

Economic Feasibility of a Mariculture Enterprise in a Transitional Economy
A case for grouper in East Timor

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EXECUTIVE SUMMARY

Ranked as one of the poorest countries in the world, East Timor's access to a productive marine ecosystem makes the prospect of mariculture worth considering as a poverty reducing economic development strategy. This paper evaluates the economic potential for a grow-out mariculture enterprise in East Timor while highlighting how such a project could help engage a transitional nation in foreign trade, increase employment opportunities and encourage community based projects that promote sustainable growth. A financial feasibility analysis is derived using data collected from a 2005 USAID funded study that investigated investment opportunities in East Timor. Based on expert advice, two species of grouper were selected for grow-out production: the lower valued *Epinephelus coioides* (orange-spotted grouper) and the higher valued *Cromilepte altivelis* (humpback grouper). The financial analysis is developed through an enterprise budget, which itemizes costs and revenues under assumed production parameters. Cash flows based on a 10-year investment period are then developed so that internal rates of return (IRR) can be used to gauge the profitability of such an enterprise given proposed scenarios. Fluctuations in fish survival rates (50%-90%) are compared with variable wholesale market prices for humpback grouper (US\$40-\$80) in a sensitivity analysis that helps to highlight certain risks and uncertainties associated with grow-out production. It was found that a positive IRR ranging from 13% to 67% could be obtained only if the higher valued species of grouper were transported directly to Hong Kong and sold at average wholesale market prices (US\$60/kg). In conclusion it is recommended that if such an enterprise is to be developed in East Timor, then a proactive marketing strategy must be implemented to ensure buyers and investors that a sustainable and quality product can be delivered to an already flourishing live grouper trade.

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ABSTRACT

This paper evaluates the economic potential for a grow-out mariculture enterprise in East Timor while highlighting how such a project could help engage a transitional nation in foreign trade, increase employment opportunities and encourage community based projects that promote sustainable growth. The cage-culture of orange-spotted and humpback grouper species were evaluated and compared using cash flow analyses. It was found that positive internal rates of return ranging from 13% to 67% could be obtained if the higher valued humpback grouper were to be transported directly to Hong Kong and sold at an average wholesale market price of US\$60/kg.

Keywords: Aquaculture, Grouper, East Timor, Economic Feasibility, Transitional Economy

Economic Feasibility of a Mariculture Enterprise in a Transitional Economy: *A case for grouper in East Timor*

BACKGROUND

Ranked as one of the poorest countries in the world, East Timor's access to a productive marine ecosystem makes the prospect of mariculture worth considering as a poverty reducing economic development strategy. The goal of this research is to evaluate the potential for a grow-out mariculture enterprise in East Timor while highlighting how such a project could, in general, help to engage a transitional economy in foreign trade, increase employment opportunities and encourage community based projects that promote sustainable growth.

East Timor, otherwise known as the Democratic Republic of Timor-Leste (or simply Timor-Leste), occupies a land area of approximately 15,000 square kilometers that includes over 700 kilometers of coastline. The country is situated at the eastern end of the Indonesian archipelago and is estimated to have a population of just over one million¹. East Timor's climate is tropical with distinct wet and dry seasons that can lead to inconsistent agriculture production throughout the year (UNDP 2006:20). East Timor's rise to independence in 2002 secured it as the newest nation of the second millennium although it continues to struggle politically and economically. A 2006 United Nations Development Program (UNDP) report referred to East Timor as the poorest country in the Southeast Asia while showing that human development indicators (HDI) imply that East Timor has actually become poorer during its short bout with nationhood (UNDP 2006). To lessen the struggle for East Timor, the road ahead must be bridged with a solution that encompasses pro-poor strategies that empower the economic potential of local communities in order to restore confidence back to the people. One way to underwrite such an endeavor is to develop economic opportunities that the communities themselves can grow, learn and work with each other. To do this, development projects need to be economically viable and at the same time be oriented towards improving the social sector while encouraging the sustainable use of resources afforded by the natural environment. Looking at the feasibility of a mariculture enterprise provides such an opportunity.

This paper addresses the financial feasibility of establishing a mariculture enterprise in East Timor while attempting to specify some of the political and sociological risks a transitional economy might encounter by undertaking this type of business venture. The following section of this paper explores the economic potential of East Timor by investigating significant international agreements in accord with natural resource issues. The demand for grouper is then explored both domestically and internationally in order to help justify the development of a grouper mariculture enterprise. Questions that are answered throughout the following pages pertain to how grouper was chosen and why grow-out production became the most realistic mariculture technique considered. Data collection methods, marketing scenarios, and key assumptions will be thereafter provided. Various key parameters and project costs are discussed and explained in Tables 1-4. In turn, results are presented via an enterprise budget and cash flow analysis that can be found in Tables 5 and 6, respectively. A sensitivity analysis is assessed comparing survival rates to market prices for the culture of humpback grouper in East Timor under assumptions provided by the financial model and can be found in Table 7. The conclusions will then be discussed in relation to four important development factors particularly

¹ U.S. Department of State online resource: <http://www.state.gov/r/pa/ei/bgn/35878.htm> (accessed 10.31.06)

of importance to transitional economies: The potential to promote economic sustainability; accessibility to viable markets (e.g. live fish trade); favorable investment climate and business incentives for both investment firms and local communities; as well as the consideration of risks associated with a politically unstable region (e.g. poverty, civil unrest, lack of leadership, etc.).

Economic Potential in East Timor

Given that around 75% of East Timor's residents live in rural areas it is not hard to imagine that agriculture is heavily relied upon for subsistence and potential income (e.g. coffee, vanilla, maize, corn, cassava, sweet potato, etc.). Unfortunately, the chaos that followed East Timor's transition to independence not only eliminated entire townships, but farms and farmlands were incapacitated as well; many have yet to recover. Likewise, 90% of East Timor's seafood industry was reportedly destroyed during the same time, leaving fishermen gearless and the few hatcheries² that did exist, annihilated beyond repair (Da Fonseca 2001). International aid was sent to East Timor following the 1999 crisis to help in the post-independence reconstruction of the region. In 2002 foreign workers and peacekeepers began to leave East Timor following the fulfillment of reconstruction and peacekeeping agendas. As a result of losing foreign business, economic growth slowed, and even reversed. The gross domestic product (GDP) per capita fell from \$466 with an estimated annual GDP growth of 16.5% in 2001 to \$366 in 2004, which is reflective of the *negative* growth of 6.7% in the GDP during 2003³. Interestingly, East Timor's National Development Plan (NDP)⁴ predicted the negative economic impact of 2002 and 2003 while at the same time noting that 'by the end of the plan there are prospects for solid, broadly based growth of 6% per annum' (NDP 2001:6). The annual growth of the GDP in 2004 was 1.8% based on national output statistics for East Timor. Two specific and prominent goals were set forth in the NDP which can also be reduced to reflect the goals of this research. They are (NDP 2006:1):

1. To reduce poverty in all sectors and regions of the nation, and
2. To promote economic growth that is equitable and sustainable, improving the health, education, and well being of everyone in East Timor.

The following paragraphs exemplify a few potentially positive economic attributes that may bring the much-needed growth and poverty reduction that the East Timorese seek.

Aside from the obvious risks and uncertainties attached to investment opportunities in a poverty stricken and politically unstable region, the prospectus for a mariculture enterprise is ideal for consideration. Development projects that encourage capacity building potential by promising to increase the skill level of local workers are of high priority in East Timor. The UNDP (2006:3) recognizes that encouraging private sectors to invest in East Timor is a primary goal to address poverty. One positive step forward can be found within the NDP that has been administered in response to reducing poverty and soliciting economic prosperity in East Timor.

² De Foncescas (2001) reported that 6 inland fish hatcheries were in operation in East Timor prior to 1999, all of which supplied fingerling carp to the domestic market. Once these hatcheries were destroyed the supply of fingerlings stopped as well.

³ Sources: ADB. 2006. *Basic Statistics 2006*. Manila.

UNDP. 2006. *Timor-Leste HDR 2006: Path Out of Poverty*.

⁴ Largely due to the phased withdrawal of UNTAET and TFET, economic growth was projected to be negative in 2002 and 2003, before commencing recovery in 2004 (NDP 2001).

The business climate in East Timor favors the foreign investor under a new investment law that was approved in July 2005, which ultimately stemmed from the NDP. Policies have been incorporated within the infrastructure of the East Timor government that considers fiscal incentives with a minimum investment of \$100,000. These include tax breaks of up to \$300 for each hired Timorese worker, rent incentives for rural projects and custom tax exemptions when minimum standards are met. This investment law also complements the UN's Millennium Development Goals (MDG) that have been set forth as a strategy to address national priorities for East Timor and for developing countries in general (UNDP 2006).

In January 2006, the governments of Australia and East Timor signed the Treaty on Certain Maritime Arrangements in the Timor Sea (CMATS). This highly disputed agreement evolved from an earlier treaty signed in 2003 (Timor Sea Treaty) and promises East Timor a multi-billion dollar economic boost through real and potential profits made from oilfields positioned in the Joint Petroleum Development Area (JPDA) which is conveniently located halfway between Darwin, Australia and the south shores of East Timor. Consequently, JPDA straddles both Australia and East Timor's exclusive economic zones (EEZ) giving way to intense maritime disagreements between the two countries from which the CMATS developed. Anticipated profits resulting from the CMATS could very well be East Timor's ticket out of poverty if funds generated from the JPDA are managed responsibly and allocated efficiently to rebuild and develop East Timor once and for all⁵. The project described in the following pages provides one way in which revenues from national and international endeavors could be reinvested into East Timor's communities for development purposes – ideally in a sustainable fashion.

In addition to valuable natural resources found beneath the seabed, East Timor is geographically situated within a region recognized by scientists as the center of marine biodiversity (Roberts *et al* 2002). Referred to as the Coral Triangle, this distinct ecoregion is characterized by more than 500 species of coral and possesses high biodiversity of fishes and other invertebrates (IUCN 2004). As a result, individuals and nations profiting from the lucrative aquarium and live fish trade often target the seas surrounding East Timor in search for these and other valuable resources. Grouper is just one of many reef species targeted in the live fish trade and its value is poised on the freshness of keeping the fish alive until the moment of consumption, much like the reverence of live lobster in the United States. For example, a humpback grouper (*Cromilepte altivelis*) captured in the wild and kept alive in a tank until sold at a Hong Kong market during the Chinese New Year can earn a wholesale market price of \$93 per kilogram (2006 est.)⁸. The Food and Agriculture Organization (FAO) of the United Nations attributes the increase in the trade of live fish to technological advances within the competing seafood industries while consumer demand is fueled by a growing appetite for live seafood afforded by Chinese and Asian communities with high disposable incomes (FAO 2004; Sadovy *et al* 2003; Johannes & Riepen 1995). A live reef fish review in 2005 reported that 'as incomes in Asia rise over the next decade and aquaculture products become more readily available, there is an expectation that consumer demand for live reef fish will likewise increase (Muldoon *et al*

⁵ The CMATS Treaty includes setting aside Timor Sea maritime boundary claims for 50 years; increasing East Timor's share of Greater Sunrise oil revenues from 18 per cent to 50 per cent. Once ratified by both countries, the CMATS Treaty and IUA will together offer a framework that will provide investors with the certainty needed for large-scale resource projects to proceed.

(<http://www.industry.gov.au/content/itrinternet/cmscontent.cfm?objectID=C0FB82FC-9AA9-4A97-8F3ECEB317A6119D>).

2005)'. It has been estimated that live fish represent almost 30% of total grouper production in the Southeast Asia whereas most of the yield comes from a relatively small portion of the region, or more specifically, from within the Coral Triangle (Sadovy et al. 2003). Due to the high-value and consistent demand for live reef fish in Hong Kong, the live reef fish trade is currently expanding into the South Pacific where conditions are also favorable for the capture (and mariculture) of target species despite a greater travel distances to demand centers (Sadovy *et al* 2003). Since wild caught groupers currently supply the majority of live grouper demand centers in Southeast Asia there has been considerable attention given to the culture of grouper and the future sustainability of this trade. For example, in a technical report by Pomeroy et al. (2003) aquaculture is cited as being a priority solution for reducing the pressures on coral reefs arising from over-and destructive fishing associated with the trade of wild caught live reef organisms.

The Gondol Research Institute for Mariculture (GRIM) located in nearby Bali, Indonesia, is the leading research extension program in the region and promotes innovative mariculture practices while providing logistical support and on-site training for managers and fish farmers alike. Following consultations with experts from GRIM, it was decided to analyze two specific species of grouper: a lower valued *Epinephelus coioides* (commonly known as the green or orange-spotted grouper) and the higher valued *Cromileptes altivelis* (humpback or high-finned grouper). This decision was based on the availability of hatchery-reared stock of these species and successful track records using similar grow-out culture methods adopted in Malaysia, Indonesia, Vietnam, Philippines, Taiwan, Thailand, and Hong Kong (GRIM 2005: *personal communication* and Pomeroy *et al* 2002). Hence, the resulting analysis is heavily reliant on the regional availability of information such as the supply of hatchery-reared fingerlings, type of feed used, variation of grow-out cycles, transportation costs, demand of farmed live grouper as well as the business climate with respect to East Timor's geo-strategic location and transitional economy.

Assessing the feasibility of growing out grouper in the Indo-Pacific region was crucial for determining what species to target for production in East Timor. In order to provide a detailed financial analysis that can be assessed objectively it is first important to understand the local demand for grouper with respect to current consumption preferences while recognizing potential effects of an increase in grouper supply to the domestic sector (e.g. fish markets and restaurants). Secondly, the international demand for grouper, specifically live grouper, needs to be assessed to understand the opportunities, risks and profitability in relation to the overall success of a grouper mariculture enterprise based in East Timor. Once a demand for grouper is apparent, marketing scenarios can be established and incorporated into the financial model. These demands are explored below.

GROUPER DEMAND

Both domestic and international demands for grouper were explored in East Timor. To better assess the domestic demand for grouper a survey was carried out in East Timor addressing the local fish trading infrastructures. Communities were surveyed as to their willingness to participate in a grouper industry and relevant opinions were solicited. The data was gathered using a face-to-face technique. Open marketplaces and restaurants were surveyed as potential buyers for cultured grouper in East Timor. Export markets for grouper were assessed using current and historical wholesale market prices for grouper at Hong Kong markets. Weekly and monthly wholesale market prices were obtained from online databases that provide updated price

information from select Hong Kong markets. Hong Kong was selected as the exporting target based on the availability of information and its role as a hub in the international trade for live reef fish. Prospective transporters were also identified who are willing to transport the fish to Hong Kong markets. Other major importers of live reef fish (i.e. grouper) would be Japan and Singapore if a significant infrastructure for transportation to these destinations could be established in the future. An excellent review highlighting the dynamics of the live reef trade, particularly the value of grouper to the industry, can be found in Maclean & Sadovy's (eds.) *While Stocks Last: the live reef fish food trade*⁶.

Domestic Demand for Grouper

East Timor's domestic demand for grouper was identified through a survey of various restaurants and markets that would be impacted as a result of an increased supply of grouper. Market and menu prices were surveyed to help develop a pricing structure for domestically traded grouper. There was no apparent demand for *live* grouper in the areas surveyed throughout East Timor, although it was recognized that fresh or frozen grouper were served in 43% of the restaurants surveyed; Spanish mackerel and tuna were the other top sellers (Chan-Halbrendt *et al* 2006:28). The average menu price for grouper sold in the restaurants was \$8/kg while the restaurants' purchase price (from fishers or middlemen) was found to be around \$2.50/kg (Ako & Chan-Halbrendt 2005:29). This means that the added value to domestically supplied grouper benefits the restaurant owners and not necessarily the fishers or fish growers. Therefore, if farmers were to maximize profits from their portion of the cultured stock then they would need an aggressive marketing strategy geared towards the restaurant and tourism industries rather than trying to sell their product to local fish markets. In East Timor, the cultural phenomenon of eating live fish has yet to catch on as it has in Hong Kong or other Asian communities. Furthermore, there was no evidence of a preferred demand for any particular species of grouper in East Timor. This implies that domestic grouper prices would probably be affected more by an increase in supply rather than the value of specific grouper species. Once development in East Timor is such that the civil unrest and unstable governance can be tamed, the tourism industry may be able to influence a slightly higher demand for fresh, frozen or even live grouper to the region.

International Demand for Live Grouper

The live reef food fish (LRFF) trade presently includes a wide variety of fish, but is dominated by several different species of groupers (Sadovy *et al.* 2003). The majority of live reef fish are imported into Hong Kong either for local consumption or for transshipment to Mainland China. It has been reported that Hong Kong exports between 20 – 60% of its total imports of live reef fish through China in order to meet consumer demand (Johannes 1995 and Chan 2000). It has also been estimated that the declared imports of LRFF to Hong Kong has an annual volume of 13,000-14,000 tons, making LRFF worth approximately 350 million US dollars with recorded imports into Hong Kong remaining fairly stable since 1999 (Muldoon *et al.*

⁶ http://www.adb.org/Documents/Books/Live_Reef_Food_Fish_Trade/live_reef_complete.pdf
(first accessed on 9/1/2005)

2005)⁷. Due to the lack of live reef fish reporting regulations in Hong Kong an estimate of 15,000-20,000 tons is believed to be more reflective of the market volume per year delivered to Hong Kong, although higher volumes (>30,000 tons) may not be unrealistic (Sadovy et al. 2003). Sadovy *et al* (2003) reported that between 15-40% of LRFF are supplied by wild-caught grow-out production units while only 10-15% of the LRFF are supplied by full-cycle hatcheries found throughout Southeast Asia. The same study found that during the 1990s high value species (e.g. humpback grouper) and low value species (e.g. orange-spotted grouper) accounted for less than 10% to 30%, respectively, of the total LRFF channeled through Hong Kong markets. In 2002 humpback and orange-spotted grouper supplied from regional sources and imported into Hong Kong was estimated to be between 10,000-12,000 tons for each species (Sadovy et al. 2003). Since the enterprise introduced here would be relatively small there should be little effect on international market prices for grouper with the addition of an East Timor grouper industry. For example, if Hong Kong's annual international demand for live grouper is a conservative 12,000 tons, an enterprise supplying 50 tons of marketable grouper would make up only 0.4% of the market share for live grouper exported to Hong Kong.

DATA COLLECTION

This study stems from a 2005 University of Hawaii USAID funded research project that explored the feasibility of developing an offshore mariculture enterprise in East Timor (see Ako & Chan-Halbrendt 2005). Researchers collected in-country (e.g. East Timor, Bali, Indonesia) baseline data from surveys and interviews from July-August 2005. Following interviews with local fishers, researchers, fish market vendors, restaurant owners, mariculture experts and local communities it was decided to explore the feasibility of culturing grouper in East Timor due to the regional availability of production inputs, institutional support (GRIM), marketing interests as well as the relatively simple technical requirements needed to construct, operate and maintain a grow-out mariculture farm. Two general areas in East Timor, Baucau and Lospalos, were selected as potential regions to grow-out grouper. The criteria used for these selections were based on accessibility (e.g. roads, airports, harbors, etc), oceanographic parameters (currents, depth, and sea temperature), ecological considerations (e.g. sandy bottom and *no* coral reefs) and existing community infrastructure. It was found through literature reviews that similar grow-out production farms have been successful in other developing countries in Southeast Asia and the Indo-Pacific (Pomeroy 2004; 2003: 2002, Sadovy *et al* 2004; Halim 2001; Siar *et al* 2001). Pomeroy conducted financial feasibility studies pertaining to grouper grow-out production in Indonesia and the Philippines (2004 & 2003). GRIM continues to assist grow-out farmers in Indonesia while conducting a variety of workshops and training sessions in the region for fishers and farmers alike. Both GRIM and Dr. Pomeroy were consulted on subjects closely related to the feasibility studies. Many of the assumptions used for the financial model are reflective of GRIM's production requirements. Thus, the following analysis is comparable to various grouper mariculture ventures already established in the region of interest.

Vemasse and Com are the two potential production sites that were selected for this study due to their close vicinity to the townships of Baucau and Lospalos, respectively. Both locations are on the protected northeastern shore of East Timor with access to the Wetar Strait and the

⁷ Prior to 1999 the Asian economic crisis affected market prices of live fish in particular due to more conservative motives of the consumers, demonstrating yet another risk that this type of enterprise, dependent on foreign markets, can exhibit.

Banda Sea. These sites were determined to be suitable for grow-out production based on the communities' willingness to participate, ideal environmental conditions and the accessibility to transport infrastructures. These sites were selected through consultation representatives from East Timor's Ministry of Agriculture, Forest and Fisheries (MAFF) along with mariculture experts and local funding agencies such as USAID.

Primary data was gathered on costs of grouper production in both GRIM (Bali, Indonesia) and East Timor. Surveys were used to collect baseline data to assess the communities' willingness to participate in an aquaculture project. These surveys were successful in providing socioeconomic details that became helpful to understanding the dynamic community structure in East Timor⁸. Various income situations were assessed and used to evaluate opportunity costs. Secondary data was collected through extensive literature reviews and consultation with mariculture experts in various parts of the region (see Ako & Chan-Halbrendt 2005, Pomeroy *et al* 2004 and Sutarmat *et al* 2003).

DEVELOPING THE FINANCIAL MODEL

The minimal degree of technical difficulty, affordable cost structure and the ease of constructing and maintaining near-shore grow-out mariculture farms makes this an ideal pro-poor development project in East Timor. In collaboration with the GRIM it was determined to use open-ocean floating net cages to grow-out grouper. This model assumes all farms will begin and end production at the same time in order to optimize space available on a one-time per harvest pickup and delivery schedule. In pursuit of a sustainable mariculture enterprise, this financial feasibility study assumes that all grow-out inputs are purchased directly from full-cycle grouper hatcheries as opposed to relying on fry and juveniles that would otherwise be caught in the wild before being grown in hatcheries or net cages. Likewise, dry food pellets will be used in place of trash fish (wild-caught, low-valued fish) as feed to nourish the grouper in the proposed grow-out farms. Experimental work at The Southeast Asian Fisheries Development Center (SEAFDEC) comparing several diets showed that fishmeal could be substituted with high-quality terrestrial meals (Asia-Pacific Grouper Network).

In this study a grow-out cycle is defined by the amount of time it takes to grow a 5-gram (5-10 cm) fingerling into a 500-gram marketable grouper. For the two species of grouper considered for this study the ideal market size was determined to be about 500 grams based on market trends; which ultimately mirror consumer taste preferences (e.g. texture). It should be noted that different species of grouper have different growth cycles that will need to be carefully considered when working out a production schedule for planning and investment purposes since profits are solely dependent on the cash receipts obtained by selling the grouper immediately following a grow-out cycle (harvest). A typical grow-out cycle for orange-spotted grouper is 8 months while the higher valued humpback grouper takes a total of 18 months to grow-out. These are the production times used in this analysis. The analysis also assumes that there will be a 6-month initial start-up period that allows for the organization and construction of the infrastructures needed to culture grouper. It is assumed that the capital equipment (rafts, nets, boats) will be replaced every 3 years between grow-out cycles. Costs per cycle were calculated for each farm and then distributed into the annual cash flow analysis, adjusting for the discrepancy between production cycles and production years. As a result some years have more

⁸ Surveys were used to help determine production costs, local wages, labor costs, local market structure, utility services, accessibility to infrastructure, types of fish and fishing techniques, etc (see Ako & Chan-Halbrendt 2005)

than one harvest while other years have none. In general, consideration should be taken to allow sufficient time to clean, inspect, repair and maintain the cages between all cycles regardless of reinvestment periods. A grow out period of 10 years was selected for the financial model due to East Timor's foreign investment law which provide incentives for projects that last longer than 5 years based on the region selected and the type of enterprise developed. For example, a condition of the 2005 foreign investment law in East Timor guarantees a tax deduction of \$300 for each Timorese worker that is employed for the entire year according to the location and nature of the project⁹. Ten years equates to 12 production cycles when growing out orange-grouper and 6 cycles when growing out humpback grouper.

Based on production units in use by GRIM, each cage, or raft, is assumed to be 4m (W) x 4m (L) x 3m (D). Each raft is to be fabricated using local resources when available (wood, bamboo, 55-gallon drums, etc) while other capital costs (hardware and motor boats) may need to be purchased abroad and imported taking advantage of East Timor's favorable investment climate with respect to tax exemptions on enterprise resources. For each farm there will be a shelter for feeding, maintenance, and storage of supplies. This shelter could also be used to house security personnel if needed. A key to successful grouper culture is to manage the proper stocking densities based on available space required. Sutarmat *et al* (2003:23) recommends stocking no more than 200 fish/m³ for fish 5-10 grams in weight and less than 20 fish/m³ for fish up to 500 grams; understanding that relative density increments in between should not be ignored. Hence, for this study 2 rafts will be required support the initial stocking density for the grouper fingerlings while an additional 8 rafts will be needed to support 4 tons of groupers or roughly 8000 fish. This model assumes then that a total of 10 rafts (including nets) will be needed to grow-out approximately 4-tons of grouper. The shelter and the 10 rafts are collectively referred to hereafter as one farm. Every farm is anchored by cables that are attached to each of the four corners and secured to fixtures placed on the ocean floor.

Marketing Scenarios

Using available data provided through GRIM analyses were carried out in terms of assessing costs based on individual farms that would each have the potential to grow out approximately 4 tons of grouper per cycle. An estimate of at least 4 farm workers would be needed to maintain each farm on a daily basis. Time invested by each farm-worker is expected to be equivalent to the time (opportunity cost) that could otherwise be spent fishing. The entire grow-out enterprise is assessed in relation to 15 farms. At a production rate of 4 tons per farm, the enterprise would have the potential to culture 60 tons of marketable grouper during each production cycle. Of the 60 tons, 80% of the total production, or 48 tons, would be marketed under the enterprise using one of the two following scenarios:

- I. Grouper would be sold at farmgate prices in East Timor; or
- II. Grouper would be shipped directly to Hong Kong and sold at wholesale market prices.

⁹ Chan-Halbrecht 2005, personal communication

Live groupers can be shipped either by air or sea to the final markets although, since flights in and out of East Timor are costly, this study only considers shipping live grouper by sea. Accordingly, the second scenario requires the hiring of a tender boat to ship the fish to Hong Kong and thus, requires the enterprise to absorb the costs and risks associated with transporting fish (e.g. piracy and fish mortality). The size of the tender boat that may be available for hire in the event of a mariculture enterprise in East Timor can hold up to 60 tons of fish at a lease price of US\$130,000¹⁰. This transportation cost to the enterprise is divided equally between the 15 farms and considered as the marketing cost per farm (see Table 2). The target production rate determined for the financial model is based on the carrying capacity of the particular tender boat identified by the authors.

The remaining 12 tons of cultured grouper will be allocated to the local communities responsible for managing and working the farms as in-kind compensation. Hence, the financial model will require that a grouper farming cooperative, or co-op, be organized in East Timor. Wages assumed for each member of the co-op are provided in Table 4. The co-op will be responsible for managing production requirements, quality control measures, farm workers and cash flows associated with the grow-out of grouper between the two sites and the 15 farms. Thus, the co-op will be required to provide at least 48 tons of grouper to be marketed under the investment strategy allocated by the enterprise investor while the remainder, or up to 20% of the total harvest, will be available to the co-op as a production incentive. This gives the co-op an opportunity to sell its portion of the cultured grouper at wholesale prices in Hong Kong (with added shipping costs); sell the grouper domestically either at farmgate, market or restaurant prices; or the co-op could keep the grouper for consumptive value and distribute it throughout the local communities. The grouper could also be dried to enhance its longevity as a source of food security. Revenues from the co-op's portion of the cultured grouper could be reinvested in existing farms, used to build new farms or be used to help pay back loans in order for the enterprise to shift from being foreign owned to locally owned; providing the original investor has an exit strategy in mind. Most importantly extra incomes could be used by families to feed and their children and pay for education costs. Both children and adults could benefit from the skills learned through disciplined mariculture practices, making this an ideal capacity building project worth considering.

Because East Timor uses US currency all costs are in figured to the US dollars unless otherwise stated. An exchange rate of 7.75 was used to convert Hong Kong prices into US prices per kilogram for grouper. Based on 2005 estimates the farmgate prices for orange spotted and humpback grouper sold in East Timor were reported to be \$8/kg and \$25/kg respectively¹¹. Average wholesale prices in Hong Kong for cultured orange-spotted and humpback grouper were found to be \$10.73/kg and \$63.02/kg respectively¹². Baseline prices used to analyze the feasibility of scenario II (selling at wholesale market prices in Hong Kong) were \$10 and \$60 per kilogram for orange-spotted and humpback grouper respectively.

¹⁰ Contract would be inclusive of all costs required for transporting live fish (crew, fuel, maintenance, etc) Personal communication, Hotung Institute (2005).

¹¹ See Ako and Chan-Halbrendt 2005

¹² Prices were averaged from 2003-2006 estimates from Hong Kong Markets: Fisheries Enforcement Division, Agriculture, Fisheries and Conservation Department, HKSAR, China. http://www.hk-fish.net/eng/market_price/common_e_2006_sep.htm (HK Fish Net)

Key Variables

Variable production parameters were figured based on personal consultations with industry specialists and researchers from GRIM, the University of Hawaii at Manoa and the Hotung Institute in Hong Kong. Production parameters are composed of both biological and technological data referring to survival rates, feed conversion ratios (FCR) and growth rates. Variable production parameters are shown in Table 1:

Table 1: Variable production parameters for a grouper grow-out production farm in East Timor

| Production Assumptions | Unit | Type | Orange-spotted Humpback | |
|--|---------------------|--------------|--------------------------------|-------------|
| Fingerlings | fish/farm | 4 ton farm | 10000 | 10000 |
| Cost | US\$/fish | | 0.85 | 0.95 |
| Stocking size | gram/fish | | 5 -10 | 5 -10 |
| Harvest size | gram/fish | | <500 | <500 |
| Stocking density | fish/m ³ | 5 gram/fish | 200 | 200 |
| Harvest density | fish/m ³ | 500gram/fish | 20 | 20 |
| Feed | US\$/kg | | 1.2 | 1.2 |
| Feed Conversion Ratio (FCR) | per fish | dry pellet | 1.4 | 1.6 |
| Production Cycle | month | | 8 | 18 |
| Survival Rate | % stock | | 70% | 70% |
| Average prices used in baseline economic analyses | | US\$/kg | \$10 | \$60 |

PROJECT COSTS

Project and farm cost data were derived from GRIM's published information as well as through communications with mariculture experts and researchers in the region (Sutarmat *et al* 2003, Da Costa (2005) and Pomeroy (2005). Cost data was used to structure the baseline framework for the enterprise budget and cash flow analyses. Project costs that are built into the financial model include basic operation and management costs associated with running a grouper enterprise on a yearly basis. Co-op, insurance and marketing costs are given in Table 2:

Table 2: Annual project costs for a grouper mariculture enterprise in East Timor

| Project (Co-op) Costs | Total (US\$) |
|--|---------------------|
| Car Lease | 60000 |
| Car mileage allowance | 15000 |
| Office equipment | 2000 |
| Supplies | 12000 |
| Office space | 5000 |
| Communication | 6000 |
| Utilities | 6000 |
| Political Risk Insurance to cover 15 farm | 36050 |
| Marketing Costs (<50 ton/cycle) | |
| Hiring of tender boat to transport fish to HK | 130000 |

Fixed Farm Costs

Specific capital investment costs that were used for the financial analysis can be found in Table 3. A 3-year amortization period is assumed for capital equipment, meaning that these items will need to be replaced every 3 years while the expense is absorbed within the flow of funds over a 10-year enterprise. Three years equate to 4 cycles when farming orange-spotted grouper and every 2 cycles when farming humpback grouper.

Table 3: Fixed capital investment (replacement) costs for each grow-out grouper farm in East Timor (US\$)

| Equipment | # Units | Price/Unit | Cost/Farm |
|-------------------|----------------|-------------------|------------------|
| Raft | 10 | 600 | 6000 |
| Net-cage | 10 | 500 | 5000 |
| Shelter | 1 | 1000 | 1000 |
| Anchorage | 4 | 200 | 800 |
| Boat (w/motor) | 1 | 3000 | 3000 |
| Maintenance | 1 | 3000 | 3000 |
| Stock and Harvest | 1 | 400 | 400 |
| Quality Control | 1 | 1000 | 1000 |
| | | Total | 20200 |

Labor Costs

Local labor costs were based on average monthly incomes figured by surveys and personal communications as described in the data collection methods discussed earlier. This project allows for a stable monthly salary of \$100 per farm worker. Fifteen farms would employ 60 local farm workers. A grouper co-op would include these farm workers plus employment for 12 local administrative workers (6 employees per site). Local administrative duties would require business managers, technicians, administrative assistants, quality control officers, drivers and general assistants. Additional costs needed to run the co-op on a yearly basis can be found in Table 2. This model will assume a total of 72 local workers will be employed under the grouper co-op and would work jointly with enterprise investors, managers, trainers and consultants.

Since grouper mariculture would be a new industry to East Timor this analysis allows for a technology transfer cost that includes the hiring of project managers, quality control technicians and training personnel that will oversee the project during the first two years of grow-out production. Twenty-five percent of the total payroll costs are attributed to technology transfer wages which accrue in the first two years of the 10-year enterprise. Seventy-five percent of the total labor costs are for local grouper co-op workers. Wages for all positions under a 10-year grow out enterprise are given in Table 4.

Table 4: Payroll for a 10-year grow-out mariculture enterprise in East Timor (15 farms)

| Employees | Quantity | Monthly Wage | Period (Year) | Total Cost (US\$) |
|---------------------------------|-----------------|---------------------|----------------------|--------------------------|
| Grouper Co-op | | | | |
| Farmers | 60 | 100 | 10 | 720000 |
| Local Business Manager | 2 | 800 | 10 | 192000 |
| Local Technician | 2 | 600 | 10 | 144000 |
| Administrative Assistant | 2 | 400 | 10 | 96000 |
| Quality Control Officers | 2 | 600 | 10 | 144000 |
| Drivers | 2 | 300 | 10 | 72000 |
| General Labor | 2 | 200 | 10 | 48000 |
| Technology Transfer | | | | |
| Expatriate Business Manager | 1 | 8000 | 2 | 192000 |
| Expatriate Technical Manager | 1 | 8000 | 2 | 192000 |
| Mariculture Consultants | 1 | 2500 | 2 | 60000 |
| Training | 1 | 1000 | 2 | 24000 |
| Total Payroll/Enterprise | | | | 1,884,000 |
| Total Payroll/Farm/Year | | | | 12,560 |

METHODS FOR FINANCIAL ANALYSIS

In order to assess the financial feasibility of a grouper enterprise this study developed an enterprise budget from the data obtained by primary and secondary sources as described in Tables 1-4. Enterprise budgets provide a representation of estimates of specific inputs and outflows associated with a business opportunity. These estimates most often include profits in the form of cash receipts (revenues) and costs associated with production cycles pertinent to the goals of the enterprise being considered. Enterprise budgets are used extensively in assessing agriculture management options and in this case, will be used to develop and interpret the cash flow analysis with respect to culturing grouper in East Timor. The enterprise budget can also be used by itself to determine the feasibility of one scenario over another. In addition the cash flow, or annualized enterprise budget, provides a decision maker with an internal rate of return (IRR) that can then be used to quantify investment returns given a particular production scenario for a period of time.

To more fully grasp the idea of an IRR, it is important to first understand the concept of a net present value (NPV). A NPV of a project simply expresses the difference between a discounted present value (PV) of future benefits and the discounted PV of future costs (e.g. $NPV = PV(\text{Benefits}) - PV(\text{Costs})$) (Campbell 2003:41). A positive NPV for the project therefore details a project where benefits (revenues) are greater than its costs. A management decision based on NPV criteria would be to choose the alternative with the highest NPV. An IRR then can be defined as the discount rate at which the net present value (NPV) of the enterprise becomes zero (Campbell 2003:44). Hence, all positive IRRs ($IRR > 0$) found in the cash flow and sensitivity analyses are representative of the percent of return an investor could expect on a particular initial investment under the assumed financial parameters. A negative IRR means that costs are greater than benefits (profits) and therefore not a feasible alternative.

Lastly, a sensitivity analysis was performed to analyze the effects that select variables have on the profitability, or IRR, of the enterprise. Two variables that carry considerable uncertainty for the grow-out production of grouper in net cages are survival rates (SR) and the wholesale prices paid for cultured grouper. Survival rates largely correspond to keeping the fish alive during production cycles, and as is the case for Scenario II, keeping the fish alive during transportation. Variations in fish survival rates (50%-90%) are compared with changing wholesale market prices for humpback grouper (\$40-\$80), which collectively helps to highlight levels of profitability associated with grow-out production.

RESULTS

Results were figured into the financial model and reported according to baseline parameters discussed above. The enterprise budget analysis given in Table 5 reflects the inflow and outflow of total costs and revenues pertaining to each farm during one grow-out cycle under the assumed production scenario. The cash flow, found in Table 6, annualizes the enterprise budget costs assumed for each cycle and details the respective revenues and costs for each farm per year assuming a 10-year production period. Enterprise budgets for the grow-out of orange-spotted grouper (not provided) showed a *negative* return of \$18,649 as well as a *negative* return of \$17,513 when selling the product at a farmgate price of \$8/kg or marketed to directly to Hong Kong at a wholesale price of \$12/kg, respectively. Therefore, results presented hereafter only relate to the culture of humpback grouper due to negative returns associated with low valued species such as orange-spotted grouper¹³. However, future analyses considering lower valued species may be merited assuming different scenarios. The break-even price for culturing orange-spotted grouper under the proposed financial model ranges from \$17/kg to \$20/kg when sold either at farmgate or wholesale market prices respectively.

Enterprise Budget

The enterprise budget in Table 5 details expected revenues and costs for each of the 15 farms for one production cycle. The net return of project reflects total revenues minus total costs after accounting for technology transfer costs, a 35% income tax and \$300 tax credit for each Timorese worker per year. The net return when humpback grouper are sold at farmgate prices (Scenario I) is negative (-\$6,146). A positive return of \$44,410 can be achieved when grouper are shipped directly to Hong Kong by the enterprise and sold at average wholesale prices (Scenario II). If all 15 farms are considered, the enterprise could expect a positive return of \$666,000 per cycle if the humpback grouper are sold in Hong Kong under scenario II. These calculations use baseline prices for selling humpback grouper either at farmgate or at wholesale prices (\$25/kg and \$60/kg respectively) using a 70 % survival rate. The enterprise budget in Table 5 shows that the net return for the grow-out humpback grouper is feasible and potentially profitable if the fish are transported and sold in Hong Kong. By the same standards, these results show that it is not feasible if selling humpback grouper at farmgate prices.

¹³ Specific information pertaining to this financial analysis can be obtained by contacting the authors.

Table 5: Enterprise budget analysis for an 18-month grow-out cycle of humpback grouper in East Timor

| | Sold at Farmgate (US\$) | Sold in Hong Kong (US\$) |
|----------------------------------|-------------------------|--------------------------|
| Revenue | 65625 | 157500 |
| Amortized capital cost | 12615 | 12615 |
| Production cost | 37676 | 37676 |
| Fingerlings | 9596 | 9596 |
| Feed | 5040 | 5040 |
| Labor | 7200 | 7200 |
| Other | 15840 | 15840 |
| Contingency (3%) | 1130 | 1130 |
| Additional Project cost | 17200 | 21500 |
| Total Cost | 68622 | 81588 |
| Net Return to enterprise* | -6,146 | 44,410 |

*Includes technology transfer costs, a 35% income tax and a \$300 tax credit for each Timorese worker

Cash Flow

The cash flow analysis in Table 6 is representative of a 10-year project and the results coincide with one of the 15 farms that would be required for the grouper mariculture enterprise assumed under the financial model. This particular cash flow analysis is for the higher valued humpback grouper when marketed directly to Hong Kong since the enterprise budget in Table 4 showed this to be the only feasible option assuming baseline conditions (\$60/kg wholesale price and a 70% survival rate). The initial investment required by the financial model is to outlay a beginning bank balance that would be equal to or greater than the total cost of the first two years of production for each farm in question, regardless of what species or scenarios are considered. Since technology transfer costs occur only in the first two years of the enterprise, the initial investment will be enough to cover costs associated with setting up the farms as well as labor and training costs (see Tables 1-4). Subsequently, the cash flow analysis provided in Table 6 assumes a \$140,000 initial investment for each farm, or a total project investment of US\$ 2.1 million would be needed to grow out humpback grouper and sell it at average wholesale prices in Hong Kong. Similarly, the initial investment of an enterprise that would sell humpback grouper at farmgate prices (e.g. \$25/kg under scenario I) would require a minimum investment of \$116,000, although even an investment equal to \$140,000 would not change the resulting IRR, and therefore would still not be a feasible alternative by this model. Assuming all conditions of the financial model, an IRR of 38% was found to be the expected return to an investor under scenario II. This implies that with a 10 year project and a \$2.1 million investment, the entire enterprise based on 15 farms under baseline conditions could make a profit equivalent to a present value of \$800,000.

Table 6: Cash flow analysis of a 10-year grow-out farm for humpback grouper sold in Hong Kong at average wholesale prices (US\$60/kg)

| | <i>Year 1</i> | <i>Year 2</i> | <i>Year 3</i> | <i>Year 4</i> | <i>Year 5</i> | <i>Year 6</i> | <i>Year 7</i> | <i>Year 8</i> | <i>Year 9</i> | <i>Year 10</i> | |
|----------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|--------|
| Beginning bank balance | 140000 | 65298 | 134528 | 93895 | 153710 | 122962 | 195907 | 255722 | 224973 | 297918 | |
| Cash receipts | 0 | 157,500 | 0 | 157,500 | 0 | 157,500 | 157,500 | 0 | 157,500 | 157500 | |
| Operating expenses | 54502 | 55015 | 40632 | 49299 | 30748 | 49299 | 49299 | 30748 | 49299 | 49299 | |
| Net Tax | 0 | 33256 | 0 | 28186 | 0 | 35256 | 28186 | 0 | 35,256 | 0 | |
| Net cash income | -54502 | 69229 | -40632 | 80015 | -30748 | 72945 | 80015 | -30748 | 72945 | 108201 | |
| Capital equipment purchase | 20200 | 0 | 0 | 20200 | 0 | 0 | 20200 | 0 | 0 | 0 | |
| Ending cash balance | 65298 | 134528 | 93895 | 153710 | 122962 | 195907 | 255722 | 224973 | 297918 | 406119 | |
| IRR: | 38% | -74702 | 69229 | -40632 | 59815 | -30748 | 72945 | 59815 | -30748 | 72945 | 108201 |

Sensitivity Analysis

The results of a sensitivity analysis give guidance on which budget variables most greatly impact the enterprise's profitability through the comparison of internal rates of returns. The sensitivity analysis in Table 7 provides IRRs that compare the profitability of the two marketing scenarios (I and II) selected for investigation. Variables that are considered a major threat to the enterprise's profit were found to be survival rates and wholesale market prices. Although no variance was given for farmgate prices, hypothetical farmgate prices are assumed to be \$15/kg and \$35/kg to add a comparative element to the sensitivity analysis. In reality of course, farmgate prices are subject to change as well with respect to increased or decreased transportation costs. The baseline model assumes a \$25/kg farmgate price and a \$60/kg wholesale market price for humpback grouper considering a 70% survival rate. Optimistic returns (117%) could be anticipated with a wholesale price of \$80 with 90% of the original stock surviving, although this is unrealistic, particularly in response to an unskilled farmer applying grow-out techniques in a new region (e.g. East Timor). If a farmgate price of \$35/kg and a 90% survival rate is considered under the financial model selling humpback grouper under scenario I would result in an IRR of 31%. This too is unrealistic as it is unlikely that someone willing accept the costs and risks associated with the transport of live fish over significant distances would be willing to pay a farmgate price of \$35/kg in East Timor unless wholesale prices for cultured grouper in Hong Kong drastically increase. In lieu of the increase in demand for global resources (e.g. oil and water), it is more likely that prices paid for fish at farmgate would decrease accordingly. More realistic values would be to expect lower survival rates and average prices. For example, selling fish in Hong Kong markets at average wholesale prices and assuming a survivability rate of 50% to 90%, the expected IRR would range from 13%-67% respectively. IRRs have been found in a similar fashion for grouper grow-out production units in the Philippines which have been found to have IRRs of 59% and 82%, which helps to validate the relevance of the results presented here in the case for East Timor (Sadovy et al 2003:xvii). Like the enterprise budget and cash flow analyses, the sensitivity analysis clearly shows that in order to better assure a positive IRR, assuming baseline conditions, the cultured humpback

grouper would need to be shipped directly to Hong Kong fish markets and sold at average wholesale prices. High IRRs related to selling humpback grouper on foreign wholesale markets helps to justify the costs involved in contracting a tender boat rather than if the cost of hiring the tender boat was forgone for farmgate prices. Although without the market driven demand for live fish in Hong Kong helping to add value to wholesale prices, transportation costs would become too expensive to make this a feasible project under the assumed model. Table 7 shows the variance in profitability (IRR) to the enterprise under the two market scenarios applied to the financial model and analyzed over a range of selling prices and grouper survival rates.

Table 7: Internal Rates of Returns (IRR) using survival rates (SR) and Price variances for humpback grouper sold in East Timor at farmgate prices (Farm\$) or marketed to Hong Kong (HK\$) *

| Farm\$ | SR 50% | 60% | 70% | 80% | 90% |
|---------------|---------------|------------|------------|------------|------------|
| 15 | - | - | - | - | - |
| 25 | - | - | -4 | 3 | 9 |
| 35 | -3 | 7 | 15 | 23 | 31 |
| HK\$ | SR 50% | 60% | 70% | 80% | 90% |
| 40 | - | -2 | 7 | 16 | 24 |
| 60 | 13 | 26 | 38 | 53 | 67 |
| 80 | 36 | 55 | 74 | 95 | 117 |

*IRR's are in bold. Negative values are assumed to be not feasible and are represented by an (-).

DISCUSSION

Economies in Transition

In general, a transitional economy can be loosely defined as one that is changing from a controlled (planned) economy to a market (free) economy. Although the premises that have defined the transitional status of certain countries vary widely and extend beyond classical definitions to include transformations from socialist-type command economies, post-colonial development or decolonization, an overthrown dictatorship or simply from being in a severely underdeveloped and poor condition. East Timor's economy gained transitional status once the Timorese voted for their independence from Indonesia in 1999. As highlighted earlier, this claim to independence led to mass destruction of the majority of infrastructure found within the borders of East Timor. Not only did many innocent patrons lose their life in the process, but the political and social upheavals that followed independence did little to encourage economic development in the region. Governance restructuring, privatization, foreign exchange, competitive policies, infrastructure reform and the assignment of property rights to once public lands are common indicators that help to measure the progress of transitional economies following the aftershocks of national transformation¹⁴.

¹⁴ EBRD 1994 Transition Report <http://www.ebrd.org/pubs/econo/6520notes.pdf> (accessed 11/17/06)
See also World Bank, "10-Years of Transition"
<http://rru.worldbank.org/PapersLinks/Open.aspx?id=3509#search=%2210%20years%20transition%22>
(accessed 11/11/06)

Risks and Uncertainties

It is recommended that before an aquaculture enterprise of any caliber is undertaken a thorough assessment of environmental and social conditions should be made to insure the sustainability of the project on a long-term basis. For example, it is well known in the aquaculture industry that offshore (oceanic) mariculture farms often coincide with increased occurrences of red tides. Red tides can occur as a result of increased concentrations of a specific types of marine algae in marine waters. In effect, these algae can render otherwise edible shellfish unfit for consumption due to the shellfishes' uptake of toxins from the algae. Other general risks that should be considered before undertaking a mariculture industry, particularly for transitional economies, are those of civil unrest and political instability. Sadovy *et al* (2003) reports that that 'civil unrest, mainly because of separatist movements in Indonesia and the Philippines, has undoubtedly reduced access to some fishing grounds and rendered live fish transport risky across a wide area. These conditions are unlikely to change in the short to medium term¹⁵'. In the case for East Timor, civil unrest has recently been exacerbated by the lack of political leadership and the poverty that haunts the nation. Unfortunately this form of political instability is not uncommon to transitioning nations. Luckily, global development organizations have recognized the vulnerability of social and political situations in struggling economies and offer various forms of investment protection by offering specially formulated insurance packages to promote business development for regions in need of social and economic development. For instance, political risk insurance¹⁶ can be purchased by an entrepreneur seeking to invest in foreign markets. The Multilateral Investment Guarantee Agency (MIGA) of the World Bank Group promises to 'promote foreign and direct investment into developing countries to support economic growth, reduce poverty and improve people's lives...and to provide investors with confidence and comfort they need to venture into developing markets (SIP 2006:2)'. Following consultation with MIGA representatives, associated insurance costs were built into the financial model and accounted for in the enterprise budget under 'other' costs (see Table 5). For a grouper enterprise in East Timor it was calculated that, given the minimum investment requirements to run the cash flow analysis, political risk insurance would cost each farm about \$2,400 per year (\$200/month) while costing the entire enterprise roughly US\$36,000 per year. These are of course, just a few of the considerations that would need to be taken into account should an enterprise such as the one presented here be developed.

Although profits may look attractive at first sight, the production of higher valued species such as the humpback grouper requires double the amount of time to grow-out to a marketable size than that of other species of grouper. A longer production cycle can increase risks and compound uncertainties while extending periods between profit returns. As there are many other species of grouper to culture, market research would need to be factored into an economic analysis in relation to up-to date wholesale market values concerning particular species and their product availability at the time of investor interest.

¹⁵ See: http://www.adb.org/Documents/Books/Live_Reef_Food_Fish_Trade/62289_chap2.pdf (accessed 11/17/06)

¹⁶ See World Bank Group: <http://www.miga.org/> (accessed 11/1/06)

The Pursuit for Sustainable Mariculture

In order to develop East Timor's fishery sector in accordance with international and national standards, the fishery must utilize sustainable alternatives such as aquaculture. An outcome of the United Nation's 2002 Earth Summit in Johannesburg South Africa established a commitment towards sustainable development in order to maintain or restore depleted fish stocks to levels that can produce maximum sustainable yields by 2015. Furthermore, the Earth Summit issued the need to develop and facilitate the use of diverse approaches and tools including an ecosystem based management regime and the elimination of destructive fishing practices by 2012 (UN 2002). More recently the Asia-Pacific Economic Cooperation (APEC) implemented 'The Bali Plan of Action' recognizing that fisheries and aquaculture resources contribute to food security, local livelihoods, and are key drivers of the economy that demand a commitment to ensure sustainable management and development in the region (APEC 2005). The outlook for aquaculture, therefore, has a promising future not only to the world in general, but particularly for developing countries such as East Timor and for other regions that have direct access to ocean resources. Many different types of aquaculture methods exist today and given the evidence supporting worldwide declines in wild fish populations the forecast of aquaculture growth is ripe for investors and even more so for developing countries struggling to meet food demands of a growing population. Groupers are referenced as being some of the most desired fish in the live reef fish trade although their species as a whole are relatively uncommon, long-lived, and late maturation makes their (groupers in general) depletion to reef ecosystems a significant concern (Sadovy *et al* 2003). Subsequent destruction of reef habitats, illegal over fishing, inconsistent availability of hatchery-reared fingerlings and weak government policies toward the marine environment are just a few of the reasons proposed in support of a more sustainable practices (WRAS 2006, FAO 2004, Sadovy *et al* 2003; Pomeroy 2002; Cesar *et al* 2000; Johannes & Riepen 1995).

Development and Management Implications

The development of marine protected areas, scientifically based fishery closures, transferable quotas, educational workshops and the sharing of information to raise awareness about sustainable practices are just a few of the many management tools that could be incorporated within such a framework. Sadovy *et al* (2003) recognize in *While Stocks Last*, that the challenge facing the marine finfish farming industry is to undertake such endeavors 'within a sustainability framework that incorporates a range of measures to reduce environmental impact while simultaneously providing socioeconomic benefits by encouraging economic development through four core stages: analysis, knowledge, constituency building, and action', and at the same time, 'drawing on case-study experiences with coastal communities, and attempts to discourage destructive fishing practices and to encourage sustainable livelihoods through aquaculture' (Sadovy *et al* 2003). Bell (1999) proposes that the solution to over- and destructive fishing in the live fish trade can be premised on four parameters (Bell 1999 cited in Pomeroy *et al* 2004:62): availability of production inputs (e.g. fingerlings); economic feasibility; enterprise incentives; and low environmental impact. Likewise, the ADB (1997) identified 3 particular aspects related to financial sustainability of an enterprise by assuring the availability of adequate funds, the recovery of project costs for project benefits as well as providing a financial incentive to investors and farmers (e.g. income and food security). Furthermore, a UNDP Report (2006)

concludes that tackling poverty includes developing and improving four basic concepts: the development of government services; the encouragement of local participation and organization; the involvement of non-governmental organizations (NGO); and encouragement of the private sector (UNDP 2006).

This economic analysis for grouper mariculture in East Timor exemplifies an enterprise capable of meeting most of the fore mentioned challenges. This research further identifies the following challenges that could be used when assessing the feasibility of a mariculture enterprise in a transitional economy. These challenges can be categorized into the four basic concepts and are discussed in more detail in the conclusion, they are:

- (1) *Economic potential and sustainability*
- (2) *Accessibility to viable markets*
- (3) *Favorable investment climate and business incentives*
- (4) *Risks associated with a politically unstable region*

CONCLUSION

Economic potential and sustainability: Mariculture can be acknowledged as a potential enterprise that could be aimed at developing East Timor's economy by providing an exportable product while time increasing employment opportunities at the community level. Thus, assuming proper business ethics and quality control measures, mariculture could be an ideal entry point into a valuable international market. The development of a successful aquaculture venture is also identified as a means to lessen East Timor's current interdependence on imported goods by encouraging projects that have potential to supply domestic markets; such is the case for grouper. Furthermore, mariculture can be a sustainable alternative to catching wild caught species and should be considered since wild caught stocks are being depleted due to their high value. This research identifies grouper as a viable species to culture given the suitable growing conditions afforded by adjacent waters.

Accessibility to viable markets: With the availability of a wide variety of fish species, including what other countries may consider 'trash fish' it is unlikely that the current domestic market would appreciate a higher valued product. A proper evaluation for marketing grouper to a domestic market might consider a value added analysis between live grouper and the alternative of supplying a fresh and dried fish to restaurants and markets. An enterprise considering the culture of grouper would need to specifically target the live reef fish trade in markets where profits can be maximized; such as Hong Kong. The cost to transport these grouper to lucrative international markets should also be taken into account as long distances, piracy and increased fuel costs are a few of the parameters that could negatively impact the final analysis.

Favorable investment climate with business incentives: East Timor's foreign investment laws were explicitly developed with the intent on attracting foreign investors as seen by the allowance of tax credits for the hiring of local employees and import incentives for business development purposes. Under the proposed financial model and assuming survival rates between 50-90%, IRRs ranging between 13-67% were estimated for a 10-year enterprise for the grow-out culture of humpback grouper in East Timor. Aside from potential returns to investors, the proposed financial model incorporates a production incentive by awarding the grouper co-op a percentage of the final product to be distributed accordingly. For instance, if the co-op sold 12

tons of grouper at average farmgate prices (\$25/kg), their profit would be US\$300,000 per cycle; which is more than enough to invest in more grow-out farms, build schools and homes, and/or pay for living and education costs for communities associated with the co-op. Needless to say, the culture of grouper can provide an attractive investment opportunity for investors and communities alike; and ultimately toward the development of East Timor's future.

Risks associated with a politically unstable region: As discussed throughout this report, civil unrest and political instability are major themes infecting transitional economies looking to develop both socially and economically. Poor countries like East Timor can find it very difficult to move beyond the post-transitional phase of development. Fortunately, in order to absorb some of the risks associated with unforeseen development factors like civil unrest and political instability, development agencies like the World Bank Group have taken notice to insure foreign investments.

Finally, the overall purpose of this study has been to encourage the sustainable development of grouper mariculture and its potential as a specific social development project in East Timor, and for transitional economies in general. It is recommended that if such an enterprise is to be developed in East Timor, then a proactive marketing strategy must be implemented to ensure buyers and investors that a sustainable and quality product can be delivered to an already flourishing live grouper trade. Eco-labeling, product certifications and environmentally friendly practices are a few additional concepts that would need to be explored in more detail if the culture of grouper were to become a successful venture in East Timor. Furthermore, with role models such as the GRIM there could be opportunities for committed business entrepreneurs to investigate promoting a strong research oriented aquaculture industry within Timor Leste. The pristine waters afforded in the region would accentuate this type of endeavor.

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