it has more often than not been the case in small local surveys of fishing communities[68] that fishermen are *at the same time* well aware of the link between fishing effort and declining productivity and generally non-compliant with regulations governing this fishing effort (such as permitted areas for fishing, gear types etc). This apparent contradiction illustrates the some of the above concepts and issues well. In the absence of alternative livelihood options, people are essentially forced to fish. And in the absence of collective action, fishers are not rewarded by complying with fishing regulations. Not participating in the 'race to fish' simply means losing out as others will continue to catch fish at an increased rate. Fishermen thus are characterised by a high discount rate on the future, meaning that they value the present much more than the future, and their fishing activity and behaviour, despite what they know, reflects this.

Policy Approach

In this context, the approach adopted by the authorities has generally been to focus on these near-to-shore waters where overfishing is at its most visible. As such, since the mid-1990s a number of official documents have acknowledged the problem of overfishing in inshore areas, though not in offshore areas. Correspondingly, policies have on the whole been aimed at encouraging inshore fishers to move to offshore waters by, for example, limiting the construction of new vessels with less than 20hp (in 1998), and providing subsidised credit for the construction of (powerful) offshore vessels.[69]

As detailed above, the fisheries 2020 Strategy *implicitly* targets very modest/flat marine fish production increases- *in volume terms*- over the coming years. While not explicitly detailed, most if not all of the 'increase' is implicitly seen as being derived from offshore areas given the envisaged declines in near-to-shore capacity outlined in the MARD sector plan (though nothing of this nature appears in the 2020 Strategy document). In the MARD Master Plan, the aim is stated to: '*Maintain fishing-ships with high capacity and reduce the number of small-fishing boats. By 2015, it is expected that the total number of fishing ships will be 80 thousand units. Of this figure, fishing ships having capacity under 20 CV will account for 30%; ships having capacity between 20-50 CV will account for 20%; ships having capacity between 50-90 CV will account for 20%; and ships/ boats having capacity of more than 90 CV will account for 30%.*'

The total number of vessels at present is thus well above these plans made in 2006[70]. Indeed, the plan for 2015 implies a substantial reduction of almost 40 percent, which seems unlikely to be achieved. At present, over half of all vessels are under 20 CV, while those of 50-90 CV and over 90 CV account for 10 percent and 14 percent respectively. In theory, simply reducing the number of smaller-engine boats, albeit quite substantially, will automatically increase the proportion of boats in the higher capacity categories, without any actual investment in new capital. Nevertheless, a substantial increase in the number of offshore capable vessels is thus seemingly targeted. It is important here to note that reducing the number of vessels will not necessarily lead to a reduction in capacity. Boats can upgrade their engine sizes for example (capital stuffing). It is interesting to note that the MARD master plan does not advocate a reduction in capacity per se- only a reduction in the number of vessels.

But overfishing is most likely not just limited to inshore waters (Edwards et al, 2004; Danida NIRAS, 2001). Indeed, there are strong signs indicating that offshore waters are also overcapitalised relative to the available fish stock- or at least significant doubts have been raised that offshore fish stocks are sufficient to support further expansion in offshore capacity. In the absence of a robust and trustworthy MEY number,

[68] See for example evidence from Phuoc Hai Commune as analysed in Boonstra & Nguyen, 2010.
[69] Decision 393/TTg (1997).
[70] Decision by the Prime Minister No. 10/2006/QĐ-TTG, dated 11 Jan 2006, approving the Master Plan for Fisheries Sector Development to 2010 and Orientation to 2020.

one cannot say with certainty that there is overfishing. Nevertheless, some signals strongly suggestive of overfishing in offshore areas are increasing reports of offshore boats fishing closer to the shore as well as straying into other territory's waters. Various case studies of fisheries communities find similar results. In the commune of Phuoc Hai in SW Vietnam,[71] for instance, more than half of vessels with over 90hp are found to be fishing in inshore areas while more than 80 percent of the smaller boats with less than 20hp are found to be operating in coastal zones further out to sea than the inshore areas. Such trends are indicative of overfishing in all areas of Vietnam's EEZ.

4.2.3 Policy

'While any renewable resource poses difficult management problems, marine fisheries are especially hard to manage.' [72]

The hard reality of the matter is that in order for fishing effort to be reduced, labour and capital do need to exit the marine capture fishery subsector, and this will necessarily bring about losers as well as winners. Understandably therefore, and despite the rhetoric, many coastal authorities have been reluctant to implement any policies that might impact adversely onto local fishing communities. In addition, local authorities in coastal areas are often keen to see production *volumes* rise in their province (inter-provincial competition), and even if they would like to implement measures to reduce fishing effort, it is very difficult to do so within current resource levels. There is thus an inconsistency between the capacity targets and rhetoric seen in national plans and strategies regarding overfishing, and the reality of what is happening on the ground.

In this sense, overcapacity may appropriately be described as the proverbial 'elephant in the room' in Vietnam. Both the fisheries authorities as well as the fishers are largely aware of the problem, but the hard decisions required to deal with it are not being implemented or enforced. Clearly, there is no one 'silver bullet' solution to the problem. Rather a multidimensional approach is required which entails policies in and outside of the fisheries sector itself. In this sense, and in light of the above discussion, three (simultaneous) broad policy directions can be identified. Firstly, there is a pressing need to start the process of reducing fishing effort. However, it is evident that regulation (of fishing effort or production) is unlikely to bind unless there are concomitant initiatives put in place to (i) incentivise fishers to behave in a sustainable manner, and/or (ii) provide alternative livelihood possibilities for fishers such that they are able to seek income in areas other than marine capture fishing.

Subsidies

The Vietnamese government subsidises the marine capture fisheries sector. It is difficult to quantitatively measure the exact extent of this, but two recent detailed studies have attempted to gather information and data on the main marine fisheries subsidies. The details of a selected few of these are included in the following analysis.

Overfishing negotiations in the World Trade Organisation (WTO)

On the occasion of Global Fisheries Day in 2009, the Director General of the WTO, Pascal Lamy, said that governments have contributed to the problem of overfishing by '*providing nearly US$16 billion annually in subsidies to the fisheries sector. This support keeps more boats on the water and fewer fish in the sea. But WTO members are now negotiating to reform these subsidies programmes so that fishing becomes a sustainable industry and so that we can fully appreciate our oceans' bounty for generations to come. A deal in the WTO now would mean richer oceans for future generations*.'[73]

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[71] Boonstra & Nguyen, 2010
[72] Jared Diamond, 2005.
[73] http://www.wto.org/english/news_e/sppl_e/sppl129_e.htm

In-line with this sentiment, an informal group of members calling themselves the "Friends of Fish" (including Argentina, Australia, Chile, Colombia, New Zealand, Norway, Iceland, Pakistan, Peru and the US) agree that subsidies to the fisheries sector have led to overcapacity and overfishing. Another group of countries, including Japan, Korea, China and Vietnam, on the other hand, have expressed skepticism over the link between subsidies and overfishing.

Many developing countries are asking for flexibility in granting subsidies to their fisheries sectors. According to the WTO[74], the focus of the discussions has evolved significantly since the beginning of the Doha Round. It is apparently no longer a question of whether there would be any new disciplines but rather on the approach to, and structure of, such disciplines. The Group has also extensively discussed special and differential treatment for developing countries. According to Vietnam[75], however, the negotiations are in some deadlock, and little progress has been made for some time.

Clearly Vietnam would stand to lose, potentially quite substantially, from any imposition of measures against countries with fisheries subsidies.

Traditionally, economists would stress that the existence of such subsidies enables fishing at levels that would otherwise be uneconomical.[76] That is, they create perverse incentives countering the disincentive to fish when it has become unprofitable. This can lead to, or aggravate, overfishing. With the above analysis in mind, there can be little doubt that the subsidies mentioned below will have this effect. However, subsidisation can be justified if a government believes that a sector has long run (strategic) potential and it wishes to foster and protect it for future growth and development. In the case of marine capture fisheries, the question marks over the long-run sustainability of the sector put this into doubt. Without a long-term time horizon (at least not at current production levels), the subsidies are basically subsidising just employment. To the extent that there are few alternatives at present, perhaps this is justified. But in the longer run, subsidisation is inefficient and should be phased out in step with the creation of alternative livelihood options.

The estimated cost of just two of the subsidies programmes, the 2008 fuel price subsidies and the soft credit policy for new vessels, totals US$184mn (see box). To put the above discussion into perspective, this is enough to pay the (recently increased) minimum wage of the state sector in Vietnam to 360,000 workers for one year.

'Bad' Subsidies

In recent years, two comprehensive reports have been written explicitly considering the nature of subsidies to the Vietnamese fisheries sector[77]. The important findings in these reports will not be repeated here. Instead, the focus is on the *quantitative impact* of certain of the so-called 'bad subsidies'[78] (UNEP, 2009).

Applying our definition, three such subsidies are considered here.

Natural Resources Tax

The Natural Resources Tax is applicable to a wide range of natural resources in Vietnam. Prior to 2009, offshore fishers (defined as those using boats with more than 90hp) were exempt from the tax for five years after they are granted their exploitation license, and were entitled to a 50 percent reduction for the

[74] www.wto.org

[75] Informal contacts with the Ministry of Industry and Trade (MoIT).

[76] The word 'subsidy' is often used in Vietnamese fisheries to refer to all types of fisheries support from the government, including port construction, vocational training and so on. Here we use a narrower definition of the term as described above.

[77] UNEP et al (2009) and VIFEP (2008).

[78] Sumailia and Pauly, 2006.

subsequent five years.[79] A new law was introduced in 2009, in which all fisheries activities (inshore and offshore) are exempted from the tax.

The rate of tax is low (2 percent for most seafood products), and revenue is therefore correspondingly low, estimated at circa 11bn VND (circa US$ 580,000) in 2008.[80] Even given the low tax rate, foregone revenues are likely to be not insignificant given the value of the product pulled from the ocean every day.

New Vessel Registration Fee
There is in place a 50 percent cut in the registration tax on offshore capital investments (the construction of new vessels and the purchase of new, more fuel-efficient, machinery for offshore fishing). There are two primary objectives of this support, namely (i) support building new vessels of >90hp, (fund=70mn VND pa for new vessels, and 18mn for upgrading) and (ii) support vessel upgrading to more fuel-efficient boats in the 40-90hp range, (fund=10mn VND pa). In its current form, the policy timeframe is three years (2008-10). At present a very low take-up of the subsidy is reported (VIFEP, 2008).

Related to this was the policy (1997-2001) of providing subsidised credit (approximately half of normal interest rate) for construction of offshore vessels (>90cv). Cost of this is estimated to have been in the region of US$ 93mn (VIFEP, 2008).

2008 Fuel Prices Support
Support to marine fisheries sector in 2008 during time of high fuel prices, While the subsidy was marketed somewhat as a support for offshore fishing, funds were also provided for vessels below 90 hp. In order to be eligible to receive the subsidy, fishermen were required to fulfil various conditions such as proving that they were normally on the water for at least six months every year, and in possession of all the requisite vessel and gear registration. The latter condition indirectly had the effect of inducing a notable rise in the number of registered vessels of approximately 30,000. UNEP et al (2009) estimate the total cost of the subsidy to have been in the region of US$ 91mn.

4.2.3.1 Reducing Fishing Effort

It is clear that any reduction in fishing effort should be gradual and carefully managed. The overall aim is to progressively reduce households' reliance on capture fishing. It is proposed that fishing effort is reduced through the following initiatives:

1. Illegal, unregulated and unreported (IUU) fishing needs to be substantially reduced and brought under control through improved monitoring and enforcement at the coastal provincial level. Specifically, this should entail ensuring:
    - Vessels fish where they should- for example, larger boats do not stray into inshore waters;
    - All appropriate licenses are paid;
    - Adherence to fishing gear regulations (e.g. mesh sizes).
2. A reduction in marine capture fishing effort in two stages:
    - A phasing out of the number of *new* boats entering the waters every year, necessarily involving a partial moratorium on boat building (regulation of boat building industry).
    - A gradual reduction in the overall number of near-to-shore vessels. Strict monitoring of vessel licenses and control of new license issuance.

Essentially this all comes down to monitoring and enforcement. In most cases, official documents acknowledge many of these problems, and the regulatory framework is also often already in place.[81] What is lacking is to strengthen enforcement capacity (and indeed to change the mindset from continued

[79] Article 9 of Circular 124/2009/TT-BTC of 17 June 2009.
[80] Personal communications with Ministry of Finance.
[81] Most notably in recent months is the National Plan of Action (NPOA) on fishing capacity reduction that identifies various management priorities for interventions in the sector.

targeting of production increases) at the coastal provincial level. For this, more resources are inevitably required. The recent change of the fisheries inspectorate responsibilities from the provincial sub-DECAFIREP to the provincial DARD should be taken into account here.

As noted above, setting a quantitative path for such a reduction is highly problematic given the lack of data and multidimensionality characterising the sector. Simply defining a desired direction is therefore enough at this stage.[82] But, experience tells us that these policies in isolation will be ineffective as they do not change the fundamental underlying incentive structures facing small fishing communities. As such, it is critical that they are accompanied by a simultaneous investment such that fishing communities are diversified and alternative and supplemental livelihood and employment options, on and off the water, can be created. Policies that create an enabling environment for fishermen to change to alternative livelihoods should be considered. This, it must be acknowledged, cannot happen overnight.

Marine Protected Areas (MPAs)
In the context of efforts to reduce fishing effort, an ambitious plan has recently been approved in Vietnam outlining the designation and establishment of sixteen MPAs. This represents a significant investment and clear statement of intent. Nevertheless, as a proportion of the total EEZ of Vietnam, the protected area would represent just a fraction, and a number of careful parallel policies do need to be implemented to ensure success (see McEwin et al, 2008).

4.2.3.2 Co-Management

It is now widely accepted internationally and in Vietnam, by most stakeholders, that some degree of control and management of common property resources must be decentralised to local levels to be effective. Without some form of ownership and 'buy-in' from the fishers, compliance with regulations can be expected to be weak. Furthermore, the amount of resources that would be required to monitor and control the marine resource as it is, is simply too large to be realistic. Given the open-access nature and the lack of clearly defined property rights, everyone can access fishing grounds, leading inevitably to overfishing. Shifting to rights-based systems (co-management for example) will help. This can take the form of consultation with local fishers, and shared management responsibilities between fishers, local government and central government actors. Decree 79/2003/ND-CP contains the legal framework for participation of local people in fisheries management and decision-making in Vietnam, and this has been complemented by a capture fishery co-management task force charged with the planning and implementation of certain pilot projects. As the World Bank noted back in 2005, '*Vietnam's planners and policy makers have recognized (the importance of co-management) and are strongly supportive of the types of interventions required for effective resource management'.*[83]

There are a number of successful pilot initiatives that have been implemented in Vietnam over the past few years. Examples of these include the Tam Giang Lagoon in TT Hue Province (2005), AO Tho B in Soc Trang Province (2007), and the Rang Dong Fisheries Cooperative in Ben Tre Province (1997). The latter cooperative is of particular note given the success it has had. The cooperative was established in 1997 at the provincial level to manage clam breeding and raising in c900 ha of intertidal land. Average unit prices during this time have increased by a factor of thirteen to US$1.30/kg, and this success was consolidated recently when full Marine Stewardship Council (MSC) certification was awarded. The fact that almost a dozen new cooperatives have emerged in Ben Tre following the good example of Rang Dong also shows the potential for pilot schemes to evolve into the mainstream.[84]

In addition, and in-line with the 1997 policy outlined above on the incentivisation of offshore capacity, the establishment of voluntary offshore fishing cooperatives has been pursued in some cases. The basic principle underlying such initiatives is that fishermen join voluntarily, they self-manage, and contribute

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[82] See Berkes et al, 2001.
[83] World Bank (2005), Article 190
[84] http://www.msc.org/track-a-fishery/certified/pacific/vietnam-ben-tre-clam-hand-gathered

through information sharing and mutual support. In short, it is a pooling of resources such that efficiency and catch quality are ameliorated. Each group, it has been recommended, should ideally consist of five to seven vessels, and measures to ensure transparent and equitable division of capital contributions and profits among the different vessels and crew should be carefully designed and implemented. Since 2006, there have been seven fishing vessel teams and one state-owned fishing company in Ben Tre Province following this model. As a result of the cooperation, most of these teams have achieved productivity increases in the range of 5-10 percent translating into increased revenue of VND c25mn per trip (Nguyen Kim Anh et al, 2010). Other examples worth highlighting have occurred in the provinces of Thanh Hoa, Nghe An, and Ken Giang (Minh Quang, 2008 and Nguyen Kim Anh, 2006, 07, 10).

These impressive examples aside, and despite the legal framework being broadly in place[85], actual action in this area has been somewhat thin and slow to develop from the 'pilot' initiatives presented above. An important constraint in this regard is the apparent reluctance on the part of some local authorities to assign fishing rights to Fishing Associations. The core of the issue stems from the fact that the Fisheries Law (2003) makes no *specific* reference to fisheries co-management. As a result, certain local (provincial and district) authorities are reticent to assign fishing rights based on what they consider to be an incomplete law. The Fisheries Law can be, and indeed has already been, used as a basis upon which to implement co-management systems, but a reluctance to act appears to remain for some.

4.2.3.3 Alternative and Supplementary Livelihoods

The livelihood of many living in coastal communities is no longer sustainable- relying on fisheries activities as the only or dominant income-generating activity has become increasingly unviable. At the same time, there are often few, if any, alternatives. The Fisheries Law (2003) does allude to this in various places, including most notably Article 13 which states that the '*state shall issue policies regarding...job alternatives relating to coastal fishing operations...*' The MARD Master Plan also recommends implementing *'a shift in labour structure in fishery occupation; especially labour directly working in fishery exploitation to move to aquatic raising and other occupations.*'

Two (non-mutually exclusive) policy approaches are possible: (i) create supplementary livelihoods to reduce, but not eliminate, dependence on fishing, and/or (ii) create alternative livelihood options outside of the fisheries sector. The first can be seen as an intermediate step towards the second. There are many examples of programs aimed at developing alternative options in fishing communities. However, examples of programs that have been successful at simultaneously reducing fishing effort are less common (FAO, 2008). Alternative livelihood strategies cannot therefore be seen in isolation from initiatives aimed at reducing fishing effort.

Coastal areas are characterised by a diversity, variability, and complexity of livelihoods. Fisheries production is affected by seasonal fluctuations which cause peaks and troughs of employment, income, and expenditure, and coastal communes are characterised by multi-occupational livelihoods in various locations, leading to some unique features of the poverty (including seasonal underemployment). As such, this section will not attempt to cover all potential alternatives to marine capture fishing. This must be done on a case-by-case basis, taking into account the idiosyncrasies of the particular region or group in question.

Nevertheless, certain principles should be borne in mind:

- Investments must be made such that the 'losers' mentioned above will be protected. Issues of equity (between the 'winners' and 'losers') and the social implications of a reduction in fisheries capacity must be prioritised.
- Stakeholder consultation at the local level is critical such that there is ownership and buy-in.
- Care should be taken to ensure that new livelihood activities are sustainable themselves.
- New livelihood options should be realistically implementable, easy to understand, and therefore easily acquirable by fishermen.

[85] The 2020 Strategy also mentions the benefits of co-management of fisheries activities.

- The lack of fungibility of skills needs to be addressed. Vocational training is clearly critical, and this should be seen in the context of incumbent GoV programmes (see below).
- New incomes should be equal to or higher than those already being earned.
- New occupations that reuse physical and human capital from fisheries must be prioritised.
- Investment should be pro-poor: regulations could be developed on local labour, minimum wages, and labour standards.
- The context of existing policies supporting coastal areas should be taken into account. These policies (or NTPs) are considered next:

Policy Context

The National Target Programme for Poverty Reduction (NTP-PR) is, along with Programme 135 Phase 2, the cornerstone of the GoVs approach to poverty reduction for the period 2006-10.[86] The NTP-PR consists of twelve policies, projects and activities with MoLISA acting as the standing agency. It relies on central government funding, and has a total budget provision of 43.4bn VND for 2006-10, of which 2.1bn VND is direct support from the centre.

Within this framework, the particular difficulties facing coastal communes are recognised to the extent that there is a National Targeted Program targeting these communes. Decision 257/2003/QD-TTg (2003) aims to support investment in the construction of essential infrastructures of coastal communes which meet 'exceptional difficulties'. The main objective of Decision 257 is to invest in essential infrastructure in order to create conditions for the development of production. The criteria for the selection of communes[87] includes that they are (i) located on or near the coast and exposed to harsh natural conditions such as flooding, drought, or poor soil, (ii) not a beneficiary of Program 135, (iii) classified as poor according to Decision 587 of MOLISA, and (iv) lack essential infrastructure for production. Funding for the program started in 2005 and 157 communes (in 21 coastal provinces) were initially selected, with the majority of these communes in the Central Coastal Region. Of the 2.1bn VND stated above, this coastal programme has a budget of 1.3bn VND, though so far expenditure has been low relative to budget. The target by 2010, as stated in a mid-term review written jointly by MOLISA and UNDP, is for 'fundamental infrastructure is sufficiently provided for communes with special difficulty in coastal and island areas'.

In addition, Decree 61/2010/ND-CP provides a number of incentives and supports to enterprises investing in agriculture and rural areas. This includes not only support for the costs of renting land or water surface areas, but also for vocational training costs of its staff. 28 subsectors are eligible for support, including many activities directly relating to the fishery sector. This group includes (i) the culture of fishery products on uncultivated land, unused water areas, the sea and islands, (ii) offshore fishing, (iii) production and processing of aquatic feeds, (iv) services of scientific and technical consulting to aquaculture. There are also many other subsectors listed that may provide alternative incomes to fishermen. Finally, a new agriculture (including fisheries) vocational training programme has recently been introduced. It is a National Targeted Programme, involving the ministries of MOLISA, MOET, MARD, and MPI.

All of these policies and programmes will take on ever increasing importance as fishing from the ocean becomes less profitable.

Agriculture and Aquaculture

Opportunities for significant productivity increases from coastal agriculture and fisheries are on the whole limited. However, their role in stabilising income, especially to the poorest, must be recognised.

Many coastal areas are characterised by poor natural conditions including flooding and drought, salination of soil, and limited land availability. The soil type is often suitable for short-duration cash crops such as sesame, peanut and corn, and ground nuts grown in certain northern coastal communes can represent a significant source of income. Improved irrigation and drainage systems are thus urgently needed in many

[86] MoLISA & UNDP, 2009.

[87] See Decision 683/2004/QD-TTg on the criteria of communes with exceptional difficulties.

coastal areas (this should be considered in the context of Decision 257 outlined above), and crop diversification should be encouraged to crops that flourish in the specific soil types (market feasibility studies needed). There is also much potential for small-scale livestock development (credit important here for start-up costs). In general, local participation is key at all stages and any agricultural systems should be labour-intensive.

Ecology-based co-management approaches, designed to tackle the conflict between economic development and sustainable management of natural resources, merit attention here. The lack of an integrated approach to sustainable management, use and protection of the coastal zone, unclear responsibilities of local authorities and rapid expansion and economic interests in for example shrimp farming in the Mekong Delta, have led to rising concerns regarding environmental and social impacts. In the coastal zone of Soc Trang Province, this has resulted in the unsustainable use of natural resources, and a Vietnamese-German technical cooperation project, '*Management of Natural Resources in the Coastal Zone of Soc Trang Province*', was thus initiated in 2007.[88] The project focuses on integrated coastal area management with an emphasis on planning for and adaptation to climate change, as well as planting, rehabilitation and management of mangroves, the development of models for the sustainable co-management of coastal areas, and increasing income along aquatic value chains (shrimp farming) through public-private-partnerships, co-management and certification. This project provides an excellent pilot example, and the many lessons learnt should be taken into account in other coastal areas of Vietnam.

Marine (and to a lesser extent land-based) aquaculture are often touted as logical alternatives to capture fishing. This clearly makes some sense, as there is a lot of (untapped) potential for brackish and marine fish farming in many coastal areas. Aquaculture also represents somewhat less of a 'jump' from marine capture fisheries than other possibilities.[89] However there is a danger here of oversimplification, as the requisite skill sets and know-how are different to marine capture fishing. Investment capital is also often a serious constraint. As such, there are many examples of failures, leaving the 'entrepreneur' in debt. Moreover, given the way that the aquaculture industry is evolving, any initiative should be accompanied by a number of strong and close support services. Cooperative governance models can help here to help with marketing, buying inputs, and appropriately targeted training.

Good practices/models of shifting from inshore fisheries to aquaculture (*Thai Ngoc Chien et al., 2009*)

- Shifting from inshore fishing to clam farming with 10.5ha of intertidal zone in Dien Kim Commune in Nghe An province. By 2010, 28 clam farmers have received average income from VND 15.4 to 28.9mn/farmer/crop.
- Shifting from inshore fishing to aquaculture with some species/aquaculture diversification in Phuoc Thuan Commune in Binh Dinh province with a total area of 14ha in the Thi Nai Lagoon area. The model has converted ten fishers to farmers who have had average income from VND 8.6 to 24.7mn/farmer/crop.
-Shifting from inshore fishing to Blood Cockle farming in Thoi Thuan Commune in Ben Tre Province. The model has successfully converted seven fishers from inshore fishing to blood cockle culture in over 3,000m^2 of alluvial areas. The model has been grown more than 1.5 tonnes of seeds and after more than 6 months, average income rose to about VND 23.5mn/farmer/crop.
- Small scale aquaculture co-management in Giao Xuan Commune in Nam Dinh Province. The model was implemented in early 2008 by the Marine Conservation and Community Development Center (MCD). Clam seed from Ben Tre was grown on 4 ha of land. In the beginning, the model had ten farmers, and after two years the model expanded to 170 farmers in the village and some surrounding areas. The model has established a co-management board and operational regulations. MCD has also supported the conversion of 30 inshore fishermen to sustainable, environmentally friendly aquaculture (www.mcdvietnam.org).

[88] http://czm-soctrang.org.vn/en/Home.aspx
[89] As detailed in Chapter 3 of this report, seaweed in particular is an important product to consider.

Issues surrounding feed are also important here, as marine trash fish is a commonly used food for farmed fish in Vietnam (also see Chapters 3 and 6). It is possible that an increase in the production of marine aquaculture species will necessarily entail a rise in the catch of trash fish- potentially offsetting any of the benefits. One should also be cognizant of the open access mentality that is very much ingrained into the fisher psyche- there is the perception by some that by privatising some marine resource areas, marine aquaculture can add to poverty by decreasing access to open access resources (e.g. recent complaints in Van Nih District, Khanh Hoa Province).

In general, it is inevitable that fisheries will continue to play an important role in the coastal economy, despite declining productivity. The most realistically attainable solution will see households holding a portfolio of income-generating activities with a mix of (co-managed) marine capture fishing with a range of alternatives.

5 Small-Scale Fisheries Activities: Aquaculture and Inland Capture

Small-Scale Aquaculture

Fish farmed commercially for export, largely in the Mekong Delta region of Vietnam, clearly dominates overall aquaculture production and revenue statistics, and accounts for most of the recent rapid growth in the sector. As a result, and due to data being more readily available, many of the sector analyses and policy time centres here. However, aquaculture is also widely practiced in other (rural) areas of Vietnam, often on a small-scale basis. Indeed, while aquaculture is increasingly viewed as a commercial large-scale industry in Vietnam, the vast majority of farms remain small[90], and fish farming represents an important contribution to livelihoods and food security for many Vietnamese households.

Small scale aquaculture is generally characterised as a traditional on-farm activity, using local resources, and often integrated with other human activity systems. It often involves limited investment in assets, some small investment in operational costs (including largely family labour) and is frequently used by farmers to diversify agricultural activities. Due to its many potential advantages, such as a less strenuous and shorter daily labour requirement (important for female farmers), close proximity to the homestead, possible significant and rapid income return, year-round cropping opportunity, and relative ease with which it can in principle be incorporated into local farming systems to diversify the household food production system, smallholder aquaculture is seen by many as a potential resource for improving household food security and supplementing income of the rural poor. Even at a subsistence level, aquaculture can provide much needed animal protein as well as cash income from the sale of any surplus crop.

However, the development of aquaculture in some rural communities (e.g. in upland areas) also faces several constraints. The unavailability of fish seed of desired quality is a major constraint, as is poor communication and transport facilities, poor market access and information, and a lack of access to training, extension, credit and other support services. All this can lead to low levels of productivity and efficiency.

Capture Fisheries

In the case of capture fisheries, marine activities, based along the 29 coastal provinces of Vietnam, clearly receive most attention. Chapter 4 of this report provides a detailed consideration of marine fisheries. But in addition to marine water resources, Vietnam has a dense river network, including nine major river basins as well as a substantial inland water surface area of (open access) lakes and lagoons. Very little is actually known about the levels of production, profits generated, and the characteristics of those fishing from such inland common water resources. Due in part to the nature of the subsector, data is thin as catch is simply not reported in any systematic way. As such, just one (relatively modest) national production number of approximately 200,000 tonnes is published every year. Inland capture fishing is the least understood fisheries activity in Vietnam.

Some attempts have been made to analyse the subsector in more depth, but this has necessarily taken the form of case study evaluations making generalisations difficult. Inland capture fishing is not explicitly mentioned in the MARD master plan and the 2020 Strategy refers only in passing to this subsector. It is anecdotally considered by many as somewhat of a backward and old-fashioned activity that those involved should ultimately aim to move out of. Yet, it is often the poor and vulnerable (landless) who are involved, and it can represent an important source of protein and/or income. Furthermore, the suspicion among many industry analysts is that it is far more important than the official statistics would imply.[91] Concerns also exist surrounding the sustainability of riverine and inland water resources, which are considered by many to already be over-exploited in a number of cases.

[90] It is estimated that 17 percent of aquaculture farms in Vietnam are less than 1ha while 87% are less than 5ha (GSO, 2006).

[91] Mekong River Commission, 2008.

In this context, this chapter will consider a side of the fisheries sector that receives relatively little explicit attention by researchers and policymakers. This is made possible thanks to data from the Vietnam Access to Resources Household Survey (VARHS)[92], which involves a detailed questionnaire to approximately 3,000 households in twelve rural provinces of Vietnam, and covers a range of issues associated with the rural economy. Of the provinces surveyed, only three are coastal and just one is located in the Mekong River Delta. The remaining seven are located in the Central Highlands and North East and West of Vietnam, and are thus areas in which fisheries activities are not normally considered to be important. The following analysis will focus on surveyed households engaged in small-scale aquaculture and inland capture fishing (from open access common property) water resources in these twelve provinces.

In the surveyed provinces, inland fisheries resources are available in the form of small family ponds, rivers, and small (open access) reservoirs and lagoons (as well as ocean fish stocks for the coastal communities surveyed). Besides these, there are potential pockets for the development of small ponds along hill streams and seasonal water-logged areas. Poverty and food insecurity are prevalent among the surveyed populations, and in particular in the upland communities of the northern mountainous provinces and the Central Highlands. These provinces are not only less developed compared to the rest of the country but also lag far behind in the production and consumption of basic food items. Per capita consumption of fish, which is the cheapest and most affordable source of animal protein for local communities, is far less than the national average. Again, compared to other regions of the country, the capacity of human resources and aquaculture services is poorly developed.

5.1 Importance of Small-Scale Fisheries to Rural Livelihoods

This paper draws on the results of two rounds of the VARHS conducted in 2006 and 2008. The survey included a substantial panel element, and this analysis is based on the 2,157 panel households for whom we can also define household income. The survey collects information on many different aspects of households' living conditions, including demographics, land, agriculture, non-farm wage and non-wage activities, assets and social capital, among others. Also included in the survey are relatively detailed questions which identify and characterise household aquaculture activity, as well as fisheries activities from open access resources. Other parts of the questionnaire focus on household land use, and allow identification of households with fish or shrimp ponds on their land.

Open access fishery activities are predominantly undertaken by men, the proportion being in excess of 80 percent in 2008. In the case of aquaculture, the corresponding figure is only 54 percent. Those doing the two types of fisheries activities have similar education levels to each other and to the national average, but aquaculture workers are slightly older than the national average. Many of the sampled households are engaged in some form of fisheries activity. Table 5.1 presents household participation in the two types of fishing activity, namely aquaculture and inland capture fishing. Results are presented for each of the twelve surveyed provinces and by per capita income quintile. The table also presents information on fisheries production for these households, reporting mean production values (in thousand VND) and as a proportion of total household production.

[92] This survey has been conducted in 2006, 2008 and 2010 (ongoing), and is a collaboration between the Development Economics Research Group (DERG) of the University of Copenhagen, the Central Institute for Economic Management (CIEM), the Institute of Labour Science and Social Affairs (ILSSA) and Institute for Policy and Strategy for Agriculture and Rural Development (IPSARD). For more information on survey design, see UoC et al, 2009.

Table 5.1: Participation in, and Production of, Fisheries Activities

	Aquaculture				Inland Capture Fisheries			
	2006		2008		2006		2008	
	% HHs	Mean Prodn Value (% Total Prodn)	% HHs	Mean Prodn Value (% Total Prodn)	% HHs	Mean Prodn Value (% Total Prodn)	% HHs	Mean Prodn Value (% Total Prodn)
Province								
Ha Tay	6.1%	2171.9 (28.9)	6.1%	4771.2 (25.8)	5.5%	728.0 (21.9)	5.9%	542.6 (10.0)
Lao Cai	28.7%	814.7 (12.8)	17.2%	684.6 (15.4)	2.3%	1550 (16.2)	6.9%	92.0 (3.1)
Phu To	26.5%	475.6 (7.6)	17.0%	858.4 (14.8)	3.0%	377.9 (6.5)	3.0%	236.4 (6.2)
Lai Chau	16.2%	279.6 (9.8)	9.9%	264.8 (6.0)	18.9%	296.5 (11.5)	18.9%	91.2 (2.9)
Dien Bien	31.1%	1316.2 (35.9)	43.4%	543.4 (11.7)	21.7%	97.8 (4.2)	23.6%	130.1 (3.0)
Nghe An	13.0%	760.5 (19.6)	7.8%	1283.7 (25.8)	10.9%	308.6 (16.9)	3.1%	512.9 (14.5)
Quang Nam	3.4%	5054.4 (53.6)	2.0%	3573.4 (23.3)	2.4%	271.4 (11.1)	7.2%	1165.1 (19.7)
Khanh Hoa	2.9%	300 (3.8)	2.9%	301.5 (3.8)	5.6%	1150 (28.2)	5.9%	497.4 (8.4)
Dak Lak	7.9%	400.1 (4.6)	10.8%	485.0 (4.1)	5.7%	98.78 (2.2)	7.2%	135.7 (2.9)
Dak Nong	21.2%	657.8 (4.6)	10.6%	560.2 (2.9)	3.5%	130.16 (2.7)		
Lam Dong	11.9%	537.3 (9.2)	4.5%	530.8 (6.7)	5.9%	499.54 (5.4)		
Long An	28.1%	1287.7 (12.5)	21.5%	1859.8 (9.4)	30.3%	477.96 (3.8)	25.5%	290.6 (2.0)
Per Capita Income Quintile								
Poorest	14.5%	356.4 (15.3%)	12.7%	402.3 (15%)	14.8%	222.75 (10.3%)	14.3%	203.5 (7.5%)
2nd	12.7%	603.5 (14.2%)	12.3%	1719.9 (32.8%)	10.6%	398.9 (8.6%)	9.3%	272.7 (6.6%)
3rd	16.6%	895.7 (16.4%)	13.1%	954.6 (13.4%)	9.2%	595.8 (7.9%)	8.1%	395.4 (5.3%)
4th	16.9%	1375.05 (18.1%)	10.6%	1187.2 (11.7%)	10.0%	443.8 (4.1%)	4.8%	415.8 (3.2%)
Richest	16.4%	1962.5 (12.6%)	11.3%	2786.8 (10.0)	3.7%	744.8 (3.5%)	6.2%	445.9 (1.7%)
All	**15.4%**	**1076.5 (14.8)**	**12.0%**	**1483.0 (13.1)**	**9.7%**	**418.3 (6.0%)**	**8.6%**	**314.2 (3.7%)**

Source: Authors' own calculations based on VARHS 2006 and 2008
Note: Values are in thousand VND. 2008 values are deflated to 2006 prices.

Participation

In aggregate, 15 percent of the surveyed households report having earned income from aquaculture in 2006 and 12 percent in 2008; 10 percent fished in inland open access water bodies in 2006 and 9 percent in 2008. This already highlights the importance of these activities at the household level. In both cases a substantial minority of the panel households report having done the corresponding activity in only one of the two years, an issue this chapter will investigate later. Just a small number of households report having practiced both aquaculture and fishing in common property resources, indicating that the two fisheries activities largely appear to be practiced by different types of households.

Dien Bien is the province where, in both years, the greatest number of households undertake aquaculture (31 percent and 43 percent in 2006 and 2008 respectively). Significant numbers also undertake aquaculture in Lao Cai, Phu Tho and (unsurprisingly given its location in the Mekong River Delta region) Long An, while numbers in the remaining provinces are lower. The greatest number of households catching fish from inland open access resources is observed in Long An, followed by Dien Bien and Lai Chau. The numbers are quite low in the remaining provinces. Nevertheless, the importance of either or both of these activities in mountainous northern provinces is notable. Indeed, even excluding Long An (the only province in the survey situated in the Mekong Delta), a significant number of households practice aquaculture (11 percent) and inland capture fishing activities (7 percent) in 2008.

There appears to be no strong association between the household's per capita income quintile and undertaking aquaculture, but fisheries in inland open access resources are disproportionately undertaken in poorer quintiles (a trend especially evident in 2008) confirming the suspicion outlined above. The relatively low entry cost of most open access fishery activity potentially explains this pattern. Aquaculture involves a higher entry cost, but still seems to be undertaken by households in each income quintile. In Long An (a relatively wealthy province), it is the richer households that are more likely to do aquaculture, but in the poor provinces of Dien Bien and Lai Chau it is in fact the poorest households that practice it more. The scale of aquaculture though is much smaller in the latter cases compared to the wealthier farmers from Long An.

Production

As shown in the table, average 2008 production values for the whole sample are 1,483 thousand VND for aquaculture. Production values from inland capture fishing are much smaller by comparison, about a half of aquaculture production in 2006, and just one quarter in 2008. The largest values of aquaculture production (in absolute terms) are found in the Red River Delta (ex-Ha Tay), in the North West (Dien Bien, in 2006), and the South Central Coast (Quang Nam and Nghe An). Long An in the Mekong Delta also shows high production values. Excluding Long An, per capita production values are remain high for both aquaculture and inland capture fisheries- 1,371 and 328 thousand VND respectively.

The table also reports the contribution of fisheries activities to total household production. Aquaculture represents an important source of household income, contributing between 10 and 15 percent of total household production value in 2006 and 2008. Within this, there is some significant provincial variation, with the provinces of Ha Tay, Nghe An, and Quang Nam showing particularly high contributions. Aquaculture is in general found to be less important to those provinces situated in the North and Central Highlands, though the high levels of activity in Dien Bien are striking. It is noteworthy that households in these same provinces also see high contributions from inland capture fishing. Furthermore, the number of households practicing fishing activities is not necessarily correlated with the contribution that such activities make to household income. Phu Tho is a good example in this regard.

The second half of Table 5.1 reports these same results by per capita income quintile. With one exception, there is a fairly tight bunching of contributions of aquaculture in the 10-20 percent range. This finding that aquaculture makes a relatively small contribution to household livelihoods is also confirmed below in Section 5.3. For inland capture fishing, the contribution to total household production is lower throughout, and there is a clear pattern showing it to be more important for poorer households (7.5 percent for the poorest compared to 1.7 percent for the richest in 2008). Inland capture fishing is thus clearly used as a supplement to other livelihood activities, in particular for the poorest of rural households.

Comparing assets between those that are engaged in aquaculture and those that are not (results not shown in table), it is evident that in both years the former are better off in terms of most assets: those practicing aquaculture cultivate more (crop) land (and have more irrigated land), have greater values of livestock, savings, and durable goods and are slightly more likely to be members of social interest groups.[93] These differences between participants and non-participants are much less evident in respect of open access fisheries: those participating do have more land than those that do not, but in terms of the other assets they are no better off (livestock, ownership of durable goods) or actually worse off (savings, membership of groups). This finding is entirely consistent with the likelihood that those doing open access fisheries may find themselves in lower income groups (see Table 4.1). In both groups though, those engaged in fisheries are less likely to have a household business; fishing activities may to some extent substitute for having a business.

In summary, a significant minority of households are engaged in small scale fisheries activities. This is the case in Long An, but it is also true in other provinces that are not traditionally seen as 'fisheries provinces' in Vietnam. It is also clear that fisheries is just one part in a portfolio of activities, such that their overall

[93] These are strong associations. We cannot say anything here about causality.

contribution to household income while important, is not very large. Aquaculture is undertaken by both poor and rich households, whereas open access fisheries are disproportionately undertaken by poorer households.

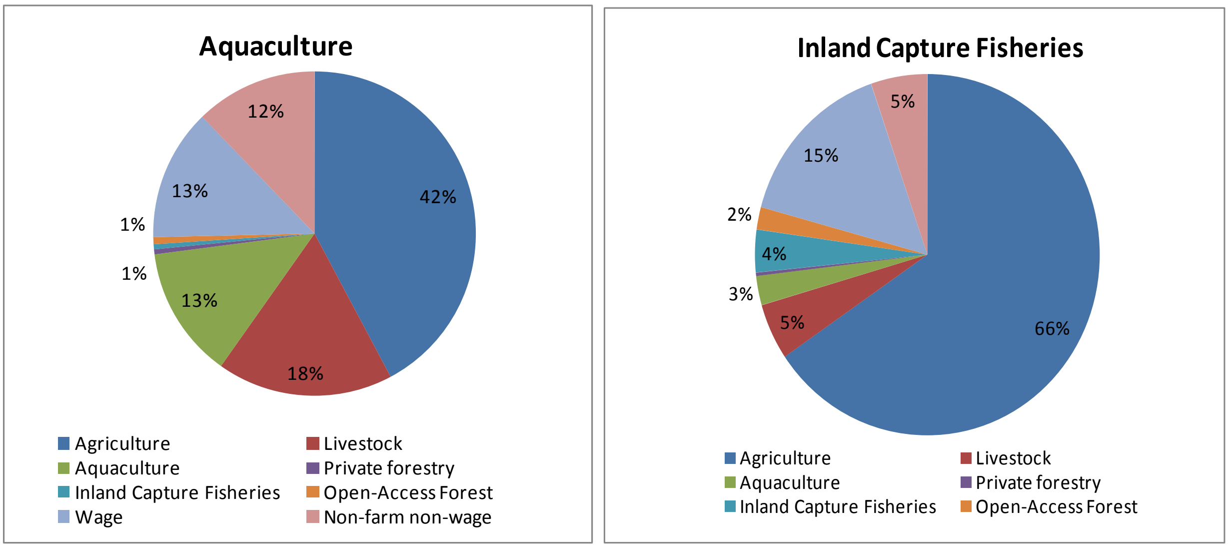
Livelihood Portfolios

With the above results in mind, further analysis shows that households practicing small-scale fisheries are engaged in many other activities at the same time. In the following analysis, we therefore define activities for the household as a whole, and divide these into rice cultivation, non-rice agriculture, livestock raising, wage work and non-farm non-wage work, as well as the two fisheries activities of aquaculture and inland capture fishing.

Of those that engage in aquaculture, more than 86 percent of households in 2008, and 91 percent in 2006, engaged in four or more of the above other activities. Furthermore, in each year around three quarters of those doing open access fisheries combine this with four or more other activities. Aquaculture is predominantly combined with agricultural activities; in each year, more than 85 percent of those households doing aquaculture also cultivate rice, more than 85 percent undertake non-rice agriculture, while more than 80 percent raise livestock, and around half are engaged in wage work. The numbers are slightly lower for those doing open access fisheries, but agricultural activities are still very important and more than 80 percent of these households in each year cultivate rice. It is clear then that for most households, aquaculture or inland open access fisheries represent just one part of their livelihood. How much these fisheries activities contribute on average to income (in 2008) is summarised in Figure 5.1.

The figure shows the sources of income for those households that undertake aquaculture and inland capture fishing. Those doing aquaculture obtain 13 percent of their income from this source; in the case of open access fisheries the figure is much lower at under 4 percent. In both cases it is clear that these activities make relatively small contributions to household income; in all cases, the largest proportion (and the majority for those doing open access fisheries) of income comes from agriculture. Wage work also contributes a significant share in each case. For fish farmers, earnings from (other non-fish) livestock and non-farm non-wage activities are also relatively important.

Figure 5.1: Share of Income from Different Sources for Fisheries Households in 2008



Source: Authors' own calculations based on VARHS 2006 and 2008

Consumption and Sales

Household production can be consumed or sold by households. Table 5.2 presents the consumption and sales of fisheries products, by production type, product and year.

As the table shows, households sell a large proportion of their product, and this has increased since 2006. Fish and shrimps are by far the most important products resulting from fisheries activities in the survey. Production of fish comes both from fish farms and open-access fisheries, while shrimps are nearly all cultivated in shrimp farms, with production from open-access sources remaining marginal in both 2006 and 2008.

Production of fish is more or less equally divided between home-consumption and sales. Despite a fall in the number of households farming fish, fish production from aquaculture actually increased substantially between 2006 and 2008, and while some of this increased production was consumed by the producing household, most of the increase was sold. Sales as a proportion of production thus increased from 58 percent to 76 percent. By contrast, production from inland fisheries fell slightly over the two year time period, and sales as a proportion of production remained the same at just over 40 percent of total fish catch. Catching fish from inland open access water bodies thus appears to be less of a commercial venture when compared to fish farming.

As one would expect, the majority of shrimp production is cultivated rather than caught in the wild, and almost all is farmed for sale on the market with a very small percentage being consumed at home.[94] Unlike fish, production actually fell from 2006 to 2008. Wealthier households (as measured by the value of total household production) tend to sell more fish (high volumes) from private and open-access fisheries than poorer households, but it is interesting to note that participation rates in the market are in fact similar.

Table 5.2: Consumption and Sales of Selected Fisheries Products (VND 000)

		Fish			Shrimp		
		Consumption	Sales	Production	Consumption	Sales	Production
2006	Aquaculture	1288.1 (41.8%)	1790.8 (58.2%)	3,079	71.3 (3.3%)	2071.5 (96.7%	2,143
	Inland Capture Fisheries	977.6 (58.6%)	691.4 (41.4%)	1,669	9.8 (15.7%)	52.7 (84.3%)	63
2008	Aquaculture	1198.7 (24.3%)	3730.2 (75.7%)	4,929	24.3 (2.7%)	1416.7 (98.3%)	1,441
	Inland Capture Fisheries	675.5 (55.8%)	533.9 (44.2%)	1,210	35.0 (35.7%)	62.9 (64.3%)	98

Source: Authors' own calculations based on VARHS 2006 and 2008

If sample weights are used to estimate the value on inland capture of fish in the 12 provinces covered by the VARHS, this suggests around 34 thousand tonnes in 2006 and 25 thousand tonnes in 2008. While this cannot be generalised to the whole of Vietnam, these numbers appear order of magnitude consistent with the 200,000 tonne figure quoted above. The total catch from private aquaculture would appear to be substantially larger than that from open access resources, as suggested by the figures reported above.

5.2 Inputs and Returns of Fisheries

We now focus on household inputs into the production process associated with aquaculture and open access inland fisheries. For both aquaculture and inland capture fisheries, a key input is household time. In the case of private aquaculture, another key input is land devoted to fish or shrimp ponds.[95] Table 5.3 presents (non household time) production inputs for aquaculture.

[94] High prices of shrimp on the market may be one explanation for this.
[95] Although not all private aquaculture involves use of household land (marine aquaculture for example).

Table 5.3: Production Inputs for Aquaculture

	2006					2008				
	% HHs Investing	Input Expenditure	Input Expenditure as % of Total Aquaculture Revenue	Pond Area (m2)	% of Total Land is Pond	% HHs Investing	Input Expenditure	Input Expenditure as % of Total Aquaculture Revenue	Pond Area (m2)	% of Total Land is Pond
Province										
Ha Tay	59%	6,623	61%	5,210	50%	48%	8,939	38%	3,415	39%
Lao Cai	24%	1,228	35%	762	11%	47%	705	37%	1,006	11%
Phu Tho	49%	799	54%	1,762	14%	36%	1,952	59%	2,832	21%
Lai Chau	22%	391	29%	177	4%	36%	749	41%	193	5%
Dien Bien	58%	1,867	87%	664	7%	98%	1,316	63%	725	7%
Nghe An	56%	2,231	30%	4,243	39%	100%	2,504	33%	3,873	32%
Quang Nam	30%	28,559	75%	7,183	51%	17%	13,362	82%	5,790	38%
Khanh Hoa	100%	1,825	61%	1,000	2%	0%	1,085	30%	500	0%
Dak Lak	18%	389	27%			20%	476	49%	500	3%
Dak Nong	61%	597	31%	11,854	12%	33%	1,215	48%	1,500	13%
Lam Dong	25%	1,251	66%			0%	398	23%	750	8%
Long An	8%	3,872	35%	2,650	44%	22%	5,587	64%	2,533	42%
Income Quintile										
Poorest	41%	2,653	58%	865	14%	55%	2,032	52%	908	12%
2nd	42%	1,743	57%	974	13%	57%	2,265	69%	1,415	17%
3rd	31%	3,286	43%	1,773	22%	39%	2,125	52%	1,917	24%
4th	46%	2,941	41%	2,639	31%	53%	7,600	38%	2,814	29%
Richest	27%	4,349	42%	9,932	32%	35%	4,116	57%	5,936	30%
ALL	**37%**	**3,063**	48%	**2,869**	**21%**	**47%**	**3,482**	53%	**2,163**	**21%**

Source: Authors' own calculations based on VARHS 2006 and 2008

Note: Khanh Hoa and Lam Dong have low sample size, and results should thus be interpreted with caution.
2008 values deflated to 2006 prices.

As illustrated in the table, aquaculture households in the sample farm ponds with large average sizes of 2,869m^2 in 2006 and 2,163m^2 in 2008. However this varies by province, with smaller ponds found in Dien Bien, Dak Lak, and Lai Chau compared to Quang Nam and Nghe An. In general, households are found to devote approximately one fifth of their total land holding to ponds, though the size of ponds, as well as the share of land devoted to them, tends to increase with household per capita income. In 2008, for instance, the richest quintile of households devoted 30 percent of their land to ponds, versus 12 percent for the poorest.

A significant proportion of households report having made investments in ponds over the previous year (37 percent in 2006, rising to 47 percent in 2008), and in fact the results show that it is the poorer households who are more likely to have done this. Most households engaged in private aquaculture spend on purchased inputs, such as seed, feed, equipment and so on. Aquaculture requires often large operating expenditures, and this is confirmed in Table 5.3. Again, there is a large amount of variation between provinces, with high expenditures generally corresponding to provinces where households devote a high share of their land to aquaculture ponds.

Combining these results with those of previous sections, we see that in 2008, while 21 percent of land is devoted to aquaculture ponds, only 13.1 percent of total household revenue is earned from this area. When a household chooses to devote some of its land to private aquaculture, this might be at the expense of land currently being used to cultivate agricultural crops. An approximate assessment of the relative productivity of land devoted to aquaculture relative to agriculture may be made by considering the revenue earned per unit area. Based on the VARHS data, and taking in to account the fact that input expenses are greater for aquaculture, households earned on average a revenue of 2.7 thousand VND per square metre cultivated in 2006 and 5.0 in 2008. For aquaculture the corresponding figures are higher, at respectively 7.9 and 11.8 thousand VND/square metre cultivated. Moreover, while aquaculture might be thought to be more risky, the earnings per unit area are not found to be more variable those for agriculture.

An alternative measure of the relative returns to aquaculture and agriculture is time use. In 2008, aquaculture households devoted on average almost 10 percent of their time to aquaculture, and earned 13 percent of their income from it (results not shown). These same households devoted 51 percent of their time to agriculture but earned only 35 percent of their income from it. According to whichever measure is considered, the average return to aquaculture appears to be higher than that to agriculture, and aquaculture does not appear to generate more variable incomes. On this basis, aquaculture does appear to be a valuable way of supplementing earnings from agriculture, despite a relatively modest contribution to the total household budget.

For inland open access fisheries the key input is time, and households engaged in this are found to devote over 8 percent of their working time. The fact that time inputs are quite low corroborates the above findings that aquaculture and inland capture fishing are one of a number of activities conducted by the household.

Finally, it has already been noted that many households did not report income from aquaculture in both years of the panel. Some of these reported having a pond on their land in 2006, suggesting that many of the others may have worked as employees; many of these were in Long An. Of these, some households that had a pond in 2006 only a few reported having a pond on their land in 2008, suggesting that many that had previously done aquaculture on their own land had ceased. Of those that started doing aquaculture in 2008, about half had a pond on their land on 2008, up from 2006. Thus while the majority of the movement into and out of aquaculture may be associated with people ceasing or starting employment in the sector, there are also significant numbers of households creating or seemingly abandoning ponds.

5.3 A Modelling of Household Participation in Fisheries

The factors influencing household participation and revenue in private and open-access fisheries are now analysed using multivariate analysis. This approach allows verification of whether or not the characteristics observed in the descriptive analysis still apply when other factors are controlled for at the same time. With this approach, different aspects of the data that are not observable in a descriptive analysis can be pointed out. In addition to modelling participation and revenue, the factors influencing households to switch in and out of aquaculture (from 2006 to 2008) are analysed. In this report, a summary of the main findings are presented. For full details of the econometric results and variables included, the reader should refer to a working paper by DERG/UoC and CIEM (mimeo, 2010).

Household Revenue from Fisheries

The value of household fisheries production is likely to be influenced by households' investments in fisheries, the inputs they use and characteristics of household members. The value of household production is estimated using a Heckman model. This is a two step model which in a first stage consists of estimating household participation in fisheries as a function of characteristics of the household and of alternative activities. Household revenue is then estimated as a function of likely correlates, controlling for the fact that the estimation is not drawn on a random sample but only on those doing aquaculture (which introduces the possibility of a selection bias).

Results indicate that having alternative sources of income (non-labour income) discourages households from participating in inland capture fisheries in both 2006 and 2008, as does having a bigger agricultural plot in 2008, the latter even if agriculture represents the main source of income for these households. In addition households with earnings from livestock are more likely to have earnings from inland fisheries in 2008 which confirms that for households engaged in inland capture fisheries, livestock earnings are an important source of earnings. Household composition also affects participation in inland capture fisheries --

the older the majority of household members are, the less likely that the household participates in inland fisheries, corroborating the previous finding that households engaged in inland fisheries are not older than the national average. Education is also an important determinant, with households with a more educated head being less likely to participate. Male headed households are more likely to do inland fisheries in 2006. In addition, households that live in a village with a higher proportion of poor households, at least in 2008, are more likely to participate in inland fisheries. Again this confirms the association between poverty and undertaking inland capture fisheries. In 2006 having boats and being closer to the coast increases the probability of engaging in inland capture fisheries, though these are not significant in 2008.

In terms of earnings from inland capture fishing, results show that households with a large majority of older household members enjoy higher earnings, while more educated households have lower earnings in 2006. Households with the opposite characteristics are likely to have better options for earning income from other sources.

For aquaculture, households already raising livestock are more likely to participate, as are households with a male head (something which was not evident in the descriptive analysis) and in 2008 those having an older head. Education is also an important positive determinant of both participation and earnings from aquaculture. Private aquaculture appears to require experience, and is combined often with raising livestock, but it is also the case that households with some degree of non-labour income are less likely to farm fish. In both years households further from the coast` are more likely to be engaged in aquaculture, and in 2008 they also earn significantly more. Contrary to the case for inland capture fisheries, households living in a village with high proportion of poor households are less likely to participate in private aquaculture, and they also earn less from it; this confirms that private aquaculture is mainly done by households living in wealthier areas. Use of aquaculture inputs has a strong positive association with earnings. There are also some regional differences. Sampled households in the Red River Delta are less likely to participate, but those that do have significantly higher earnings in 2008. Those in the Central Highlands and the North Central Coast earn less in 2006.

In summary, households participating in fisheries have distinct characteristics, and while there are some similarities between inland fisheries and aquaculture (e.g. the discouraging effect of non-labour income, the positive association with keeping livestock), the differences (e.g. education, poverty, age) are equally striking. The regression analysis confirms more strongly the result of the descriptive analysis about the way in which these activities are associated or not with poverty. But the regression analysis also enables additional insights which were not apparent in the descriptive analysis.

Switching in and out of Aquaculture

The descriptive analysis above shows that not all the panel households were participating in private aquaculture in both survey years. In other words, there appears to be a degree of flexibility in participation in aquaculture. In order to analyse this in more depth, a probit model is used in order to estimate the probability that a household starts or stops practicing aquaculture in 2008 as a function of characteristics of the household and of alternative activities in 2006. The measure of participation being used here is earnings from aquaculture, and in this sense, zero reported earnings from aquaculture may not necessarily imply permanent abandonment of aquaculture. It is likely that some of the 'switching' households are doing so temporarily, due to exogenous events such as input and output price fluctuations, disease, illness of household members, and so on. The definitions and descriptive statistics for the variables used in the model are set out in the above-mentioned paper.

Results show that households with higher education levels, who are already fishing from open access inland water bodies, who had a pond and inputs in aquaculture in 2006 but no revenue from aquaculture, who are younger (but older than 19 on average), and who did not have a wage activity, all in 2006, exhibit a higher propensity to start aquaculture in 2008. For those households ceasing aquaculture activities, significant determinants encouraging people to stop are non-labour income and living in a village with a higher proportion of poor, which encourages households to stop, while having a pond and inputs in 2006 discourages households to stop (the former having been suggested in the descriptive analysis above).

6 Dynamic Scenario Analysis

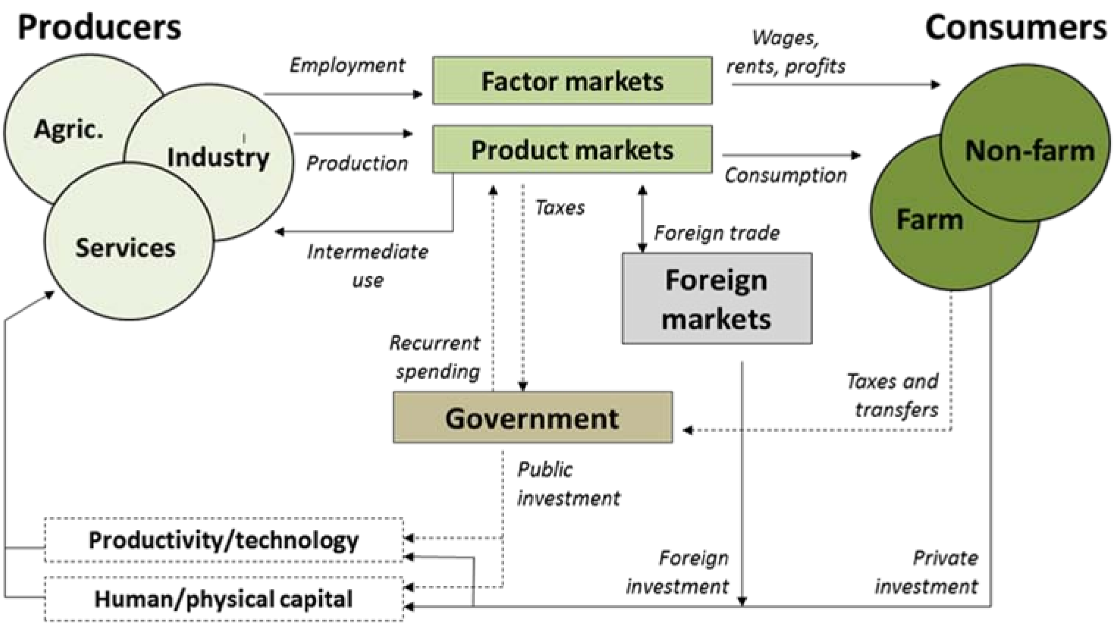
In this chapter, we develop a recursive dynamic computable general equilibrium (DCGE) model[96] in order to model some of the possible economywide effects associated with the trends and long-term strategies outlined in the above analysis for aquaculture and marine capture fishing.

6.1 Description of the Economywide Model

DCGE models are well-suited to analyzing the impacts of industrial and sector-level policies. First, they simulate the functioning of a market economy, including markets for labour, capital and commodities, and therefore can evaluate how changing economic and natural resource conditions are mediated via prices and markets. Secondly, DCGE models ensure that all economywide constraints are respected, which is crucial for studies concerned with inter-sectoral linkages or spillover effects. Finally, CGE models contain detailed sector breakdowns and provide a "simulation laboratory" for quantitatively examining how changes in the fisheries sector influences the performance and structure of the whole economy, both in terms of economic growth and also at the detailed household level.

Economic decision-making in the model is the outcome of decentralized optimization by producers and consumers within a coherent economywide framework. This is reflected in the conceptual framework for the model presented in Figure 6.1. The model identifies 29 sectors (10 in agriculture, 15 industries and 4 services). The agricultural sector includes separate subsectors for ocean fisheries and (on land) aquaculture, and the industrial sector includes separate downstream fish processing and fish feed manufacture industries. In order to reflect the skewed production patterns of Vietnamese fisheries, each sector is disaggregated across two regions: Mekong Delta and the Rest of Vietnam (RoV).

Figure 6.1: Conceptual Framework for the Economywide Model



Labour markets in each region are segmented across three skill groups: (1) workers with at least some primary education; (2) workers with at least some secondary schooling; and (3) workers who have completed secondary or tertiary schooling. Agricultural land is divided across farms that are engaged in aquaculture, and farms that use their land only to grow crops. Aquaculture land (i.e, ponds) in each region is used exclusively by fish farmers. All factors are fully employed, and regional agricultural and national

[96] Developed by CIEM and DERG/UoC.

non-agricultural capital is immobile across sectors. This detailed treatment of factor markets allows us to capture the unique production technologies employed in different regions. Thus when aquaculture production expands, it generates additional demand for factor inputs, such as fish feed, which then affects economywide factor returns and production in other sectors. Moreover, land expansion for aquaculture may face resource constraints, which will then affect economywide factor returns.

The model distinguishes between 30 representative households that are disaggregated across the two sub-national regions (i.e., Mekong Delta and RoV), by farm/nonfarm, fish/crop-only farms, and by per capita expenditure quintiles. The model is calibrated to the 2007 social accounting matrix (SAM) of Vietnam as introduced in Chapter 2 of this report. For this chapter, the national SAM is regionalized to separate out the Mekong Delta, for whom the fisheries sectors play an especially important and unique role. Moreover, a more detailed structure of the fisheries sector is included to isolate the indirect economic linkage that fish feed plays between ocean fisheries and aquaculture. The information used to disaggregate households in the SAM was drawn from 2006 VHLSS.

Appendix 8.3 of this report contains a detailed description of the model.

6.2 Model Results

Scenario 1: Baseline Scenario

In order to estimate the economic impacts of structural and policy changes in Vietnam's fisheries sector, it is necessary to first specify a baseline scenario that reflects development trends, policies and priorities in the absence of any changes to current trends. The baseline provides a reasonable trajectory for growth and structural change of the economy for the ten-year period 2007-2017 that can be used as a basis for comparison.

Economic growth in the DCGE model is determined by rates of factor accumulation and technical change. The assumed values for the baseline are shown in Table 6.1.

Table 6.1: Baseline Scenario Assumptions

	All Vietnam	Mekong Delta	Rest of Vietnam
GDP growth rate (%)	**6.44**	**4.67**	**6.78**
Labor supply growth rate (%)	**2.25**	**1.74**	**2.36**
Tertiary educated	2.64	2.20	2.70
Secondary educated	2.20	1.80	2.30
Primary educated	0.35	0.20	0.40
Crop land expansion rate (%)	**0.42**	**0.25**	**0.50**
Aquaculture pond land expansion rate (%)	**2.60**	**3.00**	**1.50**
Total factor productivity growth rate (%)	**3.04**	**1.95**	**3.27**
Agriculture	1.30	1.00	1.50
Industry	2.87	2.00	3.00
Services	3.87	3.00	4.00

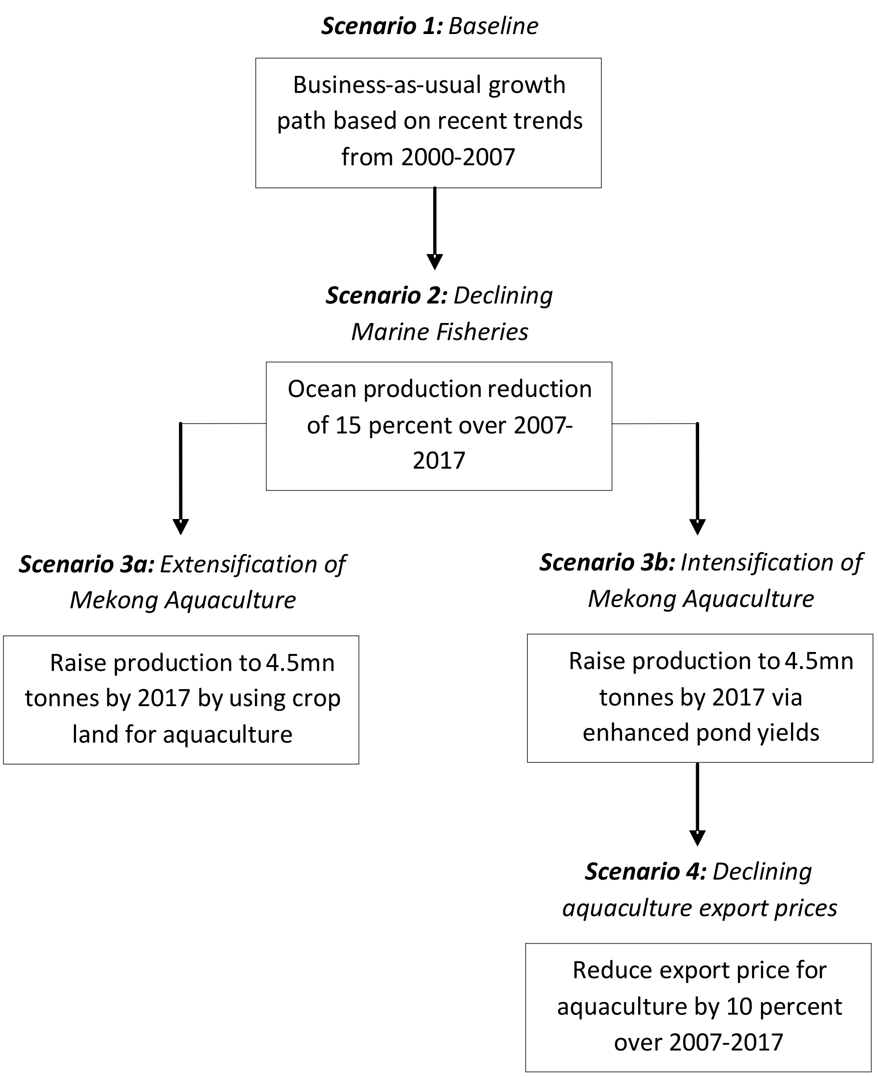
Source: Results from the Vietnam DCGE model.

For labour supply, we follow recent trends and assume that Vietnam's workforce will grow alongside the population at 2.25 percent today per year until 2017. We assume that cultivated crop land will continue to grow slowly (as based on 2000-2007 trends) at 0.25 and 0.50 percent per year in the Mekong Delta and RoV, respectively. This means that growth in agricultural production is increasingly dependent on the adoption of improved technologies rather than land expansion. Aquaculture pond land will grow more rapidly at 2.6 percent per year overall, reflecting recent trends and the strong performance of the sector. Improvements in the education levels of Vietnam's workforce observed over the last decade are assumed to continue, with productivity rising faster for skilled and semi-skilled workers than for unskilled workers (i.e., at 2 and 1 percent per year, respectively, compared to zero percent).

Under the above assumptions, the model shows how Vietnam's economy gradually develops, with agriculture's contribution to GDP falling from 16 to 12 per cent during 2007–2017. Overall, per capita GDP grows at about four percent per year in the baseline, which, despite being a fairly modest long-run growth rate compared to current more rapid economic growth, still significantly improves average household welfare over the simulation period.

We now impose various (fisheries sector) shocks onto the baseline scenario in order to simulate certain key developments and growth opportunities in the sector. The various scenarios are shown in Figure 6.2.

Figure 6.2: Simulation Schematic



In our first scenario, we assume a reduction in marine fish catch by 15 percent in both regions of the country to reflect the emerging constraints and overfishing in this subsector as described in Chapter 4. On top of this scenario, we then conduct two scenarios exploring different possible paths for expanding aquaculture production beyond the subsector's already strong performance. More specifically, we examine the economywide effects of achieving a 4.5mn tonne aquaculture production target by 2017[97] via either extensification (i.e., land expansion) in Scenario 3a, or intensification (i.e., yield improvement) in Scenario 3b. These two scenarios start from the same initial situation and so their results can be both compared to those of Scenario 2 and with each other.

We will find that an intensive strategy is superior to an extensive one, and so a final scenario will build on the results from Scenario 3b. More specifically, Scenario 4 explores possible risks associated with falling world aquaculture prices following an expansion of aquaculture production. We will discuss the findings from each of these scenarios in turn below.

Tables 6.2 and 6.3 detail the results from the four scenarios. Table 6.2 shows GDP impacts while Table 6.3 presents changes in household consumption disaggregated by different household types. The results are discussed in detail below for each scenario in turn.

[97] The 2020 Strategy implies an aquaculture production target of 4.9mn tonnes by 2020. Assuming linear growth from 2007 levels, production in 2017 would be approximately 4.5mn tonnes.

Table 6.2: Change in GDP, 2007-2017 under Different Scenarios

	Share of Total GDP, 2007 (%)	Baseline growth rate (%)	Deviation from Baseline in Final Year, 2017 (%)			
			Declining ocean fisheries	Mekong Aquaculture		Declining world aqua. prices
				Exten-sification	Inten-sification	
		1	2	3a	3b	4
Total GDP	**100.00**	**6.44**	**0.02**	**0.36**	**0.61**	**0.37**
Agriculture	15.60	3.72	-1.14	-1.33	3.42	-0.38
Crops	10.40	3.77	0.39	-7.01	-0.33	0.64
Livestock	1.40	4.70	0.22	-1.96	0.15	0.41
Forestry	1.30	3.90	0.91	0.25	-0.45	1.26
Ocean fisheries	1.10	1.88	-14.96	-14.96	-14.96	-14.96
Aquaculture	1.40	3.44	-7.13	49.32	50.65	-1.04
Mining	10.30	4.25	0.00	0.00	0.00	0.00
Manufacturing	19.20	7.11	0.49	-0.10	-0.91	1.00
Processed fish	0.50	0.27	-24.06	-9.32	-4.07	2.79
Fish feed	0.20	0.37	-18.15	-5.80	-12.62	-31.40
Other industry	13.20	6.61	0.03	0.77	0.40	0.23
Services	41.70	7.42	0.11	0.96	0.74	0.40
Mekong Delta GDP	**17.00**	**4.63**	**-0.09**	**1.88**	**3.58**	**2.28**
Agriculture	6.20	4.75	-1.25	-6.60	10.00	1.71
Crops	4.50	4.70	0.95	-23.70	-0.72	1.89
Livestock	0.20	9.51	1.07	4.44	-0.30	2.33
Forestry	0.10	5.06	1.60	7.80	-0.88	2.97
Ocean fisheries	0.40	1.69	-14.96	-14.96	-14.96	-14.96
Aquaculture	1.00	4.92	-7.68	64.41	66.17	5.33
Industry	5.60	4.03	0.04	5.13	-0.75	2.77
Processed fish	0.30	1.99	-26.84	-9.97	5.25	14.23
Fish feed	0.10	1.08	-19.53	-4.35	-13.77	-33.48
Services	5.20	5.09	1.10	8.39	0.46	2.47
Rest of Vietnam GDP	**83.00**	**6.78**	**0.04**	**0.11**	**0.12**	**0.05**
Agriculture	9.50	2.99	-1.05	2.75	-1.66	-1.99
Crops	5.90	3.01	-0.11	7.80	0.01	-0.47
Livestock	1.20	3.74	-0.01	-3.67	0.26	-0.10
Forestry	1.20	3.83	0.86	-0.25	-0.42	1.15
Ocean fisheries	0.70	1.99	-14.96	-14.96	-14.96	-14.96
Aquaculture	0.40	-1.57	-4.50	-23.75	-24.51	-31.89
Industry	37.10	6.63	0.27	-0.39	-0.27	0.30
Processed fish	0.20	-2.36	-18.64	-8.05	-22.24	-19.51
Fish feed	0.10	-0.06	-17.26	-6.73	-11.88	-30.06
Services	36.40	7.72	0.00	0.13	0.77	0.17

Source: Results from the Vietnam DCGE model.

Table 6.3: Changes in Household per capita Consumption, 2007-2017 under Different Scenarios

	Share of total population, 2007 (%)	Baseline growth rate (%)	Deviation from baseline in final year, 2017 (%)			
			Declining ocean fisheries	Mekong aquaculture		Declining world aqua. prices
				Exten-sification	Inten-sification	
		1	2	3a	3b	4
All households	**100.00**	**3.26**	**-0.01**	**-0.51**	**0.31**	**0.15**
All Fishing Households	**26.50**	**2.62**	**-0.22**	**-2.09**	**0.78**	**-0.67**
Q1 - Mekong Delta	1.80	1.70	-0.84	-6.00	2.13	-2.60
Q2 - Mekong Delta	2.40	1.91	-0.60	-7.01	1.74	-1.77
Q3 - Mekong Delta	2.20	2.10	-0.42	-6.99	1.53	-1.17
Q4 - Mekong Delta	1.90	2.12	-0.29	-5.90	1.46	-0.76
Q5 - Mekong Delta	2.00	2.65	-0.41	-2.40	1.60	-1.33
Q1 - Rest of Vietnam	4.90	2.19	-0.04	0.38	0.55	0.06
Q2 - Rest of Vietnam	4.10	2.64	-0.05	0.27	0.32	-0.07
Q3 - Rest of Vietnam	3.40	2.96	-0.04	0.10	0.12	-0.17
Q4 - Rest of Vietnam	2.60	3.25	-0.06	0.19	0.01	-0.28
Q5 - Rest of Vietnam	1.30	3.37	-0.03	0.12	-0.26	-0.35
All other households	73.50	3.42	0.04	-0.13	0.19	0.35
Q1 - Mekong Delta	0.80	2.31	-0.09	-3.52	0.58	0.22
Q2 - Mekong Delta	1.90	2.42	-0.05	-3.31	0.42	0.25
Q3 - Mekong Delta	2.30	2.62	-0.04	-2.70	0.55	0.29
Q4 - Mekong Delta	2.60	2.69	0.00	-2.28	0.43	0.30
Q5 - Mekong Delta	2.30	2.93	0.07	-1.54	0.22	0.38
Q1 - Rest of Vietnam	12.50	2.47	0.04	0.90	0.59	0.48
Q2 - Rest of Vietnam	11.50	2.86	0.03	0.64	0.39	0.41
Q3 - Rest of Vietnam	12.10	3.34	0.02	0.20	0.23	0.33
Q4 - Rest of Vietnam	13.00	3.67	0.03	0.03	0.18	0.33
Q5 - Rest of Vietnam	14.40	3.81	0.05	0.01	0.04	0.33

Source: Results from the Vietnam DCGE model.

Scenario 2: Declining Marine Fish Catch

In-line with many trends globally, Vietnam's marine fishing capture sector is widely acknowledged to be overcapitalised. In short, there are too many boats chasing too few fish, and as a result productivity has been declining for some time. To ensure the long-run sustainability of the sector, production does need to fall, and Scenario 2 assumes a 15 percent reduction in marine catch over the period 2007-17. Table 6.2 shows the impact of reducing fish stocks on ocean fisheries GDP. Value-added of the marine fisheries sector is 15 percent below what would have been achieved under the baseline scenario by 2017 as a result of declining fishing.

Only a tiny percent of ocean fisheries production is directly exported, with the remaining production supplied to downstream processors (or consumed directly). The first of these is Fish Processing, which receives about 45 percent of ocean fish supplies. The declining supply of domestically produced ocean fish inputs into the fish processing sector causes final year GDP in this subsector to decline substantially by 24.1 percent by 2017 relative to the baseline. The large decline is driven by the fact that ocean fish represents a key input into processing (accounting for almost one fifth of production costs for fish processors).

Table 6.4 shows that direct ocean fish exports decline by 48.6 percent relative to the final baseline value in 2017 (though this is off a low base). Similarly, there is a decline in processed fish exports, partly due to falling production and also in order to maintain supply to domestic consumers, who, due to falling supplies, are willing to pay higher prices for ocean fish.

Table 6.4: Change in Trading Patterns of Fish Products (relative to baseline)

	Deviation from baseline in final year, 2017 (%)			
	Declining ocean fisheries	Mekong aquaculture Exten-sification	Mekong aquaculture Inten-sification	Declining world aqua. prices
Import quantities				
Ocean fish	33.8	139.9	191.5	155.5
Processed fish	-15.1	-45.6	-43.4	5.4
Fish feed	-2.3	74.2	79.4	12.5
Export quantities				
Ocean fish	-48.6	-73.3	-78.7	-75.0
Aquaculture	-2.9	116.3	116.0	-12.4
Processed fish	-24.3	-9.2	-4.2	2.8

Source: Results from the Vietnam DCGE model.

The second downstream sector to be effected is Fish Feed. Approximately one quarter of ocean fish production flows to fish feed processors, and ocean fish is a key input, accounting for roughly two thirds of feed producers production costs. As a result, GDP in the domestic fish feed subsector is 18.2 percent smaller in 2017 relative to the baseline. Falling feed production has third-round knock-on effects for the aquaculture sector, for whom feed accounts for a significant proportion of production costs. Aquaculture production therefore falls by 7.1 percent from the final year baseline production level. Aquaculture also supplies inputs into processed fish (most farmed fish is processed prior to export), and there is thus a 'double-whammy' for the fish processing subsector as both major inputs decline.

In this scenario, national GDP remains broadly unchanged. The labour that was working in ocean fisheries is now forced to relocate. Overall employment in the marine fishing sector declines (albeit by less than the 15 percent drop in production). These workers are endowed with a certain amount of education/skills and so they re-enter the job search market and, based on their skills, geographic location, and the prices of the products and wage rates in different sectors, they move to the most appropriate sector.

Table 6.3 shows that fishing households are hurt most, because (a) some are engaged in ocean fishing; (b) some are also engaged in aquaculture,[98] which in turn leads to declining feed. Households in the Mekong Delta are most dependent on fishing incomes, and they therefore experience the largest consumption declines. Overall, declining ocean fisheries production hurts the poorer households more because of their greater dependence on fish incomes. Non-fishing households in the Mekong Delta are also affected by the decline in ocean fisheries production, although imports offset some of decline in domestic ocean fish supplies.

[98] Data does not distinguish here between the two types of fisheries.

In summary, declining ocean fisheries of this magnitude has important economywide linkages, primarily through the channel of being a supplier of feed to aquaculture. While aquaculture may be the dynamic subsector, its fate is partly linked to the ocean fishing. This means that that the livelihoods and welfare of farmers engaged throughout the fisheries sector will decline as a result of a smaller ocean fishing sector. A concerted effort to enhance alternative fish sector jobs for poorer households is thus needed.

Scenario 3a: Expanding Aquaculture Production via an Extensification Strategy

This scenario builds on the above Scenario 2. In addition to falling marine catch, the amount of farm land allocated to aquaculture ponds is now assumed to increase. As shown in Table 6.5, aquaculture production rose to just below 3mn tonnes by 2017 under the baseline scenario (i.e., an expansion of 40 percent from 2007 production levels). In fact, Vietnam aims to rapidly grow aquaculture production over the coming decade to 4.9mn tonnes by 2020. Without any improvements in aquaculture yields (i.e., output per hectare of land) and in order to achieve an aquaculture output of about 4.5mn tonnes by 2017 (i.e., assuming linear growth from 2007 to 2020), we calculate that an estimated 1.7mn hectares of land needs to be shifted from crops to aquaculture.[99] Furthermore, we assume that all of the production increase occurs in the Mekong Delta.

Table 6.5: Changes in agricultural land allocation and fisheries production, 2007-2017

	Base value, 2007	Baseline change, 2007-2017	Absolute deviation from baseline, 2017			
			Declining ocean fisheries	Mekong aquaculture		Declining world aqua. prices
				Exten-sification	Inten-sification	
Mekong Delta farm area (1000 ha)	**4,770**	**352**	**0**	**0**	**0**	**0**
Crop land	4,045	102	0	-1,724	0	0
Fish farmers	2,514	64	0	-1,724	0	0
Crop only farmers	1,531	39	0	0	0	0
Aqua ponds	725	249	0	1,724	0	0
Rest of Vietnam farm area (1000 ha)	**9,494**	**516**	**0**	**0**	**0**	**0**
Crop land	9,210	471	0	0	0	0
Fish farmers	2,629	134	0	0	0	0
Crop only farmers	6,581	337	0	0	0	0
Aqua ponds	283	45	0	0	0	0
Aquaculture production (1000 mt)	**1,886**	**386**	**-340**	**-340**	**-340**	**-340**
	2,123	854	-212	1,468	1,508	-31
World aquaculture prices (Index)	**131.3**	**0**	**0**	**0**	**0**	**-10**

Source: Results from the Vietnam DCGE model.

Under this scenario, production and value-added of the aquaculture subsector in the Mekong Delta rises substantially (Table 6.2). For example, while final year aquaculture GDP fell by 7.1 percent from the baseline in previous scenario, it now rises by 49.3 percent. This means that aquaculture GDP in the Mekong Delta is 46.5 percent larger as a result of extensification. Given this rising production, demand for feed also increases, and given an assumed falling marine catch, much of the additional feed is imported. Feed imports thus rise by 74 percent (Table 6.4). Due to the assumption that all of the production increase takes

[99] Land in Vietnam is almost entirely used, so we assume a complete substitution here.

place in the Mekong Delta, the value of aquaculture in the RoV declines due to falling aquaculture prices and intensified competition from producers in the Mekong.

However, an extensification strategy also brings downsides. GDP of the Mekong Delta region is found to rise (1.9 percent above baseline by 2017), but there are large corresponding declines in food crop production in the region. Extensification of aquaculture to this extent would necessitate crop production falling by 23.7 percent relative to the baseline, and by 7.0 percent at the national level. Even though Mekong GDP rises, there would be a large decline in consumption spending for households in the region (Table 6.3). This is for a number of reasons: (a) aquaculture is more land and less labour intensive than rice and food farming. Shifting land to aquaculture thus 'releases' surplus labour, resulting in wages in the Mekong Delta being driven downwards; (b) falling prices for aquaculture produce induces lower returns on production for fish farmers (thus reducing farm revenues per hectare); and finally, (c) non-fish food prices rise as a result of this reallocation, which adversely impacts on real consumption spending. In the RoV, households benefit from higher prices for their major crops as they are less dependent on aquaculture and so less affected by its falling prices.

Overall, extensification is not a good welfare-enhancing option given the trade-offs it has with food crops.

Scenario 3b: Expanding Aquaculture Production via an Intensification Strategy

Although not stated explicitly, the MARD master plan, as well as other official fisheries sector documents, appears to target the substantial aquaculture production increases outlined above without a corresponding increase in land area. Such an 'intensification' strategy is clearly a desirable objective as it would imply that new resources or productive capacity are effectively being brought into the economy. In Scenario 3b we again build on the scenario of a declining marine fish catch, modelling the same increase in aquaculture production (4.5mn tonnes by 2017) this time coming entirely from improved yields (i.e., aquaculture land area does not deviate from the baseline).

Under this scenario, the TFP growth rate for aquaculture in the Mekong Delta Region jumps by 4.5 percentage points relative to the baseline annual growth rate of 2 percent. Despite the fact that aquaculture production rises at the same rate to the same final volume in both the extensification (3a) and intensification (3b) simulations, the former requires a trade-off in the form of ponds substituting crop land. As such, an intensification strategy such as this results in larger growth effects. National GDP in 2017 from an intensification strategy is 0.6 percent higher than under an extensification strategy (Table 6.2), and GDP in the Mekong Delta expands by as much as 1.9 percent by 2017.

In this scenario, there is no longer as large a drop in food crop production (given no forced reallocation of land). Food crops' slight fall in production is due to workers reallocating their time to work in the more productive aquaculture sector. These effects are particularly apparent in the Mekong Delta Region where the negative impacts of production increases through extensification are now strongly positive (Table 6.3). So, rather than hurting fish farmers' consumption (as in the previous extensification scenario), intensification now generates benefits which are fairly evenly distributed between rich and poor households. In fact almost all households benefit from faster economic growth, higher national incomes, and more moderate food price increases. In particular, the latter effect helps make intensification a really 'pro-poor' strategy (nobody loses and the poor win the most) - an unambiguous Pareto gain.

Scenario 4: Aquaculture's Vulnerability to World Price Shocks

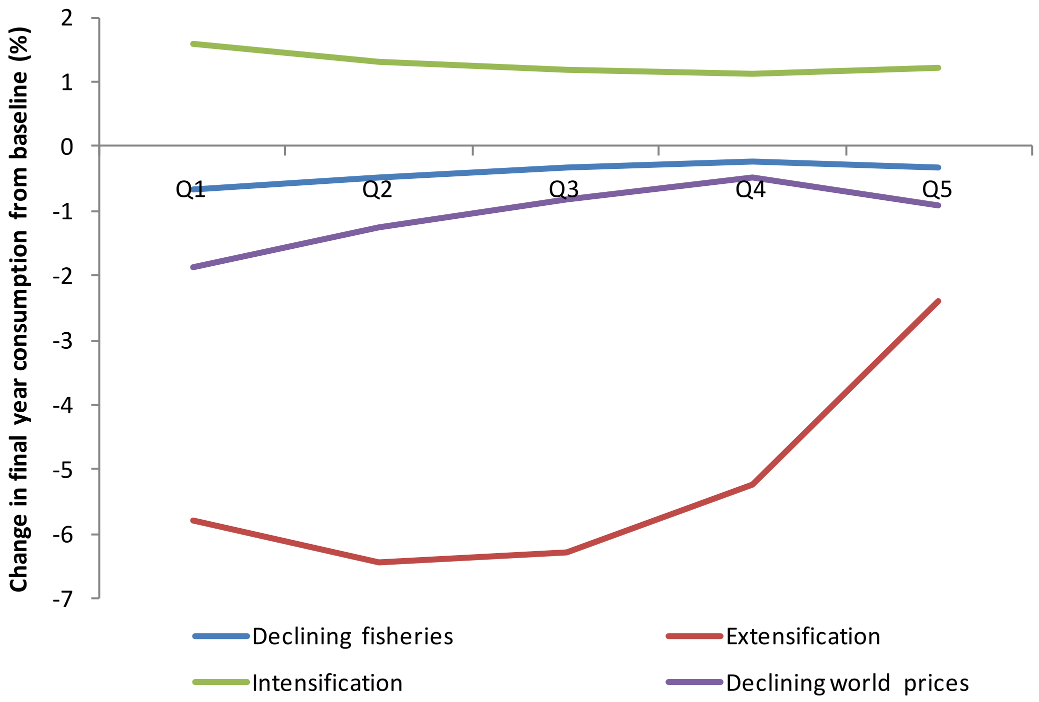
The long-term vision for the fisheries sector (as outlined in the sector 2020 Strategy), and the way trends are evolving anyway, are of an increasing focus on aquaculture as the key producing mechanism. Given the narrow range of species, and the export orientation of the sector, world prices are thus a serious risk to take into consideration. Scenario 4 therefore builds on Scenario 3b (falling marine catch and increased aquaculture catch through intensification), by adding a 10 percent drop in real world export prices for aquaculture.

A price drop of this magnitude would partially offset the benefits of an intensification strategy. Table 6.4 shows how aquaculture exports fall dramatically (i.e., to below baseline levels). In-line with falling aquaculture production, feed demand would also fall. National GDP is lower in this scenario (Table 6.2), due to falling aquaculture and feed production. Unsurprisingly, the Mekong Delta area is the worst hit, but overall GDP still rises thanks to the intensification strategy.

Households in the RoV are not impacted to the same extent as households in the Mekong Delta region. While the latter region suffers due to their greater dependence on aquaculture incomes, other regions and nonfarm households gain (Table 6.3).

In summary, Figure 6.3 shows the shifting fortunes of the Mekong Delta region under each of the scenarios modelled. All households are hurt by the declining ocean fisheries catch, albeit only slightly in the case of non-fishers given the sector's small share of the economy. However, marine fisheries is strongly linked to the aquaculture sector via its role as a source of feed. Thus, the economywide effects of declining ocean fisheries are particularly pronounced. Finding alternative income opportunities for displaced ocean fishing workers is therefore a priority and is also consistent with a strategy to expand aquaculture production. However, a declining fish catch coupled with an expansion of aquaculture through *extensification* would be a detrimental policy response, hurting fish farming households and especially the poorest. Even assuming a declining marine fish catch of 15 percent, expanding aquaculture production through *intensification* (improved yields) would generate strongly positive consumption effects, most notably for the poorest households. It would also benefit non-fish-farming households. However, declining world market prices for farmed fish can offset any of the gains from an intensive aquaculture strategy.

Figure 6.3: Change in final year per capita consumption for all fishers the Mekong Delta by expenditure quintile, 2007-2017



7 Concluding Remarks

Fisheries in Context

- The fisheries sector, as a whole, accounts for a small share of GDP, almost half of which is derived from aquaculture. In terms of its contribution to GDP, the sector is comparable to the textile and garment sector. Although the sector contributes relatively little to national GDP, it generates a disproportionate amount of export earnings via the downstream fish processing sector.

- The 2020 Sector Strategy targets fisheries to account for an rapidly increasing share of 'agriculture, forestry and fisheries' by 2020. In the MARD master plan, an output growth rate for the next five years broadly in-line with the previous five years is targeted. It is also in-line with the plan for livestock production (excluding fish), though higher than that for crop production. Fisheries is therefore clearly being prioritised within the agriculture sector. If the targets of the 2020 Strategy are realised, recent production trends will continue. Targets imply an increase of 52 percent relative to current levels, and a compound annual average growth rate of 3.6 percent. Compared to the growth of recent years, this actually represents a deceleration, though within this, aquaculture is targeted to account for an increasing share, implying an aquaculture output in 2020 double that of today. The corresponding output of marine capture fisheries output will basically be flat.

- All indications are for local demand for fish to grow strongly. National production will almost certainly keep pace with domestic demand in the short to medium term, suggesting average real prices will remain reasonably stable. However, the domestic preference is presently for marine/river fish, with almost all farmed fish exported. As a professional and urban middleclass emerges, demand for processed farmed fish will probably increase. Until then, the preference for 'wild' fish is expected to persist.

Aquaculture

- Vietnam's aquaculture sector has been among the most successful in the world, whether judged by output, value, contribution to foreign exchange or rural livelihoods. The sector has prospered until now without *very serious* environmental or social disruptions, and plans are for the sector to continue growing. Vietnam has benefited from two species that have a comparative advantage, Pangasius and the Giant Tiger Shrimp, but the entrepreneurship and risk-taking of farmers deserve credit for taking advantage of these opportunities. To ensure continued sustainability, this report suggests a number of measures.

- Pangasius faces own-price inelasticity and income elasticity less than one. Although a normal and not inferior good, Pangasius must compete with low-cost whitefish such as tilapia in the aquatic products market, and with chicken and pork among meat products. This may have been evident in 2009 when a decrease in price was combined with a decrease in quantity exported; the demand curve must have shifted inwards. This could have occurred because of cheaper substitutes. Whitefish will be a staple on menus in Europe and the US, but for consumption at home, easy and fast products are preferred. Processors of Pangasius therefore must develop more sophisticated (value-added) forms if the projected expansion output is not to produce a sharp decline in revenues (given price inelasticity). One of the ironies of food products with inelastic demand is that higher supply actually results in lower revenues, because the increase in output is swamped by the decline in price.

- The vertical integration of the Pangasius (and to a lesser extent) shrimp industry value chains must be carefully managed (especially vis-à-vis grow-out farmers). Access to international markets requires that exports meet food safety requirements. There are also more demanding (environmental and social) requirements to satisfy certification agencies. Vertical integration can accomplish traceability but there will be losers among independent grow-out farmers. Some are already moving to nursery operations but some may be willing to grow new species such as tilapia.

Pilot projects to determine the viability of producing tilapia initially for the domestic market should be pursued. This was the strategy applied in the Philippines with the GIFT tilapia.

- Aquaculture in Vietnam relies on a narrow range of species bringing high production and market risk. Other species could be cultivated in Vietnam. High value marine species (now that seed constraints have largely been overcome) would provide an alternative livelihood for fishers, and simultaneously save foreign exchange through import substitution. The report suggests a number of possibilities.

- Quality, and thus value, must become more of the focus in Vietnamese aquaculture. The growth in exports has been healthy, yet it is felt that Vietnamese export produce is still not sufficiently 'visible' on the international market. Branding is clearly key in this respect. One further promotional policy would be state certification and labelling of feed, with penalties for non-compliance. This requires resources for enforcement but the benefits are reduced risks to farmers. Seed quality should also be a concern. Mortalities of Pangasius fingerling are high, and this has consequences for drug use and costs. Nurseries could be assessed for the quality of their seed and the results broadcast; this in itself would give nurseries an incentive to improve quality.

- Regulations concerning waste water must be enforced. Disease could virtually eliminate the industry given the close proximity of farms and the use of a common river system. Restrictions on drug use are important. Even media reports on overuse of antibiotics could severely damage the market as was the case of Chilean salmon. In 2007 an Egyptian newspaper reported that Pangasius was contaminated -this was later denied by the Egyptian Ministry of Agriculture- but exports to Egypt have been falling ever since. The authorities must be cognizant how some competitors and NGOs may "misinform" about environmental or social conditions in order to satisfy their clientele. Authorities must be proactive and transparent.

- Aquaculture farmers are price takers. As such, the critical decision to maximize profits for the farmer is the quantity of output. In theory this is when the marginal cost is equal to the price set by the market. Pangasius is a relatively low value species with a farm-gate price less than one seventh that of shrimp, so farmers must produce a lot to cover costs. Fixed costs are low, so any change in variable costs can have a marked impact on profits- either positively with feed price reductions for example, or negatively due to climate change- as simulations in this report show.

- Overall the aquaculture industry in Vietnam has shown innovation and entrepreneurship. The expansion of Pangasius is unique in the history of aquaculture and considerable resilience was shown when the US anti-dumping duties were imposed. Exports may in the long run cease to be the principal driver of the industry but Pangasius and Shrimp are likely to remain primarily export-oriented in the near to medium term, requiring improved husbandry to meet international certification standards. Meeting these standards will incur short term costs and may be perceived as non-tariff barriers. But if Vietnam wishes to access developed international markets, it must abide by them. There is no price premium for meeting standards; instead the cost must be borne by exporters. Greater accountability for more responsible environmental practices will also benefit producers in the long-run.

Marine Capture Fisheries

- Despite year on year rises in ocean catch, productivity has been declining for many years. Fishers are facing a triple-whammy: They are having to fish longer and harder to catch the same volume of catch; the fish they do catch tends to be of lower commercial value; and the operating costs of fishing (such as fuel) are, in general, rising. In many cases, economic losses are thus being incurred, causing hardship on a fishing community already facing challenges. Indeed, for those small-scale fisheries activities that are seemingly economically viable in Vietnam, it is most likely due to strong market demand (which may come and go), government subsidies to the sector, a low opportunity cost to attracting labour to the ocean, and insufficient attention paid to sustainability.

- Despite very visible trends of overcapitalisation and resulting overfishing, their *explicit* mention in government documents is rare. The implication of certain of the objectives in the 2020 Strategy, for instance, is of a flat ocean catch over the next decade, but this is not explicitly stated, nor is any mention of a need to reduce capacity on the waters. Given the year-on-year absolute increases in fishing effort, and the intractability of the problem, immediate and transparent action is advisable.

- The supply chain in inshore and offshore fisheries is unbalanced, with the processing companies capturing most of the rents. On the whole, fishers have slim operating margins implying a high vulnerability to adverse cost or price changes. A small rise in operating costs can lead to losses. This was clearly illustrated with the fuel price rises of 2008. Subsidising the sector may ease the short term pain on these occasions, and indeed has played an important role in fishers' livelihoods, but longer term subsidisation should not be seen as a viable policy.

- As with aquaculture, a focus on value, instead of volume, of catch is needed. Provincial plans remain largely focused on tonnage of catch, and there is a mismatch between local plans targeting increases and the need, and apparent objective, to keep national marine catch from growing. This creates perverse incentives and can aggravate overfishing. In addition to the obvious environmental benefits of reducing fishing effort, data shows that economic profits for fishers would be greater with a lower volume of catch. As a result of declining productivities, the relative appeal of other vocations, outside of marine capture fishing, is rising. It is thus a critical time to invest in alternative livelihood options. There is no easy answer, but lessons should be learnt from initiatives already underway and crucially should involve local stakeholder participation.

Small-Scale Fisheries

- A significant minority of rural households in the North and Central Highlands provinces engage in small-scale fisheries activities of aquaculture and inland capture fishing. Most households undertake these activities as part of a diversified livelihood portfolio, and fishing activities make a significant, but not dominant, contribution to the income, especially for the cases where households have ponds on their land. Aquaculture in particular though seems to be a relatively high return activity for the households that carry it out; it potentially has a higher return than agriculture and is not necessarily much more risky on the basis of data used in this report. In practice aquaculture seems to be undertaken by households at different levels of income, but it appears that the more educated and those living in less poor villages may be more likely to do it and more likely to sell their output.

- By contrast fisheries catch from open access resources (other than marine fishing) is disproportionately undertaken by poor households; it also makes a significantly smaller contribution to the income of such households. The overall catch though from open access resources though is still significant. On this basis, inland capture fishing currently appears to be underrepresented in sector plans and analyses.

- Household level fishery activities are not just limited to the Mekong Delta region. It should be recognised that these activities in fact take place throughout Vietnam, including significantly in the poorer provinces of the North West. But the nature of the activity there is somewhat smaller scale and less developed. The potential for fisheries activities elsewhere in Vietnam to make an important contribution to household incomes as well as their consumption needs is significant.

Sector Interlinkages

- Domestic feed manufacture capacity now far outstrips the availability of its primary input (namely, marine 'trash' fish). To the extent that there is overfishing and a low/falling supply of marine (trash) fish to be used as an input for fish feed, there is a constraint to the further development of the domestic feed manufacture industry and therefore aquaculture production more generally. It would be important therefore to be cognizant that such large targeted expansions in aquaculture production may necessarily entail a rise in demand for marine trash fish- potentially offsetting any efforts to reduce overfishing. The linkage between marine fish catch and farmed fish, through the fish feed channel, has important consequences for the sector as a whole.

- All household types in Vietnam would be hurt by a declining marine fisheries catch. However, marine fisheries is strongly linked to the aquaculture sector via its role as a source of feed. Thus, the economywide effects of declining marine fisheries are particularly pronounced. Finding alternative income opportunities for displaced marine fishing workers is therefore a priority and is also consistent with a strategy to expand aquaculture production. However, a declining fish catch coupled with an expansion of aquaculture through *extensification* would be a detrimental policy response, hurting fish farming households and especially the poorest.

- On the other hand, even assuming a declining marine fish catch of 15 percent, expanding aquaculture production through improved yields (*intensification*) would generate strongly positive consumption effects, most notably for the poorest households. It would also benefit non-fish-farming households. However, declining world market prices for farmed fish can offset any of the gains from an intensive aquaculture strategy.

8 Appendix

8.1 Evaluation of Voluntary Aquaculture Standards in Vietnam

Chapter 3 identified compliance with increasingly stringent standards of importing countries to be a key factor in the aquaculture subsectors' continued success. This section will include a detailed analysis and set of recommendations of *voluntary* aquaculture certification standards in Vietnam.

This drafting of this appendix was led by Dr Flavio Corsin and his team at the newly established International Centre for Aquaculture and Fisheries Sustainability (ICAFIS), situated in the Vietnam Fisheries Society (VINAFIS). In addition, contributions of Pham Anh Tuan (Directorate of Fisheries, D-Fish), Tuong Phi Lai, and Pham Thanh Linh are gratefully acknowledged. While advice was received from many colleagues and friends (list at the end of this report), the research team of ICAFIS and UoC takes full responsibility for any remaining errors or shortcomings in interpretation. All the usual caveats apply.

List of Abbreviations

ACC	Aquaculture Certification Council
AD	Aquaculture Dialogue
AFFS	Accredited Fish Farm Scheme
ANZ	Australia New Zealand
APFIC	Asia-Pacific Fishery Commission
ASA	ASEAN Shrimp Alliance
ASC	Aquaculture Stewardship Council
ASEAN	Association of Southeast Asian Nations
ASI	Accreditation Services International
B2B	Business to Business
B2C	Business to Consumer
BAP	Best Aquaculture Practice
BMP	Better Management Practices
BTA	Bilateral Trade Agreement
CBD	Convention of Biological Diversity
COC	Code of Conduct
COFI	Committee on Fisheries
DAQ	Department of Aquaculture
DOF	Department of Fisheries
FDA	Food and Drug Administration
FTA	Free Trade Agreement
GAA	Global Aquaculture Alliance
GAP	Good Agriculture Practices
GFSI	Global Food Safety Initiative
GMO	Genetically Modified Organisms
GOAL	Global Outlook for Aquaculture Leadership
GRASP	GLOBALGAP Risk Assessment on Social Practice
GSC	Global Steering Committee
ICAFIS	International Collaborating Centre for Aquaculture & Fisheries Sustainability
ICS	Internal Control System
IDH	Dutch Sustainable Trade Initiative
MRAG	Marine Resources & Fisheries Consultants
NACA	Network of Aquaculture Centres in Asia-Pacific
NAFIQAD	National Agro-Forestry-Fisheries Quality Assurance Department
ShAD	Shrimp Aquaculture Dialogue
VietGAP	Vietnam Good Agriculture Practices
VINAFIS	Vietnam Fishery Society

1. Background

The Expansion of Voluntary Aquaculture Certification

Voluntary aquaculture certification has been expanding rapidly over the past few years, in terms of both number of certification schemes and number of producers being certified. This expansion has been perceived in several governments as a threat to both the producers, who may face higher costs to both comply with standards and pay for audits to obtain certification, and the competent authorities, who are in charge of issuing mandatory certification of aquatic products and sometimes see their authority jeopardised. This scenario has lead to several initiatives:

- Asia-Pacific governments sought advice from the FAO and APFIC, who commissioned reviews of aquaculture and fisheries certification and in 2007 held a workshop on certification to advise governments on this matter
- The Committee on Fisheries (COFI) of the FAO requested the FAO to develop Guidelines on Aquaculture Certification, which are currently under development.
- Several governments initiated their own "pseudo-voluntary" certification schemes, which are somehow a combination of mandatory and voluntary requirements. The Department of Fisheries of Thailand took the lead in this effort and is now leading also the development of ASEAN shrimp GAP
- In 2010, the FAO commissioned a review of GAP/BMP/Codes of Practices and other similar "best practice" documents.

Current Status in Vietnam

There are about 1 million aquaculture farmers in Vietnam, at least 10 certification schemes applicable to Vietnamese aquaculture farmers but less than 20 farmers or farmer organisations have actually been certified. This indicates that either the schemes are poorly applicable to Vietnamese producers or they do not provide the necessary benefits to counterweight the costs associated with compliance with the standards and certification or the Vietnamese farmers are poorly aware of the current certification requirements and market-trends.

The Trend

Increasingly buyers, and consequently processing plants, are requesting farmers to comply with voluntary standards. This trend however is different for different species and depends on the current farming practices, on the scale of farming and on the target markets. In fact, pangasius production is relatively larger scale, is characterised by a relatively small number of vertically integrated farms playing an increasingly important role, and, although it feeds over 100 markets globally, one third of the production is sold to European countries. On the contrary, shrimp production is dominated by a large number (in the order of the hundreds of thousands) small-scale producers and products, although also reaching a wide number of markets, are sold (especially Tiger shrimp) in a greater proportion to Japan (i.e. 29.5 percent) as opposed to US and EU which in 2009 accounted for 23.6 percent and 16.8 percent respectively.

The role of MARD

At present the Ministry of Agriculture and Rural Development (MARD) of Vietnam is in front of a cross-road. With its own GAP program in an embryonic stage and an increasing number of producers being requested to obtain certification for compliance to standards from an ever growing number of voluntary schemes, the newly established Directorate of Fisheries (D-Fish) is debating on the direction to take concerning voluntary aquaculture certification. Although draft VietGAqPs for shrimp and Pangasius have been submitted by the Department of Aquaculture (DAQ) to D-Fish in September 2010 these are largely inspired to the VietGAP for the agriculture sector. In addition, there is still a high degree of uncertainty among D-Fish leadership on what should be the detailed content of such VietGAqP documents.

Species Focus

In view of the importance of Pangasius and shrimp for Vietnamese aquaculture (see Chapter 3 of this report) as well as the fact that these are also targets of the main certification schemes, focus was put on these two species groups here. However, consideration was given to other species groups farmed in Vietnam.

A questionnaire to assess costs and benefits of GLOBALGAP and GAA/BAP certification was also developed and disseminated to the (few) certified enterprises. Only GLOBALGAP certified enterprises responded to the questionnaire. Answers were analysed using a descriptive approach.

The assessment of the extent to which the aquaculture certification standards were covered by Vietnamese legislation was conducted using the following sets of standards.

- ASC/Pangasius Aquaculture Dialogue
- GAA Shrimp (excluding the "Information" standards, which are meant only to report information)
- GAA Pangasius
- GLOBALGAP All Farm
- GLOBALGAP Aquaculture Base (draft posted for public comments and meant to incorporate all the species specific modules, e.g. Shrimp)
- ASEAN GAP Shrimp

Each standard was assessed on a three-level scale, i.e. covered in full by legislation, only partially covered or not covered at all. In view of the complexity of the Vietnamese legal system, this assessment was not meant to be fully comprehensive and covered only the main legal documents.

2. Review of Voluntary Aquaculture Certification in Vietnam & Establishment of Dialogue between MARD and Key Schemes

Global Aquaculture Alliance

Overview

The Global Aquaculture Alliance (GAA) is a non-profit trade organisation based in the USA. GAA was one of the first organisations to develop standards for the aquaculture sector, issuing so called Best Aquaculture Practice (BAP) standards for shrimp, tilapia, and (American) catfish and in August 2010 for Pangasius. Standards are available for four links in the aquaculture production chain namely hatcheries, farms, feed mills and processing plants. Enterprises certified for more than one link, receive a 2, 3 or 4 star certification depending on the number of links for which they are certified. Standards are developed by technical committees said to have broad stakeholder representation.

The GAA/BAP standards for shrimp and Pangasius have a slightly different structure, although they both cover similar sustainability areas such as: community, environment, food safety and traceability.

The standards are grouped under the following headings:

- Property rights and regulatory compliance: covering largely legal requirements, hence not adding any additional requirements on producers
- Community relations:
- Worker safety and employee relations
- Mangrove (shrimp)/wetland (Pangasius) conservation and biodiversity protection
- Effluent management
- Sediment (shrimp)/sludge (Pangasius) management
- Soil, water conservation
- Fish meal, fish oil conservation (only Pangasius)
- Control of escapees, use of GMOs (only Pangasius)
- Postlarvae sources (only shrimp)
- Storage and disposal of farm supplies
- Animal welfare (only Pangasius)
- Drug and chemical management
- Microbial sanitation (shrimp and Pangasius), biodiversity (only Pangasius)
- Harvest and transport
- Traceability

Certification is conducted by auditors of the Aquaculture Certification Council (ACC). The ACC has been traditionally very close in governance to the GAA. In addition, relying on a single certification body has often been perceived as a form of monopoly. For this reason, since 2009 ACC is playing primarily a role in coordinating certification efforts, with the actual certification being taken over by independent (third party) certification bodies. Upon successful certification, producers can apply a BAP label on the product. Therefore the GAA/BAP certification scheme is a Business to Consumer (B2C) scheme.

Several major players in the food business such as Wal-Mart, Darden Restaurants, Lyons Seafood and Sobeys have express their commitment to purchasing BAP certified products. The market buy-in of the program seems however to be largely limited to the US and the UK.

In 2008 the Food and Drug Administration (FDA) announced the establishment of a pilot program to assess the quality of BAP certified products and whether BAP products could be granted expedite access to the US market.

Status in Vietnam

According to the ACC website, as per September 2010 in Vietnam there were only shrimp enterprises certified following the GAA/BAP standards. These were:

- 3 certified hatcheries and 1 pending certification
- 6 certified farms and 1 pending certification
- 15 certified processing plants and 1 pending certification

The certified hatcheries and farms are all large scale operations, hence indicating that the standards are either poorly applicable to small-scale shrimp producers or are not of interest to them. As the standards for Pangasius were issued only in August 2010, it is plausible to think that this is the main reason for the lack of GAA/BAP certification among Pangasius enterprises. The assessment of the coverage of the standards by the Vietnam legislation revealed that a great proportion (61 percent) of the GAA/BAP shrimp standards overlaps either in full or partially with the existing legislation.

Degree of overlapping between the GAA/BAP shrimp standards and the Vietnamese legislation

Issue	**No. Standards**	**No**	**Partial**	**Yes**	**% partial or full coverage by the law**
Property Rights and Regulatory Compliance	**3**	0	2	1	**100%**
Community Relations	**2**	1	0	1	**50%**
Worker Safety and Employee Relations	**11**	6	3	2	**45%**
Mangrove Conservation and Biodiversity Protection	**4**	2	1	1	**50%**
Effluent Management	**2**	0	2	0	**100%**
Sediment Management	**3**	0	1	2	**100%**
Soil/Water Conservation	**4**	1	2	1	**75%**
Postlarvae Sources	**2**	1	0	1	**50%**
Storage and Disposal of Farm Supplies	**7**	4	1	2	**43%**
Drug and Chemical Management	**5**	1	1	3	**80%**
Microbial Sanitation	**3**	1	1	1	**67%**
Harvest and Transport	**3**	2	0	1	**33%**
TOTAL	**49**	**19**	**14**	**16**	**61%**

A similar proportion of overlapping (62 percent) was identified when analysing the Pangasius standards.

Degree of overlapping between the GAA/BAP shrimp standards and the Vietnamese legislation

Issue	No. Standards	No	Partial	Yes	% partial or full coverage by the law
Community					
Property Rights, Regulatory Compliance	**3**	0	3	0	**100%**
Community Relations	**3**	2	0	1	**33%**
Worker Safety, Employee Relations	**14**	7	4	3	**50%**
Environment					
Wetland Conservation, Biodiversity Protection	**8**	3	0	5	**63%**
Effluent Management	**3**	0	2	1	**100%**
Sludge Management	**3**	1	1	1	**67%**
Soil, Water Conservation	**5**	3	0	2	**40%**
Fishmeal, Fish Oil Conservation	**4**	4	0	0	**0%**
Control of Escapes, Use of GMOs	**5**	2	0	3	**60%**
Storage, Disposal of Farm Supplies	**8**	5	0	3	**38%**
Animal Welfare	**7**	2	4	1	**71%**
Food safety					
Drug, Chemical Management	**7**	1	0	6	**86%**
Microbial Sanitation, Biosecurity	**4**	0	0	4	**100%**
Harvest and Transport	**7**	1	0	6	**86%**
Traceability					
Record-Keeping Requirement	**1**	0	1	0	**100%**
TOTAL	**82**	**31**	**15**	**36**	**62%**

The cost of complying with the GAA/BAP standards of course depends on the status of each farm. As the standards appear to cover largely the legality of a farm it is expected that these costs are relatively limited. Concerning the costs of auditing, according to a review conducted by MRAG in 2009, for a shrimp farm these appear to be USD 500 for registration fee, USD 3,000 for annual inspection fee and an annual certification fee of a minimum of USD500.

There appear to be no financial benefits (e.g. premium prices) associated with GAA/BAP certification. Hence farms appear to be obtaining certification primarily to maintain market access and in response to buyer requirements.

Dialogue established

A meeting was organised between the Deputy Director of D-Fish, Dr Pham Anh Tuan, and the president of the GAA, George Chamberlain. George Chamberlain visited Vietnam to promote GAA/BAP certification. He also met Dr Tuan, although such encounter was not planned. Highlights of the dialogue between MARD and GAA include:

- There is a strong willingness by GAA to work with MARD
- GAA proposed to MARD the implementation of training activities on BAP certification similar to the ones conducted by GAA in Malaysia with support by the Malaysian government and as part of the "Proposal to Enhance the Food Safety and Sustainability of Malaysian Aquaculture through BAP Certification" submitted by GAA and the ACC to the Malaysian government
- GAA invited Dr Tuan to attend the Global Outlook for Aquaculture Leadership (GOAL) meeting to be held in Kuala Lumpur (Malaysia) on 17-20 October 2010

- GAA suggestions were accepted favourably by Dr Tuan who showed throughout this dialogue great interest in joining efforts with schemes like GAA/BAP, although he recognised that the GAA/BAP standards, similar to others, may be too demanding for the Vietnamese aquaculture sector as a whole.

GLOBALGAP

Overview

GLOBALGAP, formerly EurepGAP, is a private sector organisation that sets voluntary standards for the production of a wide range of products agriculture and aquaculture products. The program was initiated in 1997 by Eurep, a group of European retailers, and was aimed at standardising retailers' requirements on agriculture producers, hence reducing the overall cost of certification.

GLOBALGAP standards are organised within a hierarchical structure, with All Farm standards applicable to all the farms, Crop Base, Livestock Base and Aquaculture Base standards for the 3 product categories and species group specific standards which for aquaculture cover salmonids, shrimp, Pangasius and tilapia. Although the aquaculture standards are at present separated by species group, the latest draft of the standards submitted in the middle of 2010 for public comments envisioned the merging of the 4 sets of standards for aquaculture into a single Aquaculture Module which was posted for public comments in October 2010.

GLOBALGAP Risk Assessment on Social Practice (GRASP) standards have also been developed. This module is a "Major Must" and hence needs to be complied with by all farms seeking GLOBALGAP certification. Standards for the aquaculture species have been developed by working groups, who then submit the standards to the Aquaculture Sector Committee who then finalises them. GLOBALGAP standards have a very broad coverage and include hundreds of control points on food safety, workers' welfare, local communities' consultation, environment and conservation and fish welfare.

Certification is conducted by more than one hundred third party certification bodies, although not all of these are accredited for the aquaculture scope. GLOGALGAP offers also certification to farmer groups. This option was designed to allow small-holders accessing certification. To access group certification, farmers must establish an Internal Control System (ICS). GLOBALGAP, with the support of GTZ, also produced small-holder manuals to assist farmers in the process of obtaining group certification.

GLOBALGAP offers also a benchmarking service, through which existing standards can be submitted to GLOBALGAP and, if suitable, can obtain an equivalency status to GLOBALGAP. Examples of GLOBALGAP equivalent standards are ThaiGAP (see below) and ChinaGAP. GLOBALGAP is a Business to Business (B2B) scheme, meaning that standards do not lead to a label on the product.

Being an initiative promoted by an association of European retailers (i.e. Eurep), GLOBALGAP receives great support from those retailers, for whom at least some products (e.g. fruit and vegetables) must be GLOBALGAP certified to obtain access to their customers.

Status in Vietnam

The GLOBALGAP website does not report the name/number of aquaculture farms being certified. However an October 2010 GLOBALGAP press release declared that GLOBALGAP standards (including standards for crops, livestock and aquaculture) are implemented in more than 100,000 farms located in more than 100 countries worldwide.

A search for information reveals that, as per September 2010, in Vietnam only a large scale shrimp farm and nine large scale Pangasius farms are GLOBALGAP certified. All the respondents to the questionnaire declared that the benefits they received were either nil or less than expected. All the respondents however declared being happy with the choice to get GLOBALGAP certified as compliance to their standards improved their farming operation and/or quality of their products.

The assessment of the coverage of the standards by the Vietnamese legislation was conducted on two sets of standards: All Farm (to be applied by all the farms willing to be certified as GLOBALGAP compliant) and Aquaculture Base (to be applied to all aquaculture farms). Over half of the All Farm standards (i.e. 56 percent) were covered either in part or fully by the legislation.

Degree of overlapping between the GLOBALGAP All Farm standards and the Vietnamese legislation

Issue	No. Standards	No	Partial	Yes	% partial or full coverage by the law
Record keeping and internal self-assessment/internal inspection	**4**	3	1	0	**25%**
Site history and site management					
Site History	**2**	1	1	0	**50%**
Site Management	**2**	0	2	0	**100%**
Workers health, safety and welfare					
Risk Assessments	**2**	0	2	0	**100%**
Training	**8**	8	0	0	**0%**
Hazards and First Aid	**5**	0	1	4	**100%**
Protective Clothing/Equipment	**2**	0	0	2	**100%**
Worker Welfare	**5**	2	2	1	**60%**
Subcontractors	**1**	1	0	0	**0%**
Waste and pollution management, recycling & re-use					
Identification of Waste and Pollutants	**1**	1	0	0	**0%**
Waste and Pollution Action Plan	**4**	1	2	1	**75%**
Environment and conservation					
Impact of Farming on the Environment and Biodiversity	**3**	0	3	0	**100%**
Unproductive Sites	**1**	1	0	0	**0%**
Energy Efficiency	**1**	1	0	0	**0%**
Complaints	**2**	0	1	1	**100%**
TOTAL	**43**	**19**	**15**	**9**	**56%**

The proportion of overlapping was even higher (66 percent) when the Aquaculture Base standards were analysed.

Degree of overlapping between the GLOBALGAP Aquaculture Base standards and Vietnamese legislation

Issue	N. Standards	No	Partial	Yes	% partial or full coverage by the law
Site management					
Documentation	**5**	4	1	0	**20%**
Site Access	**2**	2	0	0	**0%**
Reproduction					
Brood stock sources	**6**	0	2	4	**100%**

Issue	N. Standards	No	Partial	Yes	% partial or full coverage by the law
Broodstock specification	**2**	2	0	0	**0%**
Seedlings Sources	**5**	1	1	3	**80%**
Animal welfare, management and husbandry at hatcheries	**7**	2	1	4	**71%**
Brood Fish Stripping	**3**	3	0	0	**0%**
Feed at hatcheries	**1**	1	0	0	**0%**
Fingerling movement (if done in containers)	**1**	0	1	0	**100%**
Chemicals					
Chemical Storage	**9**	5	0	4	**44%**
Empty Containers and Non-used Chemicals	**3**	1	2	0	**67%**
Transport of Chemicals	**1**	0	1	0	**100%**
Occupational health and safety					
Training	**2**	1	1	0	**50%**
Health and Safety	**4**	0	4	0	**100%**
Legislative Framework	**3**	2	0	1	**33%**
Fish welfare, management and husbandry					
Sourcing, Identification and Traceability	**6**	0	6	0	**100%**
Fish Health & Welfare	**13**	0	13	0	**100%**
Treatments	**8**	1	6	1	**88%**
Treatment Records	**4**	0	2	2	**100%**
Vaccination	**4**	2	2	0	**50%**
Mortality	**4**	0	4	0	**100%**
Net Pens- Inspection, Maintenance & Repair	**4**	2	2	0	**50%**
Ponds	**3**	1	2	0	**67%**
Pond fertilization and maintenance	**4**	2	2	0	**50%**
Biosecurity	**10**	0	9	1	**100%**
Condition of Boats	**1**	0	1	0	**100%**
Machinery and Equipment	**4**	4	0	0	**0%**
Harvesting					
Method of Packing / Dispatch	**4**	0	3	1	**100%**
Labelling / Traceability of Harvested Fish	**3**	1	2	0	**67%**
Stunning and Bleeding	**5**	5	0	0	**0%**
Blood waters	**1**	0	1	0	**100%**
Sampling and testing	**3**	**3**	**0**	**0**	**0%**
Feed management					
General	**5**	0	5	0	**100%**
Feed Records	**10**	6	3	1	**40%**
Storage of Aquaculture Feeds	**4**	2	2	0	**50%**

Issue	N. Standards	No	Partial	Yes	% partial or full coverage by the law
Pest control	**1**	**1**	**0**	**0**	**0%**
Environmental and biodiversity management					
Environmental Management	**9**	1	8	0	**89%**
Energy Use	**1**	1	0	0	**0%**
Effluent	**2**	0	2	0	**100%**
Predator Control	**3**	1	2	0	**67%**
Escapes and Non-Indigenous Species	**3**	1	2	0	**67%**
High Conservation Value Areas	**7**	5	0	2	**29%**
Water usage and disposal					
General	**6**	1	5	0	**83%**
Supply / Quality of Ice	**1**	0	0	1	**100%**
Social criteria	**1**	**0**	**1**	**0**	**100%**
TOTAL	**188**	**64**	**99**	**25**	**66%**

Answers provided by large-scale (ranging between 6 and 45ha in area) GLOBALGAP certified Pangasius farms revealed significant investment costs ranging between USD 3,333 and USD 4,138/ha or between USD4 and USD10/t of production. Costs for audits ranged from USD 4,000 to USD 12,500, including also the cost associated with employing a consultant, which was specified in one case to be USD 7,500. The annual cost for renewing certification was reported to be between USD 2,800 and USD 7,000.

The majority of farmers expected premium prices for certified products, especially because compliance to the standards was reported to be associated with the conversion of 20 percent of the farm into an un-productive sedimentation area. However, only 1 farm reported receiving premium prices which were lower than expected (i.e. 7 percent above the conventional price).

Dialogue established

Upon contact with GLOBALGAP, the GLOBALGAP secretariat suggested initiating dialogue through the Vietnam Association of Seafood Exporters and Producers (VASEP), as they had offered to coordinate the GLOBALGAP National Technical Working Group for Vietnam. In spite of several attempts, the responsible VASEP staff did not engage in dialogue on GLOBALGAP, although D-Fish had ongoing dialogue with VASEP on other matters.

Aquaculture Stewardship Council and the Aquaculture Dialogues

Overview

Since 2004, the World Wildlife Fund (WWF) has been coordinating the Aquaculture Dialogues (AD) aimed at the development of aquaculture standards to minimise the environmental and social impacts of aquaculture. Following years of search for a suitable certification scheme to act as the "home" for the AD standards, during which extensive consultation was conducted with the Marine Stewardship Council (MSC), in January 2009 WWF, together with the Dutch Sustainable Trade Initiative (IDH) decided to support the establishment of the ASC. The ASC is expected to be fully operational in 2011.

The process of standard development is in the hands of the AD. The Tilapia AD issued standards in November 2009, which the Pangasius AD and the Bivalve AD published their standards in August 2010. The Shrimp AD (ShAD) is still under development, as are other five ADs for salmon, freshwater trout, abalone and cobia/seriola. Although certification bodies are yet to be accredited to certify for the ASC standards, in

September 2010 the ASC announced the appointment of Accreditation Services International (ASI) as the organisation in charge of accrediting certification bodies to certify for the ASC/AD standards. It is envisioned for certified farms to be allowed to apply an ASC label on products from certified farms.

As an interim arrangement, the WWF also signed a MoU with GLOBALGAP to use the GLOBALGAP accreditation/certification mechanism to assess conformity to the AD standards, leading to a so called GLOBALGAP Plus certificate. As this is part of GLOBALGAP, GLOBALGAP Plus certification will not be visible to consumers, hence it will remain B2B certification. Being supported by WWF, the ASC has been receiving huge support from retailers and seafood buyers who have ongoing "sustainability partnerships" with WWF, showing that ASC compliance will be requested by several markets including Europe (primarily Western Europe), North America, Australia and Japan.

Coverage of the Scheme

The ASC/AD standards are grouped under principles (7 for shrimp and Pangasius) and criteria under those. Principles cover a wide range of issues including environmental performance, employees' conditions, local communities' rights, animal health, animal welfare and food safety. Food safety is also covered through a partnership between the ASC and the Global Food Safety Initiative (GFSI).

Status in Vietnam

As the ASC/AD standards for tilapia, Pangasius and bivalves were recently issued and the standards for shrimp are still under development, so far there are no certified farms in Vietnam.

The AD standards are developed through a very inclusive process, through which a thorough stakeholder engagement is conducted (in compliance with the ISEAL Code). As such the applicability of the standards, which are designed to identify the top 15-20 percent of top performers and to lead to a shift of the whole industry, is likely to be considerable. The ASC/AD associate membership to ISEAL also makes this the only aquaculture scheme with a true system for the monitoring of actual impacts on the intended targets. Having said that, a report issued by WWF Vietnam in September 2010 indicated that the shrimp standards, in spite of the participation of Vietnamese stakeholders in the process, in their 1st draft would not be applicable to small-scale shrimp producers in Vietnam. A second draft is under development and is expected to be posted for public comments in November 2010.

As the Shrimp Aquaculture Dialogue standards are not yet completed, a comparison between the ASC/AD standards was conducted only on the Pangasius standards. This assessment revealed that the degree of partial or full overlapping was lower compared with other sets of standard (i.e. 42 percent) and was due largely to the social/worker's welfare standards.

Degree of overlapping between the ASC/AD Pangasius standards and Vietnamese legislation

Issue	**No. Standards**	**No**	**Partial**	**Yes**	**% partial or full coverage by the law**
Legal compliance					
Local and national regulations	**4**	2	1	1	**50%**
Land and water use					
Meeting official development plans	**1**	0	0	1	**100%**
Conversion of natural ecosystems	**4**	4	0	0	**0%**
Site connectivity	**4**	3	0	1	**25%**
Water use	**2**	2	0	0	**0%**
Water pollution and waste management					
Nutrient utilization efficiency	**4**	2	2	0	**50%**

Issue	No. Standards	No	Partial	Yes	% partial or full coverage by the law
Measuring water quality in receiving water body	**1**	1	0	0	**0%**
Measuring quality of pond effluents	**3**	2	0	1	**33%**
Sludge disposal for ponds and pens, not cages	**2**	0	2	0	**100%**
Waste management	**4**	0	4	0	**100%**
Energy consumption	**1**	1	0	0	**0%**
Genetics					
Presence of Pangasius in the water drainage system	**3**	3	0	0	**0%**
Genetic diversity	**1**	1	0	0	**0%**
Source of seed	**1**	1	0	0	**0%**
Genetically engineered and hybridized strains	**1**	1	0	0	**0%**
Escapees	**4**	2	2	0	**50%**
Pond maintenance as part of escapee management	**2**	1	0	1	**50%**
Feed management					
Sustainability of feed ingredients	**6**	6	0	0	**0%**
Efficient management of feed use on the farm	**2**	2	0	0	**0%**
Health management, veterinary medicines and chemicals					
Mortalities	**1**	1	0	0	**0%**
Veterinary medicines and chemicals	**7**	3	2	2	**57%**
Pangasius health plan	**1**	1	0	0	**0%**
Holding-unit specific record-keeping	**4**	0	4	0	**100%**
Fish welfare	**3**	3	0	0	**0%**
Predator control	**2**	2	0	0	**0%**
Social responsibility and user conflicts					
Labour law	**1**	0	0	1	**100%**
Child labour and young workers	**2**	1	0	1	**50%**
Forced and compulsory labour	**1**	0	0	1	**100%**
Health and safety	**4**	2	0	2	**50%**
Freedom of association and collective bargaining	**1**	0	0	1	**100%**
Discrimination	**1**	0	0	1	**100%**
Discrimination	**1**	0	0	1	**100%**
Working hours	**4**	0	0	4	**100%**
Fair and decent wages	**3**	2	0	1	**33%**
Labour contract	**3**	0	0	3	**100%**
Management systems	**5**	3	1	1	**40%**
Record-keeping	**1**	1	0	0	**0%**
Participatory social impact assessment for local communities	**2**	1	1	0	**50%**

Issue	No. Standards	No	Partial	Yes	% partial or full coverage by the law
Complaints by local communities	**3**	3	0	0	**0%**
Preferential employment for local communities	**2**	2	0	0	**0%**
TOTAL	**102**	**59**	**19**	**24**	**42%**

As there are no Pangasius or shrimp ASC/AD certified farms, actual costs and benefits could not be assessed.

Dialogue established

In spite of several efforts, no meeting could be organised with the ASC Development Director. As the process of Pangasius AD development was in fact completed by June 2010, no engagement could be made between the Pangasius AD and MARD. However, through several discussions, the Global Steering Committee (GSC) managing the process of ShAD standards development accepted Dr Tuan (MARD), as a member of the GSC, sharing a seat with Flavio Corsin (ICAFIS). This represents a major achievement as it is the first time a high ranking government official from a top (3rd globally) aquaculture producing country becomes actively involved in a major voluntary aquaculture scheme. This achievement indicates both the eagerness of MARD to be engaged in global aquaculture sustainability processes and the openness of the AD process. Dr Tuan also participated in several discussions conducted at the GSC meeting held in Paris between the 28th September and the 1st October 2010.

Highlights of the dialogue between MARD and the ShAD include:

- There was some degree of suspicion by some GSC members on whether the agenda of a government agency like MARD may be to get all the producers in their country certifiable. For this reasons the GSC required MARD and ICAFIS to sign a MoU clearly stating that MARD and ICAFIS would accept a set of standards that would exclude all the Vietnamese producers, if exclusion was based on performance-based, sustainability consideration (see Annex C).
- It is important for the ShAD standards to allow for the use of Genetically Modified Organisms (GMO) in feed, as banning them as part of the standards would directly conflict with the plan of the Government of Vietnam to promote the production of GM seed and crops.

<u>FAO Aquaculture Certification Guidelines</u>

Responding to concerns expressed by governments on the rapid proliferation of voluntary aquaculture certification, in March 2007 the FAO opened in Bangkok the process of developing Technical guidelines on aquaculture certification. The scope of these guidelines was to provide “guidance for the development, organization and implementation of credible aquaculture certification schemes”. As such, the guidelines are directed to entities that develop and/or implement a certification scheme applicable to the aquaculture sector and are involved with one or more of the following: standard setting, accreditation and certification.

The process of developing such technical guidelines continues to date. The last Technical Consultation for the development of the guidelines was held in Rome in February 2010. It would appear as if the process has now almost reached completion, with the guidelines having been approved by the Committee on Fisheries (COFI) Sub-Committee on Aquaculture during its Fifth Session, which was held on 27 September – 1 October 2010 in Phuket, Thailand. Although these are still early stages, it is likely that the aquaculture certification guidelines will be used to benchmark and/or assess the quality of certification schemes as it has been done for the capture fisheries sector using the FAO “Guidelines for the ecolabelling of fish and fishery products from marine capture fisheries”.

The FAO Technical Guidelines on Aquaculture Certification cover several aspects of certification, including the governance of a scheme, standard setting, accreditation and certification. They also provide minimum substantive criteria for four areas of coverage: animal health and welfare; food safety; environmental integrity; socio-economical aspects. While covering socio-economical aspects is optional, all other three areas of coverage should be included in an aquaculture certification scheme.

The guidelines are **not meant for auditing**, hence are sometimes rather general in their statements, arguably making all the main aquaculture certification schemes compliant with them. On the contrary, the sections on the governance of aquaculture certification schemes make clear reference to international documents on standard setting, accreditation and certification. The clear reference to some International Organization for Standardization (ISO) Guides and to ISEAL, requiring among others true stakeholder engagement and transparency, would arguably make only the ASC/AD compliant to the guidelines.

The guidelines also clearly call for efforts towards avoiding the exclusion of farmers based on scale, referring to the need of aquaculture certification to be applicable to small-scale producers. Among the three main aquaculture certification schemes, true efforts to engage with small-scale producers were arguably conducted only by the ASC/AD, although, at least in the case of the shrimp standards, these remain poorly applicable to the small-scale producer sector.

As an intergovernmental effort the guidelines have received strong support from governments in the region. For example the first meeting for their development was co-hosted by the Thai Department of Fisheries (DOF). As the guidelines were approved only recently (October 2010), hence their uptake by governments and private certification schemes can only be supposed. The guidelines have however the potential to act as a key benchmarking tool for aquaculture certification schemes.

ASEAN Shrimp Good Aquaculture Practices

The ASEAN Shrimp Alliance (ASA) is a government lead effort aimed at developing a harmonised set of GAP for shrimp aquaculture to be applied by ASEAN countries. An initiative started in June 2006, the ASA was recently "revived" under the leadership of the Thai Department of Fisheries (DOF), who hosts the ASA secretariat. The Thai DOF has arguably developed the most advanced government promoted mechanism of aquaculture certification, hence justifying their leadership role. Although this is largely a government effort, sector/producer organisation such as the Vietnam Fishery Society (VINAFIS) and international organisation are also invited. The ASA is said to be supported by FAO and NACA.

The ASEAN shrimp alliance held its second meeting in Bangkok in May 2010, following two Regional Expert Group meetings of the ASEAN Shrimp Alliance, which were held in September 2009 and March 2010. The ASA GAP is referred as a "standard" meant to be practical for shrimp farmers in the ASEAN region. This effort follows the ASEAN Economic Community Blueprint, which recognises the importance of GAP in enhancing intra and extra ASEAN trade and competitiveness. Reference is also made to the fact that current independent certification efforts have created difficulties to shrimp farmers in the region.

The ASA states that the FAO Technical Guidelines on Aquaculture Certification, which as stated above is also largely a government-led effort, should be used as a reference in the development of the GAP. This is stated to be an effort aimed at developing voluntary standards. Although still under development, ASA members believe that at the initial stage the certification scheme of the ASEAN Shrimp GAP should follow the national certification schemes.

The ASA is largely inspired by a previous ASEAN effort, through which ASEAN Good **Agricultural** Practices (ASEANGAP) were developed (see below).

The latest draft of the ASEAN Shrimp GAP covered a wide range of issues as follows:

- food safety and quality
- environmental integrity
- socio-economic aspects
- animal health and welfare

These GAP will most likely not lead to a true certification scheme, but possibly to a tool aimed at harmonising ASEAN national GAP programs, i.e. similarly to its agriculture counterpart (see below).

An assessment of the coverage of the ASEAN GAP for shrimp by the Vietnamese law highlighted considerable overlapping, with more than three quarters of the standards (i.e. 76 percent) being covered either partially or fully by the law.

Degree of overlapping between the ASEAN GAP shrimp standards and the Vietnamese legislation

Issue	**No. Standards**	**No**	**Partial**	**Yes**	**% partial or full coverage by the law**
Food safety and quality					
Drug/Chemical/Probiotic	**3**	0	2	1	**100%**
Water	**1**	0	0	1	**100%**
Seed and Broodstock	**1**	0	0	1	**100%**
Feed	**1**	0	0	1	**100%**
Management	**3**	0	3	0	**100%**
Environmental integrity	**17**	6	5	6	**65%**
Socio –economic aspects	**10**	3	3	4	**70%**
Animal health and welfare	**9**	2	7	0	**78%**
TOTAL	**45**	**11**	**20**	**14**	**76%**

ASEAN Good Agricultural Practices

ASEANGAP was developed under the ASEAN-Australia Development Cooperation Program and was launched in 2006 with the objective of harmonising GAP programs for fresh fruits and vegetables in ASEAN countries. ASEANGAP is a voluntary scheme covering not only food safety and quality, but also environmental management and workers' safety and welfare. Certification for ASEANGAP compliance is conducted by the national authorities in each ASEAN country. ASEANGAP also offers an opportunity for national programs to be benchmarked.

In 2009 the Ad-Hoc Task Force on ASEANGAP met to develop a regional strategy to facilitate the implementation of ASEANGAP. At the meeting ASEANGAP was presented as a "flagship initiative" to enhance competitiveness of ASEAN agriculture products. However, the need to create awareness, promote implementation and raising recognition for ASEANGAP in the marketplace were also recognised.

At present, there is no evidence that the implementation of ASEANGAP by farmers leads to any actual benefits such as premium prices, improved market access or financial incentives such as improved access to credit or insurance. It is however possible that national schemes benchmarked or inspired to the ASEANGAP (e.g. VietGAP, ThaiGAP) do offer such benefits. This was beyond the scope of this assessment, although this report was expanded to include at least Vietnamese experiences.

Experiences from Government Aquaculture Certification Schemes in the Region

Two rather different examples of national aquaculture certification schemes promoted by the government are reviewed here.

Thai Quality Shrimp: Good Aquaculture Practices and Code of Conduct

The first and most developed government-promoted scheme for aquaculture certification is arguably the Thai Quality Shrimp scheme, through which better practices were developed to cover safety, health and environmental protection (GAP) and social issues in addition to more links in the value chain (Code of Conduct, COC).

The Thai GAP program was promoted by the Thai DOF and should not be confused with ThaiGAP, which is a program primarily for agriculture products. The Thai program is now applicable to several aquaculture species groups and is now applied to the majority of aquaculture enterprises. The program is actively promoted by DOF, who is currently also in charge of farm certification although efforts are being made to involve third party (independent) certifiers. A cost benefit analysis commissioned by FAO/APFIC revealed that the benefits of the scheme are arguably limited. In addition, although some seafood buyers have expressed interest in buying certified products because of their alleged higher likelihood to being in compliance with food safety requirements, no buyers or retailer expressed concrete interest in the scheme, making this effort recognised almost uniquely on the domestic market.

Hong Kong Accredited Fish Farm Scheme

Hong Kong is a major seafood consuming country, importing seafood from several South-East Asian countries. In 2005, the Agriculture, Fisheries and Conservation Department set up the Accredited Fish Farm Scheme (AFFS), which is designed to certify HK farms using food safety and environmental protection criteria. Standards and certification are managed directly by the government and only HK based farms are eligible for AFFS certification.

The AFFS is a good example of how a voluntary certification scheme can allow consumers to recognise domestically produced products, which are perceived as being safer and more sustainable. Through this mechanism local products can be promoted as different from imported products, hence boosting the local economy.

Experiences from the implementation of voluntary agriculture standards

VietGAP

To improve the safety and quality of Vietnamese agriculture products and, according to some, to the Vietnamese Academy of Agricultural Sciences (VAAS) also to "overcome the food safety assurance disadvantages in its domestic and export markets" , MARD decided to develop a Vietnam Good Agriculture Practices (VietGAP) system. VietGAP was launched in 2008 and was largely based on the ASEANGAP. Similarly to ASEANGAP, VietGAP covers four components, namely:

- Food safety
- Environmental management
- Workers health, safety and welfare
- Produce quality

Although launched in 2008, in 2007 the Prime Minister had already issued Decision 107, promoting the implementation of VietGAP for safe vegetable, fruit and tea. The decision included also a plan for implementation, i.e. to reach 20-25 percent VietGAP compliance by 2010 and 100 percent compliance by 2015. The plan envisioned implementation to be supported financially by a combination of central government and provincial/city budget, although the responsibility for implementation rested largely on the provinces/cities.

VietGAP was established recently. Although an assessment of the standards is beyond the scope of this study, the scheme is sometimes criticised for not providing true benefits to farmers. Farmers do receive training on VietGAP which is beneficial to them as such training assist them in improving production practices. However, although there have been some report of premium prices paid to farmers (e.g. for lychees), most farmers do not appear to have access to financial benefits (e.g. easier access to credit), perhaps because most often there is a lack of buyer's commitment to buying VietGAP certified products at premium prices.

As auditing and certification are conducted by government agencies (i.e. not 3rd party independent certifiers), there is also a perception that VietGAP does not provide a true guarantee of higher safety/quality to buyers. This is witnessed by an assessment conducted by FreshStudio on the "certification" preferences of Metro consumers, who appeared to believe that VietGAP was not credible enough and who preferred a "MetroGAP" specifically designed to their needs.

GLOBALGAP for agricultural products

In Vietnam, GLOBALGAP implementation in agriculture has been promoted for a wide range of products including grapefruit, dragon fruit, rambutan and rice. Experiences in the implementation of GLOBALGAP standards in Vietnamese agriculture are mixed. There have been a number of reports of farmers complaining for limited benefits in comparison with the investment made. However, there are also reports of premium prices being paid to some GLOBALGAP certified products such as grapefruit from Vinh Long province and rambutan from Ben Tre. It is widely recognised that buyers' demand is instrumental for success, hence farmers could ripe the expected benefits only when clear agreements and partnership had been established between the buyers and the farming communities.

ThaiGAP for agricultural products

Although this section is meant to cover primarily Vietnamese experiences, some interesting lessons can be gathered from the application of Good Agriculture Practices (GAP) in Thailand. In 2004, the Department of Agriculture of the Thai government, initiated the development of ThaiGAP, i.e. a set of better practices with the primary target of improving the safety of agriculture production. By 2006, ThaiGAP was applied to 28 different agriculture products, twelve of which target export markets.

In 2003, however, the private sector had already initiated the development of so called "clusters", which included the different players in the supply chain, in addition to government, researchers and other organisations. Clusters were designed at strengthening collaboration within the supply chain, with the objective of improving the quality of production. These private-led efforts resulted in the development of a WesternGAP (as the cluster approach was initiated in the Thai western region). The name "WesternGAP" was later dropped and replaced by "ThaiGAP", i.e. using the same name as the government ThaiGAP program.

In 2007, the private ThaiGAP and entered the GLOBALGAP benchmarking process and successfully completed it. Hence in Thailand at present there is a private ThaiGAP which received the recognition of the value chain and is equivalent to GLOBALGAP. In addition, there is a government ThaiGAP which is promoted through training by the government but receives limited buy-in from the private sector and is *not* equivalent to GLOBALGAP. This situation was reported to create significant confusion among producers. Several stakeholders appear to recognise the need to harmonise efforts, instead than pursuing 2 different paths.

<u>Links between voluntary aquaculture certification and trade agreements</u>

Over the years, the government of Vietnam engaged in a number of trade agreements, both individually or as a member of ASEAN. The following Free Trade Agreements (FTA) of relevance where signed:

- Agreement Between the USA and Vietnam on Trade Relations, 2000
- Agreement on Trade in Goods Under the Framework Agreement on Comprehensive Economic Cooperation Among the Governments of the Member Countries of ASEAN and the Republic of Korea, 2006
- Trade and Investment Framework Agreement between the Government of the USA and Vietnam, 2007
- Agreement on Trade in Services of the Framework Agreement on Comprehensive Economic Co-operation between ASEAN and China, 2007
- Agreement on Comprehensive Economic Partnership among Member States of ASEAN and Japan, 2008
- Agreement between Japan and the Socialist Republic of Viet Nam for an Economic Partnership, 2008
- Agreement Establishing the ASEAN-Australia-New Zealand Free Trade Area, 2009
- Agreement on Trade in Goods Under the Framework Agreement on Comprehensive Economic Cooperation between ASEAN and India, 2009

- ASEAN Trade in Goods Agreement, 2009

Although this is not meant to be a fully inclusive list of trade agreements it highlights the breadth of bilateral and multilateral trade relationships. None of the above agreements explicitly requested a Party to comply with environmental or social practices or conditions.

Cooperation on issues of relevance to the environment is however promoted in ASEAN/ANZ, ASEAN/Japan and Vietnam/Japan agreements. The ASEAN/ANZ agreement declares its support to sustainable economic development. The 2007 USA/Vietnam trade agreement includes the following statement: “Desiring to ensure that their trade and environmental policies mutually promote sustainable development” and it is said to consider also “Issues related to internationally recognised labour rights”. Although the above statements do not appear to exert any pressure on Vietnam to strengthen its environmental or social/labour policies, they show that such issues are becoming increasingly important in the international trade arena.

Although often considered unfounded, there have been occasional claims stating that Vietnam can produce its seafood more cheaply primarily because it does not enforce environmental and social practices comparable to the ones enforced in importing countries, hence allegedly competing “unfairly” with domestic production. Discussing the validity of such claims is beyond the scope of this study. However, it would appear likely that such claims will lead to the gradual incorporation of such issues into trade agreements.

There are already important signs showing that sustainability issues are increasingly considered within trade agreements. The Generalised System of Preference (GSP), a WTO compliant mechanism that allows tariff reductions for developing countries, includes such conditions. The GSP issues by the EU in 2008 for the period between 2009 and 2011 clearly states the need of countries to comply with a long list of convention on society and environment, including the UN/International Labour Organization (ILO) conventions and the Convention of Biological Diversity (CBD).

3. Conclusions and Recommendations

Is there a place for voluntary aquaculture certification in Vietnam?

From the analyses conducted it would appear as if voluntary aquaculture certification is “here to stay”. Voluntary certification and the Vietnamese legislation often overlap, although the degree of overlapping varies considerably between different sets, with ASEAN GAP have more than three quarters of the standards covered by the law and the ASC/AD overlapping only on 43 percent of the standards.

In spite of this overlapping, which may indicate that voluntary standards are unnecessary or adding little to the existing legislation, it must be noted that legislation and voluntary standards have different objectives:

- Vietnamese legislation is meant to protect the interests of Vietnam and its people, in terms of production practices, environmental protection, social responsibility and protecting the image and the market access of the country’s products.
- On the contrary, voluntary certification provides additional reassurance to the buyers/consumers that specific practices or performance levels have been followed. They can cover externalities (e.g. the impact of aquaculture in Vietnam on global capture fisheries) but also provide additional reassurance on the fact that, for example, food safety risks have been further reduced. Voluntary standards also allow for “cross-border” standardisation of practices.

A question comes to mind: “Is it a matter of trust?” Partially, yes. Several of the people consulted believed that:

- Laws were sometimes difficult to implement because of the extremely large number of producers;
- A government-led certification program which is audited by government agencies is less trustworthy than a government-led program which is audited by third party certification bodies.

However it is not only a trust issue. Voluntary standards cater for different stakeholders (i.e. they focus on the consumer/buyer views). They are also perceived as being more independent as the actual standards are not owned by a producer or producing country. It is important not forget that all certification schemes require compliance to the law, hence they are perceived as providing assurance that: the law has been followed & additional practices to ensure product safety/quality have also been conducted. Looking at European agriculture producers, for example, we see that they are required by most of the top European retailers to comply with GLOBALGAP. Does it mean that European retailers do not trust European governments? Probably not. Rather, it is just a matter of providing a broader coverage and homogeneous requirements. This however shows that, in some cases, most producers in a country may be required to comply with a voluntary set of standards (in this case GLOBALGAP) to have access to a specific market.

Certification or not certification?

Will the above scenario, with virtually all producers in a country complying with a set of voluntary standards, happen also in Vietnam? Probably not in the near future, as the number of certification schemes and the breadth of markets (and market demands) will still allow for the marketing of conventional products. As the costs of certification are considerable and the benefits appear to be most often limited to improved market access, at present farmers should implement standards and incur the costs of certification only when there is a clear market demand or premium prices (although these are likely to occur only for the so called “first-movers”, i.e. the first achieving compliance to a specific certification scheme).

Voluntary certification and market demand for compliance to standards will however become increasingly stronger in the years to come. The need of retailers to show so-called Corporate Social Responsibility (CSR), will mean that more and more retailers will request “sustainable” certified products. The increasingly multinational nature of retailers and the raising awareness of consumers globally on sustainability issues will also mean that gradually compliance to voluntary certification schemes will in fact be “mandatory” to access certain markets. South African buyers for example are already interested in ethical products (e.g. fair-trade), showing a trend towards recognising the value of voluntary certification. Compliance to voluntary certification will become the norm, although it will take a considerable amount of time before this represent a true market-access threat for most Vietnamese aquaculture producers.

It is however reasonable to think that, given the fact that GLOBALGAP is a scheme recognised primarily on the European market and that Pangasius producers are operating at a scale in which they could upgrade to becoming compliant relatively easily, not having a GLOBALGAP certificate would make access to the European market increasingly difficult. The ASC may also become gradually an essential requirement to access some markets (e.g. Europe, North America). This trend towards ASC and GLOBALGAP certification in Pangasius will most likely receive a major boost in the near future. In fact, as per November 2010, WWF offices in Europe have been issuing so called seafood guides which score Pangasius as follows:

- ASC and organic Pangasius: Green (sustainable, purchase recommended)
- GLOBALGAP Pangasius: Yellow (acceptable but not ideal)
- Conventional un-certified Pangasius: Red (avoid)

The analysis of such guides is beyond the scope of this report. However their implications and ability to influence the voluntary certification scenario globally appear to be very significant.

Contrary to Pangasius farming, as shrimp farmers are extremely far for compliance to any of the mainstream standards, it is likely that great amounts of “conventional” shrimp will be available in the future and that certified shrimp production in Vietnam will remain a niche.

As the number of producers in Vietnam is in the range of the millions, it is also difficult to think that Vietnam will, with the present farming structure, be capable of implementing any voluntary certification scheme. For that matter, it would be extremely difficult for the government to monitor/enforce any farm level practices, unless these have a direct implication on the product quality (e.g. the use of a chemical which can be detected on the product). It is therefore essential for the sector to organise into producer organisations. This would allow to:

- Have a more limited number of auditable entities (i.e. the producer organisations), hence making it possible for a limited number of auditors to provide certification for a large number of farms
- Reduce the cost of certification as this would be divided among all the farmers in the organisation.
- Ease law enforcement and extension activities, as it is easier to engage with few producer organisations rather than millions of scattered producers
- Generate additional benefits associated with the establishment of producer organisations, e.g. improved advocacy (and often reduced cost of inputs), increased voluntary technical support to be provided by "better" farmers in the organisation, improved access to extension services, etc.

Such an effort should be coordinated by VINAFIS in close collaboration with MARD.

Relationship between the Government and voluntary certification schemes

As discussed above, the role of the government is different from the role of voluntary certification schemes. However, the degree of overlapping highlights the need for synergy. It is unlikely that voluntary certification schemes will be able to rely on the government system for conducting audits. However, as seen in the US, it is possible that governments, for example in importing countries, will join forces with voluntary certification mechanisms and their third party independent auditing systems to provide some sort of "fast-track" for certified product.

It appears increasingly clear that MARD and the Vietnamese government should actively engage and collaborate with voluntary certification schemes, especially to:

- Contribute to the development of standard (e.g. the ASC, GLOBALGAP, GAA), to ensure that the standards are truly applicable to Vietnamese producers.
- Ensure that the voluntary standards do not conflict with the Vietnamese legislation or strategies.
- Ensure that the voluntary standards include issues compliance to which is considered of higher importance by the government.
- Develop mechanisms through which certified value chains have access to a fast-track process to reach the export market.

Should the government also support farmers to comply with voluntary certification standards? As we have seen, there are two separate cost items associated with compliance with voluntary standards: the cost of following the standards (which includes an investment cost and a recurrent cost) and the cost of auditing to demonstrate compliance.

So far, the government has been supporting the sector largely in terms of training, research and improving infrastructures (e.g. irrigation systems). As the government has a responsibility towards all the producers, at present it would be impossible to provide additional financial input to allow producers to comply with voluntary standards. However, the government could set up financing mechanisms (e.g. cheaper loans) to assist farmers in "upgrading" their farm to become compliant to voluntary scheme. This should be done only when either the objective of the voluntary scheme coincide with the government's (e.g. establishment of water effluent or sludge treatment facilities) or there is a concrete risk that resource-limited producers (e.g. small-scale ones) will be excluded from an important market if not complying with such standards (a risk which does not appear to exist at present).

The government could also collaborate with certification schemes in developing training material and programs to ensure that similar messages are delivered. Similarly the government could support research that assist producers in improving their performance (e.g. feeding, survival), which is a key component for example of the ASC/AD standards. Care should however be taken to avoid "advertising" specific certification schemes as farmers could be easily misled. As stated above, farmers should comply with certification standards only when there is a clear market demand.

Concerning the cost of auditing, this should not be covered by the government, as the target should be to help farmers to improve their production practices rather than in demonstrating compliance. The costs associated with auditing and conforming compliance should in fact be paid by the value chain itself. This approach is currently being supported by several organisations such as the Dutch Sustainable Trade Initiative (IDH) and GTZ. MARD may consider "subsidising" the cost of audits if small-scale producers indeed risk to loose access to a market. However, this approach appears to be either not necessary of not sustainable. In fact, in the case of Pangasius there are no real small-scale farmers left and the present small-scale farmers are actually rather large, hence not justifying a government intervention in their favour. On the contrary, shrimp farming is characterised by hundreds of thousands of small-scale producers. If these should be supported to cover the cost of audits, assuming that they are all organised in farmer groups (typically made of 15-25 members), the overall cost will be in the range of 10-20 million USD per year.

There is another way in which the government could benefit from the work conducted by voluntary certification schemes. Some voluntary schemes (e.g. the AD/ASC) undergo a rather thorough multistakeholder process to identify the key issues needing to be addressed to engage in responsible aquaculture production. MARD could review those schemes and select the standards which could effectively be included in legislation. This would have the advantage of:

- Easing the job of MARD officer as they would not need to "reinvent the wheel"
- Show the acceptance of multistakeholder processes
- Ease farmers' access to the specific scheme from which the standards were taken

This approach however should not be taken too far, as making compliance to a certification scheme, e.g. GLOBALGAP, mandatory, even if only to large-scale farms, will pose an unnecessary burden on producers. Plans to enforce GLOBALGAP for large-scale Pangasius farms in 2011 should therefore focus on "cherry-picking" the GLOBALGAP standards that are of most important to the government and not in requiring compliance to the whole scheme. In other words, voluntary certification should be requested/mandated by buyers, not by governments.

To VietGAP or not to VietGAP?

There is a clear trend by the government of Vietnam towards the development and the implementation of government-led voluntary standards, i.e. VietGAP. However, a VietGAP program for aquaculture products is likely not to have any "grip" on the international market. Observations from the implementation of VietGAP to the agriculture sector would seem to indicate that, at present, credibility of the program would be a challenge also on the domestic market. There are, however, benefits in having a VietGAP program which acts as a stepping stone towards compliance to major certification schemes, without unnecessarily burdening the producers.

How to VietGAP?

The role of the government is to develop and enforce legislation. The development of good legislation which is applicable to Vietnamese producers and beneficial to the country as a whole is therefore of utmost importance. Such legislation should be developed, if possible, through broad consultative processes that allow producers' views to be represented. In addition, the law should continue to be developed (as it has often been in the past) following international conventions such as ILO, CBD and others. This will both promote Vietnam within the international community and ease the implementation of voluntary standards which are also inspired and supportive of such conventions (e.g. the ASC/AD standards). Of course enforcement of the developed legislation is essential, especially in view of the fact that trade agreements such as the EU GSP can be withdrawn for example because of serious and systematic violations of the principles laid down in some of these international conventions.

For similar reasons, it is important for any government-led VietGAP for aquaculture to include key legislations (hence making it partially a mandatory scheme) in addition to providing standards that bring farmers closer to compliance to the main certification schemes (hence having a voluntary component). VietGAP standards should be developed in compliance with the FAO guidelines and the ISEAL Code of Good Practice, hence using a transparent and multistakeholder process.

There could be two different approaches for domestically consumed and exported products. *Domestically consumed products* could be submitted to a formal VietGAP certification process. This should be implemented through the adoption of third party independent certification bodies which have been accredited by an independent organisation. Hence certification should not simply be conducted by MARD/DARD. This would create a credible scheme that Vietnamese consumer can use to distinguish between conventional and "sustainable" products. Such a scheme should also allow for farmer group certification, hence improving small-scale producers' access to the certification program. For *export products*, the application of VietGAP should take a more capacity-building approach. On one side it should create awareness on voluntary aquaculture certification. On the other it should help farmers willing to be certified for one of the major schemes, to do this gradually and with some technical assistance. In this case, such technical assistance could be provided directly by MARD/DARD.

The development of an export-oriented VietGAP, even if using third party certification bodies, is highly unlikely to receive the buyers' recognition to provide true benefits to farmers. Benchmarking such a VietGAP to one of the main certification schemes (e.g. GLOBALGAP) will be an unnecessary step as this is generally done when an existing program is in place and recognition (i.e. benchmarking) is pursued, and not for a new, yet to be established, program.

In any case, the development and implementation of a VietGAP program should be conducted in a broad and open manner. Partnership with organisations such as VINAFIS and VASEP could result in a more demand-driven scheme which satisfies the demands of farmers, consumers and government in a true win-win-win arrangement.

List of key people consulted[100]

Name	Affiliation
Antoine Bui	Binca Seafood
Carson Roper	Aquaculture Stewardship Council (ASC)
Catherine Zucco	WWF Germany
Dang Kieu Nhan	Mekong Delta Development Institute (MDI)
George Chamberlain	GAA
Jack Morales	Sustainable Fisheries Partnership
Jan Gilhuis	Dutch Sustainable Trade Inititative (IDH)
John McGrath	Imani Development
Le Chi Binh	An Giang Fisheries Association (AFA)
Michael Akester	FSPS2
Nguyen Binh Phuong	Vinh Quang Fisheries Corp.
Nguyen Nhu Tiep	National Agro Forestry Fisheries Quality Assurance Department (NAFIQAD)
Pham Anh Tuan	D-Fish/MARD
Rene Van Rensen	Fresh Studio Innovations Asia
Siebe Van Wijk	Fresh Studio Innovations Asia
Tran Huy Hien	DOCIFISH
Valeska Weymann	GLOBALGAP

[100] Being consulted does not imply full endorsement of this report

8.2 Fisheries Data

All of the findings and recommendations in this report are contingent on the data used being reliable and complete. Good data is essential not only to enable accurate evidence-based analysis and policy recommendations. In addition, good quality data collected and made available on a regular and timely basis would help enormously in fisheries authorities' endeavours in monitoring and evaluation of the sector, increasing transparency, and encouraging compliance over time.

The Vietnamese fisheries sector is characterised by a multitude of different actors, species, and gears and technologies. The fact that a diverse group of small players, who each individually account for a small share of total fisheries activity, together comprise a significant chunk, adds to the complexity. Data collection in the sector is therefore certainly not straightforward and necessarily entails an organised and systematic approach.

The Fisheries Information Centre (FICEN) is the division in charge of fisheries statistics and forecasting in D-Fish. In the context of the new D-Fish, FICEN is in its early days, so there is an opportunity for investment now. It is clear that the division should be prioritised.

Parallel data collection systems

The data situation in Vietnamese fisheries is further complicated by the fact that there are in fact two parallel data collection systems in operation- one conducted by the sector itself (now FICEN in D-Fish), and the other managed and controlled by the GSO[101]. At present, the two systems do not speak to each other.

In general, the sector data are more detailed and viewed as more accurate by most fisheries specialists. However, resources dedicated to data collection in the sector are far inferior to GSO, and as a result, data is not always consistent or systematically collected (sometimes there are changes in methodology or definition, resulting in gaps or lack of comparability). Therefore, despite the perceived lower detail and quality, GSO production and value numbers are usually recommended. And the GSO numbers are the official government numbers.

In the case of aquaculture, production and water surface area statistics usually coincide, so this is less of a problem. But for MCF, production volume numbers consistently differ due to different definitions, classifications, and collection methodologies. Differences are not large enough to lead to divergent trends or conclusions, but it does all add to the confusion.

The FICEN is keenly aware of these issues and is planning to work with GSO to unify the systems. The recently approved GoV programme for 2011-15, with the objective of unifying the GSO and sector statistical systems is clearly relevant here (GSO is the lead agency for this). It would be important for D-Fish to make the most of this opportunity as the two systems can complement each other to the benefit of the whole system. Furthermore, in July 2011 a new Agriculture and Fisheries Census will be initiated by the GSO. This five-year census collects important data relating to fisheries households, especially in the area of socioeconomic characteristics, and D-Fish should ensure they are closely involved with GSO in the elaboration of questions, data analysis etc.

Data completeness

Basic data on production levels, vessels, and water surface areas are, on the whole, available (albeit within the two parallel systems as described above). However, more detailed data on more specific, but nonetheless important, fisheries issues is not currently collected in any systematic, centrally-administered way.

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[101] The Provincial Statistics Offices (PSOs) (Division for Agriculture, Forestry and Fisheries) have enumerators at the commune and district levels, supplemented by ad hoc surveys perhaps twice yearly.

Due to the sector's diversity, case studies do often represent the only way to accurately collect some types of fisheries data. Every year a number of surveys and studies are conducted, often specific to one region, species, or issue. As a result there are pockets of good quality and detailed data. However the extent to which this filters up to a central repository is very limited, and it is thus strongly recommended that efforts are made to gather all of these data pockets into one place. This will not provide a dataset that is comprehensive or consistent across years- nevertheless, it would provide an important resource for fisheries analysts.

VnFishBase

In the case of marine capture fisheries, the infrastructure for data collection is largely already in place. VnFishBase (Danida funding and technical assistance, 1996-2008) is a web-based database for marine capture fisheries in Vietnam (housed with DECAFIREP, but now moving to FICEN). It is user-friendly, and is designed such that the sub-DECAFIREPs for each of the 29 coastal provinces have their own account, enabling them to log into the database and enter data relating to their area of jurisdiction. Sound methodologies, in-line with international best practice have been programmed, and new areas are being developed (such as a section for illegal, unregulated and unreported fishing).

The IT infrastructure is already fully set-up and ready to be used, and for basic production and vessel data, it is working and being updated fairly satisfactorily. When it comes to data on fishing costs, gear types, fishing grounds information, prices etc, however, it is currently completely underutilised relative to its potential. The key now is that the provinces (sub-DECAFIREPs) update the system on a regular and systematic basis (at present just ad hoc). Enumerators need to be properly trained and the updating of the database should be institutionalised such that it becomes a core part of the (monthly) activity of fisheries authorities.

VietFishBase (set-up and funded with Danida) 1996-2005 was an Access-based database, with useful information. For approximately five gear types, six engine size classifications, twenty questionnaires per month. Holds some useful data especially on costs and revenues at a reasonable level of disaggregation (some results presented above). But there are some issues, such as inconsistencies between cost and income data (given different boats in the sample), and some data gaps. As a general rule, while the time series element of the data is perhaps somewhat unreliable, the cross-sections do offer a useful snapshot. It is now important that steps are taken for this to be incorporated into VnFishBase.

Specifically, it is proposed that the following data is collected and inputted on a regular basis (monthly) for data collection:

- Production/catch (disaggregated by area, vessel, species);
- Vessel information[102] (disaggregated by area, vessel, species);
- Fishing cost data (fixed and variable costs);
- Prices disaggregated by species and location;
- Fishing effort components: Gear types, Boat Active Days,
- End markets (domestic, export, whole fish, fish sauce etc);

No such system is currently in place for aquaculture. One option, therefore, is to build upon the VnFishBase, such that it has capacity to store data relating to fish farming also. There is a Danida-supported initiative to introduce an on-line aquaculture data system, currently in nine pilot provinces. This is separate from VnFishBase. It might make sense to incorporate everything into VnFishBase.

With the above frameworks in place, monthly reporting should be improved (from the sub-DECAFIREPs and sub-Aquaculture units) such that a standardized set of data is communicated to the central level each month.

[102] This is currently relatively well updated by provincial authorities.

In conclusion, as things currently stand, Vietnamese fisheries statistics and survey data provide an insufficient basis for the management of fisheries resources in a sustainable and cost efficient manner. The sector would benefit from an improvement in both the scope and quality of data. Investment, in the data collection infrastructure, and in human resources specific to this area, should be a priority. Throughout the report, the careful reader will inevitably note inconsistencies in some numbers. The reader is encouraged to see numbers as best estimates, and to focus more on overall trends and ballpark figures.

8.3 DCGE Model Specification (used in Chapter 6)

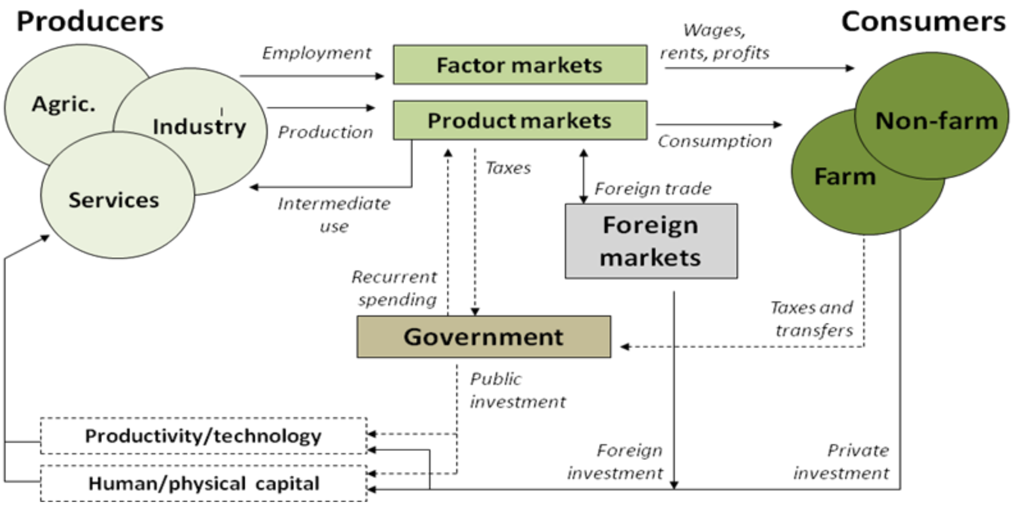
The model belongs to the structural-neoclassical class of CGE models (Dervis et al. 1982). Such DCGE models are well-suited to analyzing the impacts of industrial and sector-level policies. First, they simulate the functioning of a market economy, including markets for labour, capital and commodities, and therefore can evaluate how changing economic and natural resource conditions are mediated via prices and markets. Secondly, DCGE models ensure that all economywide constraints are respected, which is crucial for studies concerned with inter-sectoral linkages or spillover effects. Finally, CGE models contain detailed sector breakdowns and provide a “simulation laboratory” for quantitatively examining how changes in the fisheries sector influences the performance and structure of the whole economy, both in terms of economic growth and also at the detailed household level.

Model Specification

Economic decision-making in the model is the outcome of decentralized optimization by producers and consumers within a coherent economywide framework. This is reflected in the conceptual framework for the model presented in Figure 8.1. Production occurs under constant returns to scale. Intermediate demand is determined by fixed technology coefficients (i.e., Leontief demand), while constant elasticity of substitution (CES) production functions allow factor substitution based on relative prices. This means that, for example, as unused crop land in Vietnam becomes scarcer, producers have some ability to substitute land for less scarce factors, such as labour and capital. Profit maximization implies that factors receive income where marginal revenue equals marginal cost.

The model identifies 29 sectors (10 in agriculture, 15 industries and 4 services). The agricultural sector includes separate subsectors for ocean fisheries and (on land) aquaculture, and the industrial sector includes separate downstream fish processing and fish feed manufacture industries. In order to reflect the skewed production patterns of Vietnamese fisheries, each sector is disaggregated across two regions: Mekong Delta and the Rest of Vietnam (RoV).

Figure 8.1: Conceptual Framework for the Economywide Model



Based on the 2006 Vietnam Household Living Standards Survey (VHLSS), labour markets in each region are segmented across three skill groups: (1) workers with at least some primary education; (2) workers with at least some secondary schooling; and (3) workers who have completed secondary or tertiary schooling. Agricultural land is divided across farms that are engaged in aquaculture, and farms that use their land only to grow crops. Aquaculture land (i.e, ponds) in each region is used exclusively by fish farmers. All factors are fully employed, and regional agricultural and national non-agricultural capital is immobile across sectors. This detailed treatment of factor markets allows us to capture the unique production technologies employed in different regions. Thus when aquaculture production expands, it generates additional demand for factor inputs, such as fish feed, which then affects economywide factor returns and production in other sectors. Moreover, land expansion for aquaculture may face resource constraints, which will then affect economywide factor returns.

Substitution possibilities exist between production for the domestic and the foreign markets. This decision of producers is governed by a constant elasticity of transformation function, which distinguishes between exported and domestic goods. Profit maximization drives producers to sell in those markets where they can achieve the highest returns based on domestic and export prices. Further substitution possibilities exist between imported and domestic goods under a CES Armington specification. This takes place in both final and intermediates usage. Under the small-country assumption, world demand and supply is assumed to perfectly elastic at fixed world prices, with the final ratio of traded to domestic goods being determined by the endogenous interaction of relative prices.

The model distinguishes between 30 representative households that are disaggregated across the two sub-national regions (i.e., Mekong Delta and RoV), by farm/nonfarm, fish/crop-only farms, and by per capita expenditure quintiles. Households receive income in payment for producers' use of their factors of production, and then pay direct taxes, save (i.e., invest) and make foreign transfers (all at fixed rates). Households then use their remaining income to consume commodities under a linear expenditure system (LES) of demand. The government receives revenues from imposing direct and indirect taxes, and then makes transfers to households and the rest of the world. The government also purchases commodities in the form of recurrent consumption expenditures, and the remaining income of the government is saved (with budgets deficits representing negative savings). All savings from households, government and the rest of the world (foreign savings) are collected in a savings pool from which investment is financed.

The model includes three broad macroeconomic accounts: the government balance, the current account, and the savings-investment account. In order to bring about balance among the various macro accounts, it is necessary to specify a set of 'macroclosure' rules, which provide a mechanism through which macroeconomic balance can be achieved. A savings-driven closure is assumed in order to balance the savings-investment account. Under this closure, the marginal propensities of households to save are fixed, while investment adjusts to income changes to ensure that the level of investment and savings are equal. For the current account it is assumed that a flexible exchange rate adjusts in order to maintain a fixed level of foreign savings. In other words, the external balance is held fixed in foreign currency terms. Finally, in the government account, direct tax rate rates are fixed and the fiscal deficit adjusts to equate total revenues and expenditures.

The model is 'recursive dynamic', implying that it is solved as a series of static equilibriums, with updating of key parameters between periods. Unlike full inter-temporal models, which include forward-looking expectations, the recursive dynamic model used in this paper adopts a simpler set of adaptive rules, under which investors essentially expect prevailing price ratios to persist indefinitely. Under this specification, sectoral capital stocks are adjusted each year based on previous investment levels, net of depreciation. The model adopts a "putty-clay" formulation, whereby each new investment can be directed to any sector in response to differential rates of return, but installed equipment must remain in the same sector (Dervis et al., 1982). Unlike capital, growth in the total supply of each labour category and land is determined exogenously. Sectoral productivity growth is also specified exogenously with the possibility of different rates of productivity growth by factor. Using these simple relationships to update key variables, we can generate a series of growth paths based on different fisheries scenarios.

The model is calibrated to the 2007 social accounting matrix (SAM) of Vietnam as introduced in Chapter 2 of this report. For this chapter, the national SAM is regionalized to separate out the Mekong Delta, for whom the fisheries sectors play an especially important and unique role. Moreover, a more detailed structure of the fisheries sector is included to isolate the indirect economic linkage that fish feed plays between ocean fisheries and aquaculture. The information used to disaggregate households in the SAM was drawn from 2006 VHLSS. This survey provides information on households' unique income and expenditure patterns, and is directly embedded within the DCGE modelling framework as the main determinant linking economic growth and income distribution.

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Data Annex

Data for Elasticity Estimates

Using cod as a substitute:

Equation 1:

ln q = - 151 - 2.28 ln pCatfish - 1.00 ln pMeat + 14.8 ln Income + 0.408 ln pCo - 0.373 T

Predictor	**Coef**	**SE Coef**	**T**	**P**
Constant	-151.22	45.15	-3.35	0.005
ln pCatfish	-2.2755	0.6517	-3.49	0.004
ln pMeat	-1.000	1.569	-0.64	0.535
ln Income	14.823	4.599	3.22	0.007
ln pCod	0.4075	0.3247	1.26	0.232
T	-0.3727	0.1028	-3.63	0.003

S = 0.237368 R-Sq = 82.0% R-Sq(adj) = 75.0%

Analysis of Variance

Source DF SS MS F P

Regression 5 3.32824 0.66565 11.81 0.000

Residual Error 13 0.73247 0.05634

Total 18 4.06070

Durbin-Watson statistic = 1.49171

Using tilapia as a substitute:

Equation 2:

ln q = - 91.0 - 2.35 ln pCatfish + 0.80 ln pMeat + 8.58 ln Income
 - 0.487 ln pTilapia - 0.202 T

Predictor	**Coef**	**SE Coef**	**T**	**P**
Constant	-90.99	42.07	-2.16	0.050
ln pCatfish	-2.3469	0.5442	-4.31	0.001
ln pMeat	0.804	1.286	0.63	0.543
ln Income	8.578	4.276	2.01	0.066
ln pTilapia	-0.4869	0.1907	-2.55	0.024
T	-0.20199	0.09592	-2.11	0.055

S = 0.205120 R-Sq = 86.5% R-Sq(adj) = 81.3%

Analysis of Variance

Source DF SS MS F P

Regression 53.51374 0.70275 16.70 0.000

Residual Error 13 0.54697 0.04207

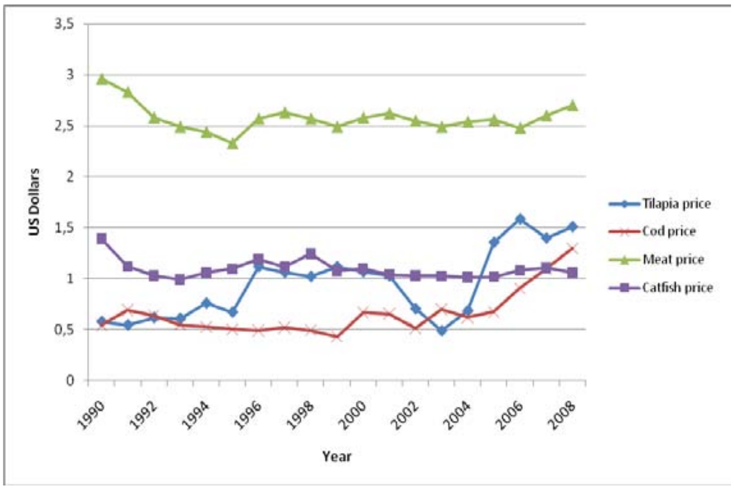
Total 18 4.06070

Durbin-Watson statistic = 1.44445

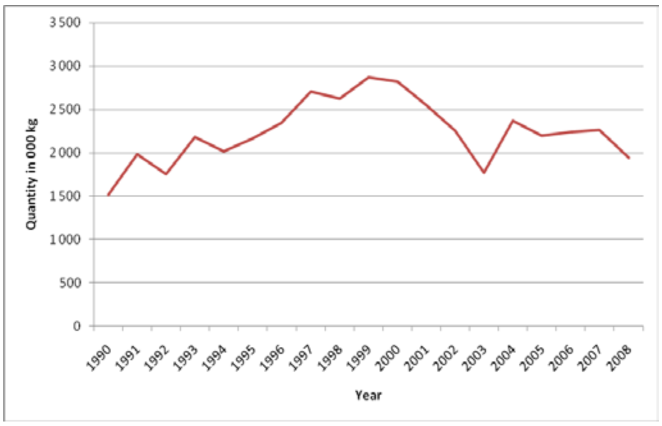
USA annual per capita disposable income in USD

Year	US population	per capita disposable income
1990	250181000	23568
1991	253530000	23453
1992	256922000	23958
1993	260282000	24044
1994	263455000	24517
1995	266588000	24951
1996	269714000	25475
1997	272958000	26061
1998	276154000	27299
1999	279328000	27805
2000	282418000	28899
2001	285335000	29299
2002	288133000	29976
2003	290845000	30442
2004	293502000	31193
2005	296229000	31318
2006	299052000	32271
2007	302025000	32693
2008	304831000	32946

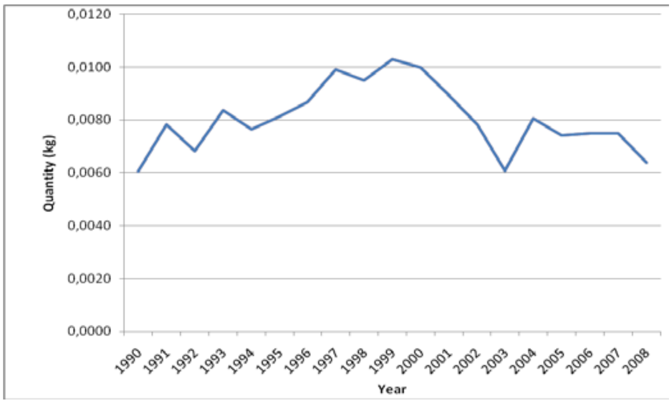
Price of Catfish and Substitutes in US (USD/Kg)



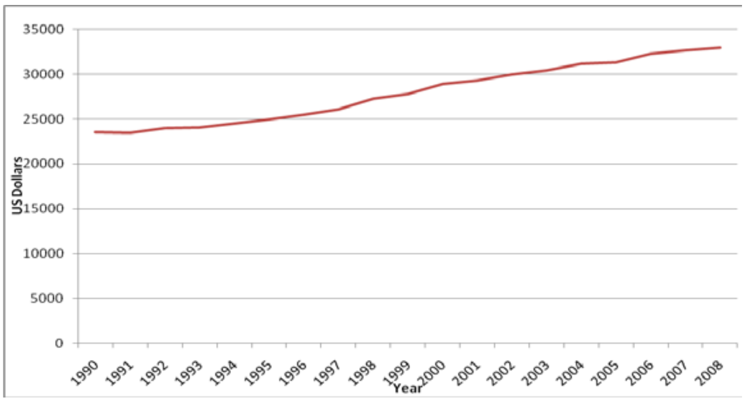
Quantity of catfish demanded per year (in kg)



Quantity of catfish demanded per capita (in kg)



Annual per capita real disposable income (in chained 2005 USD)



Maximum Sustainable Yield

Sea zones	Species Group	Stand-Biomass		MSY	
		Tonnes	%	Tonnes	%
Fishing Ground 1 (Tonkin Gulf)	Small Pelagic fishes	433,100	8.53	173,200	8.07
	Demersal Fishes	153,269	3.02	76,635	3.57
	Total	586,369	11.55	249,835	11.64
Fishing Ground 2 (Central Coast)	Small Pelagic fishes	595,550	11.73	238,250	11.10
	Demersal Fishes	592,150	11.67	296,075	13.80
	Total	1,187,700	23.40	534,325	24.90
Fishing Ground 3 (South East)	Small Pelagic fishes	770,800	15.19	308,300	14.40
	Demersal Fishes	304,850	6.01	152,425	7.10
	Total	1,075,650	21.20	460,725	21.50
Fishing Ground 4 (South West)	Small Pelagic fishes	945,400	18.63	378,150	17.60
	Demersal Fishes	123,992	2.44	61,996	2.90
	Total	1,069,392	21.07	440,146	20.50
Fishing Ground 5 (Giữa Biển Đông)	Big Pelagic fishes	1,156,032	22.78	462,413	21.50
Total	Small Pelagic fishes	2,744,850	54.08	1,097,900	51.10
	Big Pelagic fishes	1,156,032	22.78	462,413	21.50
	Demersal Fishes	1,174,261	23.14	587,131	27.40
	Total	**5,075,143**	**100**	**2,147,444**	**100**

Source: RIMF, N. V. Nghĩa (2007), Đ. M. Sơn (2005b), ALMRV-II (2006)

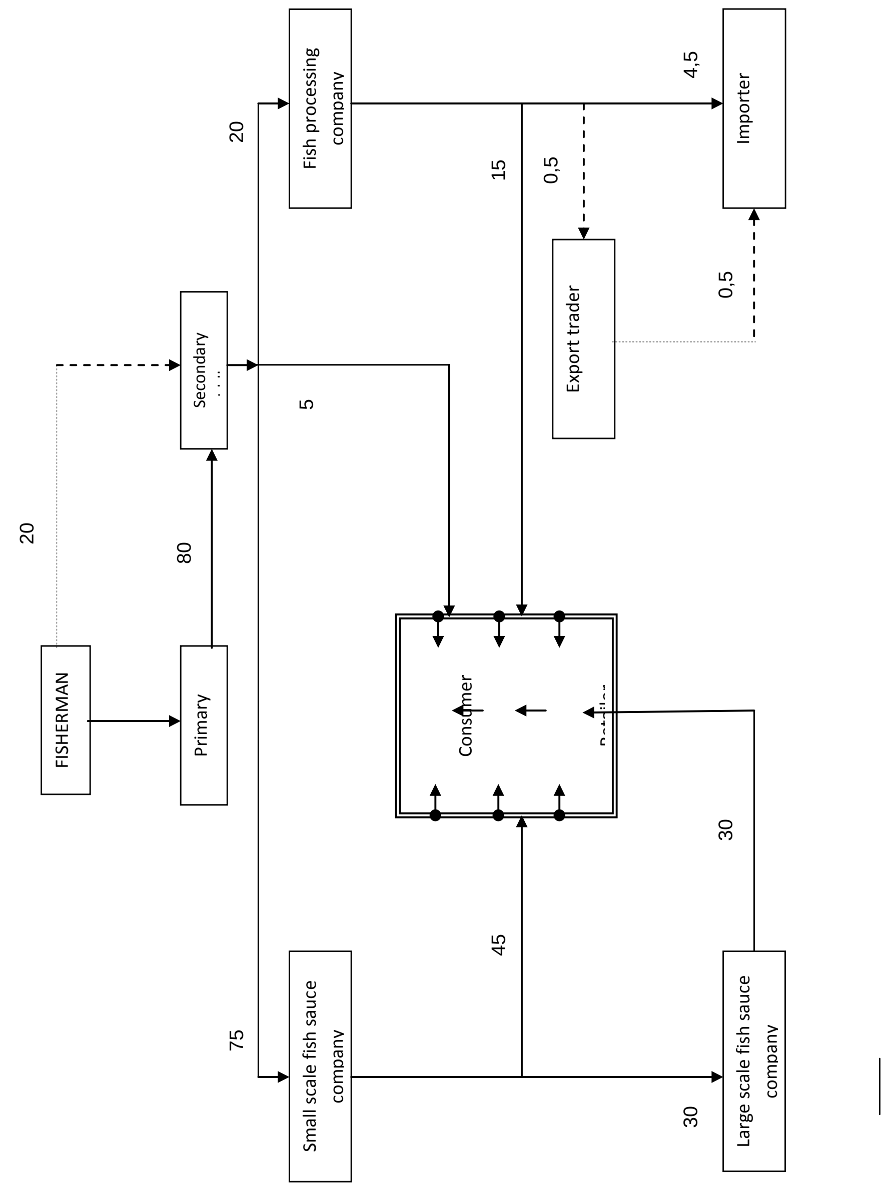
Anchovy Value Chain- Costs and Profits

VND / Kg	Export		Domestic Mkt		Fish Sauce	
	Value	% VA	Value	% VA	Value	% VA
1. Fishermen						
Total cost	4,578	11%	4,578	27%	4,578	23%
Variable cost per trip	1,752		1,752		1,752	
Labor cost	1,999		1,999		1,999	
Depreciation + maintenance	804		804		804	
Interest	23		23		23	
Output price	20,000		10,000		4,500	
Marginal profit	15,422	37%	5,422	33%	(78)	-0.4%
2. Primary middlemen						
Input price	20,000		10,000		4,500	
Total cost	300	1%	300	2%	300	2%
Variable cost per trip	250		250		250	
Depreciation	50		50		50	
Output price	22,000		11,000		5,000	
Marginal profit	1,700	4%	700	4%	200	1%
3. Secondary middlemen						
Input price	22,000		11,000		5,000	
Total cost	350	1%	350	2%	350	2%
Transportation and transaction cost	300		300		300	
Depreciation	50		50		50	
Output price	24,000		12,000		5,500	
Marginal profit	1,650	4%	650	4%	150	1%
4. Processing company						
Input price/kg material	24,000		12,000		5,500	
Total cost/kg material	6,667	16%	3,667	22%	14,000	70%
Production cost	5,833		3,333		11,560	
Transportation/transaction cost	167		167		1,275	
Depreciation	667		167		1,165	
Output price	41,167		16,667		20,000	
Marginal profit	10,500	26%	1,000	6%	500	3%

Tuna Value Chain- Costs and Profits

VND / Kg	Value (VND / Kg)	% VA	% VA (Dealer route)
1. Fisher			
Total costs	13,592	52%	44%
Variable cost	8,079		
Labour cost	2,375		
Depreciation	1,815		
Repair and maintenance cost	1,200		
Interest payment on loans	124		
Output price	14,000		
Marginal profit	408	2%	1%
2. Trader			
Purchase price of fish	14,000		
Total costs	602	2%	2%
Labour cost	178		
Preservation	170		
Transport	248		
Depreciation	4		
Fees	2		
Others (oil, electricity)	2		
Output price (to processor)	16,000		
Marginal profit (to processor)	1,398	5%	
Output price (to 1st wholesale dealer)	18,000		
Marginal profit (to 1st wholesale dealer)	4,000		13%
3. Processing Company			
Purchase price of fish	16,000		
Total costs	2,473	9%	
Output price	26,218		
Marginal profit	7,745	30%	
4. Dealer (1st level)			
Purchase price of fish	18,000		
Total costs	246		1%
Labour cost	65		
Preservation	120		
Transport	58		
Depreciation	2		
Fees	1		
Output price (to 2nd wholesale dealer)	21,500		
Marginal profit (to 2nd wholesale dealer)	3,254		11%
5. Dealer (2nd level)			
Purchase price of fish	21,500		
Total costs	600		2%
Transport, preservation, depreciation	600		
Output price	25,000		
Marginal profit	2,900		9%
6. Retailers			
Purchase price of fish	25,000		
Total costs	150		0%
Output (retail) price	30,000		
Marginal profit	4,850		16%

Anchovy Value Chain



Tuna Value Chain