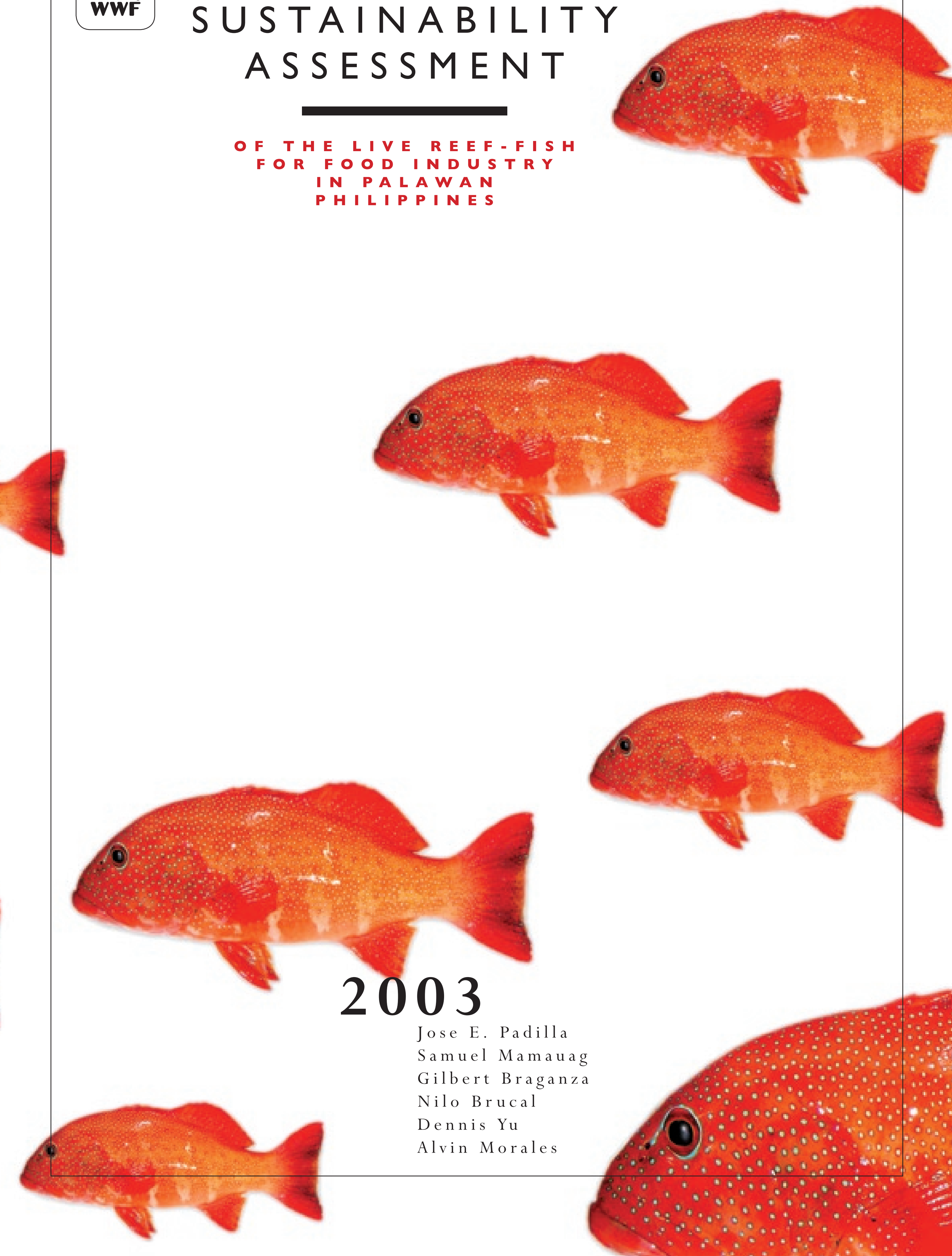
SUSTAINABILITY ASSESSMENT

OF THE LIVE REEF-FISH FOR FOOD INDUSTRY IN PALAWAN PHILIPPINES



2003

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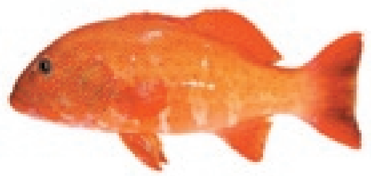

P. leopardus
coral trout
lapu-lapu
suno

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Executive Summary

Concerns have been raised about achieving a balance between and among trade, development, and environment in light of some dismal developments in trade liberalization. Contrary to expectations, trade liberalization has been observed to have adversely affected human and natural capital in terms of biodiversity erosion, natural resources depletion, increased pollution in many developing countries, widening gap between rich and poor, and declining per capita income in a large number of countries.

In response, the WWF launched the Sustainability Assessment (SA) of Trade-Related Policies Project in 1999. SA emphasizes the importance of multistakeholder consultations in evaluating the impact of trade policy on the economy, environment, and society. It ensures that the potential benefits from trade are realized by instituting mitigating and enhancing (the so-called flanking) policies at the local, national, and international levels.

In the Philippines, WWF undertook a SA of live reef-fish for food industry (LRFFI). This industry is driven by strong international demand, primarily in Hong Kong and China. While export of live fish is relatively a small sector in Philippine trade, it has significant environmental and social implications. The commodity is primarily collected from coral reefs, one of the most productive yet sensitive marine ecosystems. The government encourages the export of live fish as an industry to generate foreign currency and to provide a better source of income for fishermen. However, it is now generally perceived that the fish stocks that support this industry have largely declined and their habitats have been degraded, threatening the sustainability of the fishermen's livelihood.

Objectives

Primarily, the study on LRFFI was conducted to demonstrate the usefulness of SA in looking at the environmental, social, and economic impacts of an international trade activity. The aim is to help reform the decision-making processes toward trade policies that are more sustainable and equitable. Specifically, the study aims to:

a. Describe the major players involved in LRFFI and the relationships that exist among them;
b. Analyze the economic, social and environmental impacts of the industry;
c. Undertake multistakeholder consultations at the local (project site) and national levels; and
d. Formulate policy and institutional arrangements that would effectively govern the industry.

Implementation

The Calamianes Group of Islands in the northern part of Palawan was chosen for the study because of the prevalence of live fish trading in the area. Palawan is a major supplier of live fish, accounting for as much as 55% of the country's total export of the commodity. The species of concern is *Plectropomus leopardus*, or coral trout, the major species traded.

A team of social and biophysical scientists conducted the assessment. The team developed a sustainability assessment framework appropriate for LRFFI. It implemented the framework by collecting secondary and primary data and by conducting participatory consultations with major industry stakeholders in the second quarter of 2002. The team interviewed and consulted with fishermen, traders, exporters, and local government officials, among others, in the islands and in Manila. The team also explored coral reefs in several sites to assess the impact of live fish collection, and gathered yearly data on catch. The resulting voluminous information was processed and analyzed to get a quantitative assessment of the economic, environmental, and social impacts of the industry. This document contains the results of the assessment.

Aside from the technical team, a multistakeholder Technical Working Group (TWG) was formed to set the direction of the study and to serve as a forum for discussing its progress and results. The TWG was composed of representatives from government agencies, Non-Government Organizations (NGOs), People's Organizations (POs), and the private sector, namely: National Economic Development Authority, Department of Agriculture–Bureau of Fisheries and Aquatic Resources, Department of Environment and Natural Resources, Palawan Council for Sustainable Development Staff, Department of Trade and Industry, Department of Foreign Affairs, International Marinelife Alliance–Philippines, PAMALAKAYA (a national alliance of fisherfolk organizations), WWF Philippines, and representatives of LRFFI in the study site.

Findings

Evolution of LRFFI

In the Philippines, the collection of live reef fish for food started in the southern tip of Samar Island in the 1980s. From there, it spread to other parts of the country, including the study site. The economic potentials of the industry brought traders and fishermen from other provinces to the islands. The higher price for live fish was the most significant factor in the emergence of the industry. From a small group of 30 pioneers, the number of fishermen grew to almost a thousand in 1992. By late 1990s, an estimated 60–70% of local fishing communities were engaged in live reef fish collection.

Changes in catching methods were also observed over time. Hook-and-line replaced the less efficient fish traps. However, the most common method was the use of cyanide. A cyanide solution in a container was squirted to stun the fish. It made collection easier, but it bleached the coral reefs and killed the fish. Cyanide fishing went as far back as the 1960s, starting with the ornamental fish industry and spreading over to LRFFI. Reports of massive cyanide use prompted the provincial government of Palawan to impose a ban on the catching of live fish in the entire province. The ban was lifted, however, after the fishermen and traders protested and agreed to police their own ranks to stop cyanide fishing. The lifting of the ban opened the industry once again and encouraged the entry of more firms.

Today, the LRFFI in the Calamianes is characterized by dynamic arrangements between and among fishermen, traders/middlemen, boat owners/operators, financiers, and exporters. Transactions take place in four geographical stages – in the islands, in the town of Coron, in Manila, and eventually in Hong Kong and China. A complex system of patronage characterizes the relationships of people in the industry. Fishermen and middlemen are based in the islands, with the latter financing the operations of the former. The middleman provides the boat, fishing implements, gasoline, and other provisions, including loans for the basic needs of the fisherman's family, especially during off-season. The agreement is verbal – built on trust and a promise that fish will be sold exclusively to the financier. The fish collected by the middleman are taken to "buying stations," owned mostly by exporters, in Coron. The exporters maintain sophisticated holding tanks to keep the fish alive. The live fish are transported by chartered small planes to Manila-based exporters. Finally, the fish are transported by commercial flights to Hong Kong and other destinations.

Indicators

The assessment framework developed by the technical team focused on identifying and quantifying appropriate indicators using secondary and primary data, and information gathered from consultations with stakeholders. The indicators are summarized below.

The biological and ecological indicators suggest that the industry is "mining" and degrading its resource base, greatly compromising its current and future regenerative capacity. Catch has lately been declining and any short-term increase in catch comes from fishing grounds outside the Calamianes. Fishermen have been in search for more productive fishing grounds and have been spending more time at sea. The mean size of fish collected is getting smaller and exploitation rates indicate serious overfishing.

Economic indicators essentially support the same results. Income from fishing has been dissipated by declining catches due to overfishing and to the swelling number of fishermen. Likewise, returns from capital and labor have been greatly diminished over time, despite the increase in price of fish in nominal peso terms. The reason why fishermen remain in fishery is primarily the lack of non-fishing employment alternatives in the remote islands.

The social and political institutions are not adequately equipped to address the declining ecological and economic state of LRFFI. These institutions have not adequately responded to arrest the emerging problem despite past policy pronouncements. More recently, however, local institutions are showing resolve to address the problem before the situation becomes irreversible. A necessary and sufficient approach to improve the situation of LRFFI in Calamianes is multistakeholder commitment to do specific roles in managing the industry.

Summary Results of Sustainability Indicators for LRFFI

Sustainability Indicators	Results Using Primary and Secondary Data
Catch	• Live fish catch, in kilogram (kg) weight, predominantly of *P. leopardus*, decreased from 1998 to 2001.
Catch per unit effort (CPUE)	• Absence of benchmark does not allow trend analysis, but fishermen perceive CPUE to have declined significantly over the past 5 years.
Fishing distance and duration	• Respondents travel farther than in the past in search of new and productive fishing grounds, resulting in longer fishing trips/duration.
Species composition	• *P. leopardus* remains the most dominant species.
Fish body size	• Mean body size of *P. leopardus* decreased from 1998 to 1999. • There was also a reduction of the ratio of total weight (in kg) to total number of individuals in the catch (abundance) of live fish from 2000 to 2001. • Both results suggest growth overfishing.
Size/age at sexual maturity	• Live fish trade targets a size range (28–32 cm total length) of young and sexually immature to maturing individuals. • High catch rates of small-sized individuals may lead to recruitment overfishing.

Sustainability Indicators	Results Using Primary and Secondary Data
Exploitation rates/yield per recruit	• Maximum Sustainable Yield (MSY) is exceeded; stocks of P. leopardus in the Calamianes are overfished.
Habitat degradation due to cyanide exposure	• No significant spatial effect; estimate of habitat degradation was small, but dead coral cover was greater than live coral cover on cyanide-impacted areas compared to non-impacted areas.
Price	• Increased significantly over a 10-year period
Employment	• No time series data but current number is estimated at over 1,000 artisanal fishermen, primarily migrants from other provinces
Investment	• As the number of fishermen increased, so did investments. While no census data exists, considering fishermen-boat ratio of 3 persons, there should be at least 300 boats engaged in the industry. The number of boats in past years was much higher, according to traders.
Labor productivity	• Average annual gross profit amounted to over PhP25,000 in 2001. This is lower than legal minimum wage rates. Fishermen remain in the industry because they do not have employment alternatives.
Capital productivity	• Average returns on investments are very low. • Quite a number of fishermen are already losing.
Income distribution	• Inequitable distribution of benefits – those who have greater access to and control of finances reap the benefits while ordinary fishermen continue to incur debts year round
Government capacity and capability	• No management plan for fishery; besides, there are no resources to do this. • Perceived presence of vested interests by local financial and political elites. No real decisions are made. • Barangay government is regarded relevant in terms of facilitating the participation of fisherfolk in decision-making. • Coordination among government agencies is constrained by cross-cutting jurisdictional issues, ambiguous working relationships, and lack of institutional accountability
Self-reliance and empowerment	• No substantive multi-sectoral consultations, multistakeholder dialogues, and other relevant consensus-building activities in all levels, or no resource management use (at levels of fisherfolk, LGU, policy, etc.).
Gender-complementing roles and functions	• Gender roles to keep economic activity within the family have shifted and have achieved equal levels of significance. • Uncertainty of income from LRFFI led women to assume more economically significant roles.
Access to basic social services	• Absence of key service infrastructures at the barangay level (especially in the islands where fishing communities are located)

Role of Trade

With its abundant labor and potentially productive marine waters, the Philippines has a comparative advantage in the constantly growing global fish trade. To harness such potential, the government provided a supportive trade policy environment, particularly in the export of various fish products. This resulted in such economic benefits as foreign exchange earnings, jobs, and higher income for those directly involved in the export industry. However, there were also detrimental effects.

First, the price premium on preferred size of fish results in the targeting of young and sexually immature fish, which in turn leads to recruitment overfishing. Second, the significantly higher price of live fish drives the collection of fish well beyond limit and without regard to the capacity of the stock to regenerate. Third, cheap capital from traders and exporters further fuels the fishing frenzy.

Clearly, international demand accounts largely for the unsustainable path of the industry. The extent to which this trade can be harnessed to reverse the trend appears limited. Moreover, the observed pattern of moving fishing operations from overfished to more productive reefs is due partly to transfer of investments by traders and exporters. Nevertheless, any measure that would address the problems of the industry needs the acceptance and active participation of traders.

Recommendations

Using the environmental impact assessment framework, the logical recommendation would be to impose a moratorium on fishing to allow the fish stocks to recover. But from the sustainability assessment framework, which gives due consideration to economic and social impacts, rationalization of the industry is recommended to address the problems of overfishing, cyanide fishing, and intrusion of migrant fishermen into Palawan waters, among others.

A "roadmap" to a sustainable fishery

In the context of participatory decision-making an iterative process outlined in the figure below is recommended. Writing of this report has benefited from the implementation of some steps in this suggested process.

The take off point is the completed technical report on the SA of LRFFI. Stakeholders, whose inputs were actively sought in the surveys and focus group discussions, need to be informed about the results of the study. Such results, which represent processed information and issues that came from the stakeholders themselves, need to be validated during the presentation. Stakeholders include the fishermen, traders covering the entire market chain, local government units at all levels, national government agencies, NGOs, and peoples' organizations, among others. It is noted that the results of the study have been presented and generally accepted by stakeholders in two forums.

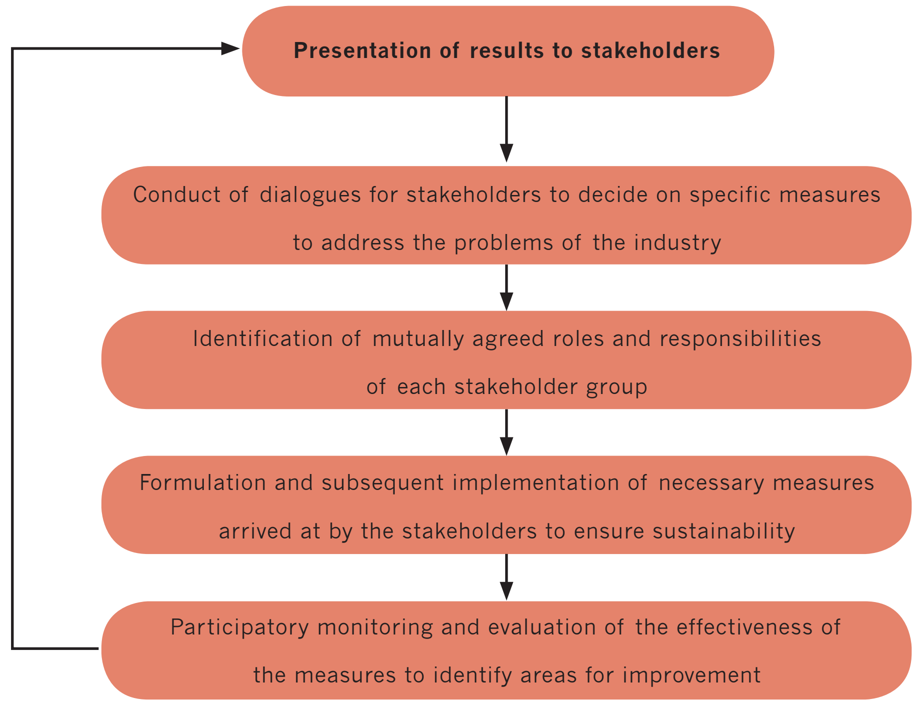
The validated technical report embodies the agreed and accepted characterization of the industry in terms of economic, environmental and social status. It will serve as an invaluable guide in ensuing continuing dialogues among stakeholders to identify specific measures that will address the problems of LRFFI. Such dialogues are process oriented; inputs of all stakeholders are heard and considered by the entire group. It is a slow process, but there is no alternative to this multistakeholder process that would ensure stakeholder acceptance of identified measures.

An important output from these dialogues is an agreement on the roles of the various stakeholders for each identified measure. The role of each stakeholder should be specific, and compliance is measurable to avoid potential "free riding" by any stakeholder group. In the LRFFI, the key stakeholders whose roles need to be delineated clearly and where their agreement is critical, are the traders and fishers, in this order of significance. The traders drive the entire industry by providing the necessary investments. Their enormous influence on the fishermen may be harnessed to address the problems of overfishing and cyanide fishing.

The identified measures should comprise of a minimum set of regulatory and economic instruments necessary to address the three main problems of the industry, namely, overfishing, cyanide fishing, and intrusion into Palawan waters by fishermen from other provinces. The technical team that prepared this report may be called upon to provide expert advice on the menu of options that could work in the fishery. Identification of the minimum set of regulations should be guided by the results of the technical report.

The implementation of the regulatory and economic instruments should be monitored in terms of their effectiveness in addressing the problems of the industry. This stage of the roadmap is an iterative process. Further, the result of the evaluation will have to be presented to stakeholders for appropriate action. If the initial regulations are not sufficient to reduce both overfishing and cyanide fishing, additional measures must be put in place until the desired outcomes are achieved. However, the costs of implementing the measures need to be weighed against the benefits.

Roadmap to a Sustainable Live Reef-Fish Industry



Acknowledgements

This report is a result of a multi-stakeholder cooperation among those who share similar concerns about the future of the Live Reef-Fish for Food Industry (LRFFI). Special thanks are extended to the stakeholders in the Calamianes Islands in Palawan–the fishermen particularly from the islands of Coron, Delian, Kanipo, Nangalao and Panlaitan, traders, exporters and others who are directly engaged in the trade–for generously allowing us a glimpse of the activities during the conduct of the participatory research. The brief but very precious opportunities generously provided to our team led to the writing of this report.

The insights and candid views provided by the following are recognized: Hon. Alfredo Enriquez, Municipal Mayor of Coron; Mr. Arnulfo Vicentino, Municipal Planning and Development Officer of Coron; Municipal Councilors Patrick Matta and Jing Astor; Congressman Brown Sandoval; Ms. Nora Labrador, Mr. John Pontillas and Director Winston Arzaga of the Palawan Council of Sustainable Development Staff; officers and members of the Calamianes Fisherman's Association, particularly Ms. Miniani Baylosis and Mr. Jing Astor; Sagrapunta Foundation; and Environmental Legal Assistance Center. The assistance to the research team of Mr. Al Linsangan and Mr. Melchor, both residents of Coron, Palawan, was very valuable in navigating the Calamianes waters.

The members of the project Technical working Group have provided general directions to the project and also comments on the preliminary results of the study. The chair and members of the project TWG include the following; National Economic Development Authority; Department of Environment and Natural Resources; Palawan Council for Sustainable Development Staff; Department of Trade and Industry, Department of Foreign Affairs; International Marinelife Alliance–Philippines; PAMMALAKAYA; WWF-Philippines; the Trade and Investment Unit of WWF-International; representative of the Calamianes Fisherman's Association.

Finally, to WWF-International, Bureau of Agricultural Statistics, Department of Agriculture and WWF-Philippines for the financial support and for believing in what the project hoped to achieve.

List of Acronyms and Abbreviations

AFMA	Agricultural and Fisheries Modernization Act
APEC	Asia-Pacific Economic Cooperation
BAS	Bureau of Agricultural Statistics
BFAR	Bureau of Fisheries and Aquatic Resources
BPR	Biomass Per Recruit
CGI	Calamianes Group of Islands
CI	Conservation International
CPUE	Catch-Per-Unit Effort
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
ECAN	Environment Critical Action Network
EIA	Environmental Impact Assessment
FAO	Food and Agricultural Organization
FISAT	FAO-ICLARM Stock Assessment Tool
GBR	Great Barrier Reef
ICLARM	International Center for Living Aquatic Resource Management
ILP	Import Liberalization Program
IMA	International Marinelife Alliance
IPRA	Indigenous Peoples Rights Act
LGC	Local Government Code
LGU	Local Government Unit

LIT	Line Intercept Transects
LRFFI	Live Reef Fish for Food Industry
MSY	Maximum Sustainable Yield
NGO	Non-Goverment Organization
OECD	Organization for Economic Cooperation and Development
PAG-ASA	Philippine Atmospheric, Geophysical, and Astronomical Services Administration
PCSD(S)	Palawan Council for Sustainable Development (Staff)
PNP	Philippine National Police
PO	Poeples' Organization
SA	Sustainability Assessment
SEP	Strategic Environment Plan
SCUBA	Self Contained Underwater Breathing Apparatus
TRP	Tariff Reform Program
TWG	Technical Working Group
UNEP	United Nations Environment Program
VBGF	Von Bertalanffy Growth Function
WTO	World Trade Organization
WWF	World Wide Fund for Nature
YPR	Yield-Per-Recruit

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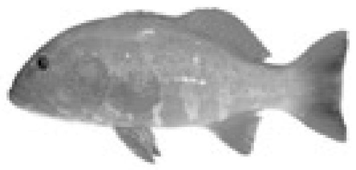


PART I BACKGROUND[1]

1. Introduction

Achieving development is the basic tenet of globalization. It is believed that increasing interaction among people from different parts of the globe will create wealth and share benefits across borders (Lam 2001), propping up the economies of developing countries to address such goals as poverty alleviation, economic growth, and environmental protection. One significant component of globalization is trade liberalization, which involves the gradual but steady removal of trade barriers across countries. This has allowed faster movement of goods across national boundaries, and better efficiency in production and in the provision of services. It has also paved the way for substantial cross border flow of capital. Proponents of free global trade believe that these benefits present new hopes for many countries in solving national problems.

Recently, however, some governments have pointed to deficiencies in the global trading system. They have observed that since the formation of the World Trade Organization (WTO), which hastened the trade liberalization process, trade deficits have increased and growth rates fell (UNEP 2001). Others cited failures in achieving a balance between economic gains and environmental protection. They argued that trade liberalization had caused serious damage in certain natural resource-based sectors, with substantial social costs. Studies on the forestry sector, shrimp aquaculture, and certain internationally traded agricultural products seem to support this.

Based on early and emerging literature, it seems that the environmental and social costs of trade liberalization have started to outweigh the economic benefits. In many countries, biodiversity has been eroded; natural resources have been depleted; pollution has increased, especially in the developing countries; the gap between rich and poor has widened; and per capita income has declined. Questions have been raised about economic gains from trade in light of the eroding social and environmental capitals.

[1] This section was written by J. Padilla and N. Brucal

Environmental and social considerations should be given due weight in environmentally sensitive projects and in policy formulation. One of the concrete tools to ensure this is environmental impact assessment (EIA). The Philippines has institutionalized EIA, but its focus has been limited to environmental assessment and mitigation. Lately, some sectors have pointed to the need to widen the scope of assessment. The sustainability assessment project being implemented by WWF Philippines, in collaboration with multistakeholders, fills this need. SA focuses not only on environmental assessment but also on economic and social aspects.

The WWF Philippines project is part of a global program on SA focusing on trade policies. SA emphasizes a multistakeholder-oriented approach in assessment through rigorous analysis of impacts of trade policies on the economy, environment, and society. Its goal is to maximize the benefits from trade by enhancing the positive impacts of trade and mitigating its negative economic, environmental, and social impacts. This can be achieved through a set of local and national policies (and possibly international agreements) formulated after thorough assessments and consultations with and among stakeholders.

The WWF effort has been motivated by earlier and parallel initiatives. The UNEP has made an effort at integrated assessments and has come out with the Reference Manual for Integrated Assessment of Trade-Related Policies (UNEP 2001). The manual serves as a guide for governments and policymakers in assessing trade policies toward achieving a synergy among economic, environmental, and social goals. Canada has come out with Strategic Environmental Assessment to ensure that environmental goal is properly taken as a valuable component in development equations. The US has passed EO 13141 in 1999 to ensure careful environmental assessment of the potential impacts of trade-related policies.

The Philippine case study

In April 2001, WWF launched at a workshop in Manila the Philippine case study on the SA of trade policies. Participants agreed on the conduct of SA in light of the scarcity of information on the social, economic, and environmental impacts of trade liberalization. The participants also identified the fisheries sector as a priority area. The sector is tremendously important to the Philippine economy as it contributes close to 4% of gross domestic product and employs around one million people.

The choice of the sector further assumed significance in light of the contentious Tariff Reform Program (TRP), which is now on its fourth and final phase. The TRP is a policy initiative started in 1981 to improve the country's international competitiveness. The TRP also addresses its international commitments based on the "reply and offer" principle, which calls for presentation of a set of offers and counteroffers by the Philippines when negotiating with other countries. The program has gone through four stages, with each stage marked by reduction in tariffs of a number of commodities. Along with the Import Liberalization Program (ILP), the TRP abolished high levels of protectionism over time, thus engaging the Philippines in liberal trading arrangements in the hope that it will enhance the country's competitiveness and productivity.

Subsequently, a technical team was mobilized to undertake the SA. A multistakeholder Technical Working Group was also formed to serve as a forum for setting the direction of the project and the evaluation. The TWG recommended the assessment, aside from the TRP, of the country's export-oriented trade policy. To demonstrate how SA worked, a specific subsector – the LRFFI – was chosen on account of its international trade orientation and its perceived environmental, social, and economic impacts. The case study was conducted in the Calamianes Group of Islands because of its 65% contribution to total exports of groupers – the largest group of species in the LRFFI.

The case study has a wider geographical prominence because the province of Palawan was reputed to be the Philippines' remaining frontier of pristine and unspoiled natural resources. Palawan's forest and coastal areas are very well recognized to contain many endemic and rare animals and plants. Its unique environmental beauty lures people to commune with and enjoy its natural richness. But it also serves as a magnet for migration, leading to overexploitation of resources, sometimes with the use of destructive techniques.

Concerns over sustainability of LRFFI were echoed worldwide when cyanide was detected in most live reef fish tested under a program of the International Marinelife Alliance, and as continued cyanide use destroyed coral reefs. In 1997, the Asia-Pacific Economic Cooperation (APEC) hosted the Workshop on Impacts of Destructive Fishing Practices on Marine Environment in Hongkong to address this issue. Workshop participants agreed on a number of steps that must be taken to protect the coral reef ecosystems.

SA's focus on LRFFI was deemed timely as concerned national and local government agencies and the stakeholders were trying to figure out appropriate interventions to address the declining industry. The SA approach could provide substantive basis for addressing the problem at various geopolitical levels. Furthermore, the multistakeholder process provides for participation of all stakeholders, and the required openness and transparency encourage stakeholders to be more responsive, thus helping them to arrive at acceptable courses of action.

2. Objectives of the Study

Primarily, the study aimed to demonstrate the usefulness of SA in looking at the environmental, social, and economic impacts of an activity driven by international trade, with the end goal of reforming the decision-making processes in trade toward sustainable and equitable development. Specifically, the study aimed to:

a. Describe the major players involved in LRFFI and their existing relationships;

Figure 1.1 *Map of the Calamianes Group of Islands*

b. Analyze the economic, social, and environmental impacts of the industry;

c. Formulate policy and institutional arrangements for the industry; and

d. Initiate measures to institutionalize SA in the Philippines.

3. Evolution of Live Reef-Fish for Food Industry

Like in other countries, the LRFFI in the Philippines is driven by international demand, primarily from Hong Kong and China. It began in Southeast Asia when live food fish catches declined in the waters of Hong Kong in the 1970s (Pratt et al. 2000). The trade proved to be a lucrative business, posting an estimated retail value of US$1 billion (Pratt et al. 2000). The figure is projected to increase by 60–100% in 2003 from the 1997 price level given the expanding market demand in China.

In the Philippines, the collection of live fish for food started in Guiuan[2] in the southern tip of Samar Island in the 1980s. It spread to other parts in the Philippines, including the Calamianes Group of Islands in northern Palawan (Figure 1.1). The Calamianes is composed of the municipalities of Coron, Busuanga, Cullion and Linapacan (please refer to map). It covers 47 barangays, a land area of about 194,700 hectares, and a population of over 71,100. Coron is the biggest in terms of land area and population. The area is of low, rugged, and rolling terrain, with occasional wide plains and pasture areas. The land is generally used for agriculture, with the best tracts of land owned and maintained by a few wealthy landowners. Communities both in the upland and coastal areas are strongly dependent on the natural assets. Fishing, however, remains the main source of income and livelihood.

A local businessman is recognized as the pioneer of live reef-fish for food collection and trade in the Calamianes. The story goes that sometime in late 1980s, Hong Kong-based traders approached

[2] It is reported that commercial collection of live reef-fish decreased significantly in Guiuan due to overexploitation and destructive fishing.

the businessman to establish the industry in the area. Seeing the economic potential, the businessman accepted the offer of financial and technical support and started the live fish for food collection in the islands of Panlaitan and Kanipo. Today, the activity is spread over the Calamianes and other parts of Palawan. Depending on the season and weather conditions, specific fishing grounds are preferred. Favorite sources of live reef fish are Delian and Kanipo in Coron, Demipac and Panlaitan in Busuanga, Binudac in Culion, and Nangalao in Linapacan. Of late, the intrusion of large fishing vessels from other provinces and the prevalent use of destructive fishing methods have forced the locals to move further away. New fishing grounds as far southeast as Amanpulo and vicinity are now visited.

Initially, fishermen from the distant provinces of Surigao, Bohol, and Leyte were brought to the area to fish and to train locals in catching live fish. The activity slowly grew among fishing communities. Fish soon replaced lobster as the main live aquatic product in trade. By late 1990s, 60–70% of fishing communities were engaged in live reef fish collection.

Given the delicate nature of the fish, fishermen were trained in proper handling techniques. To keep the fish alive at sea, fishermen built mini aquariums in the hull of their boats, where the fish was released right after collection. The mini aquariums allowed seawater to flow in and out freely, creating an artificial environment for the fish until they were sold to traders, who maintained sophisticated holding tanks.

Catching methods changed over time. Hook-and-line replaced the less efficient fish traps. However, the most common method was the use of cyanide because it made collection easier. Cyanide is squirted from a container to stun the fish. Cyanide fishing went as far back as the 1960's (Pratt et al. 2000). It was initially used to catch ornamental fish. An estimated 65 tons of cyanide is squirted each year in Philippine coral reefs to catch live fish for food and for ornaments.

Reports of massive cyanide use prompted the provincial government to impose a ban on catching live fish in the waters of Palawan. The ban was lifted after the fishermen and traders agreed to police their own ranks to stop the use of cyanide. To ensure continued compliance, local and national legislations were formulated to govern destructive fishing.

The lifting of the ban reopened the industry and encouraged the entry of more firms. From a small group of 30 pioneers, the number grew to to almost a thousand fishermen in 1992. In mid-1990s, major industry players were operators, exporters and traders linked with Manila-based Chinese businessmen, who in turn had tie-ups with Hong Kong-based traders and restaurants.

The enormous financial returns in the early years of the industry motivated fishermen to shift to catching live reef fish. Higher price for live fish was the most significant factor in the emergence of the industry. In 1992, the price per kilo of a good size (0.5–1 kilo) grouper or "*suno*" was PhP50. By the late 1990's, the price went as high as PhP300 per kilo.

LRFFI in 2002

Today, the LRFFI in the Calamianes is characterized dynamic arrangements between and among fishermen, traders and exporters (Figure 1.2). Main transactions take place in the town of Coron. It is the central trading site for all live reef fish because of its proximity to the islands and other towns, and because there is an airport for easy and fast transport of the product to Manila.

Major players in the LRFFI in the Calamianes are the fishermen, traders/middlemen, boat owners/operators, financiers (*amo*), and exporters. About 1,000 fishermen are scattered over the small islands of the Calamianes. Up to three middlemen stay in the islands to provide banca or engine to fishermen in exchange for a marketing agreement. The fishermen pay for the banca or engine on installment without interest. They bring all their catch to the middleman at the prevailing price. When catch is low or during lean periods the middleman provides for the basic necessities and household needs of the fishermen on credit. Payments – partial or full, depending on the amount – are made in subsequent fishing expeditions until the debt is fully paid. As conditions become dire, fishermen become more indebted. This often leaves them in debt all year round and, thus, fully dependent on income from LRFFI to pay off debts.

There are no papers or legal instruments in middleman-fisherman arrangements, but trust is strictly observed. A fisherman who falls out of graces or who loses the trust of the middleman often finds himself divested of everything that has been provided to him, including boat, engine and other fishing equipment. Some studies note that in informal lending agreement, the absence of binding commitments between lender and borrower accounts for the excessive interest rates. This is due to high risks involved in unsecured lending, such as those by traders to fishermen.

The price of live reef fish in the islands is usually lower by PhP100 than the price in Coron. A small number of financially independent fishermen bypass the middlemen by traveling all the way to Coron to get a higher price. The price varies depending on the species and the classification of fish. *Plectropomus leopardus,* or coral trout, is the most popular based on exporters' requirements and, therefore, fetches the highest price. A coral trout with a *good size* classification – 0.5–1 kg – gets the prevailing maximum rate, which can go over PhP2,000 during Chinese New Year and other special events. The *undersized* fish – 0.4 kg and below – gets the lowest price, while that for *oversized* fish is pegged at prevailing maximum price. No additional value is assessed for weights exceeding 1 kg. Regardless of the size and the species, the amount drastically drops to 10% of the prevailing price when imperfections are observed, like slight discoloration, damage on the scale, etc.

Island-based middlemen transport the live fish right away to the buying stations where their financiers or *amo* have "business ties" to minimize rejects and mortalities that usually happen from long period of stocking or poor handling. The *amo* are based in Coron and finance

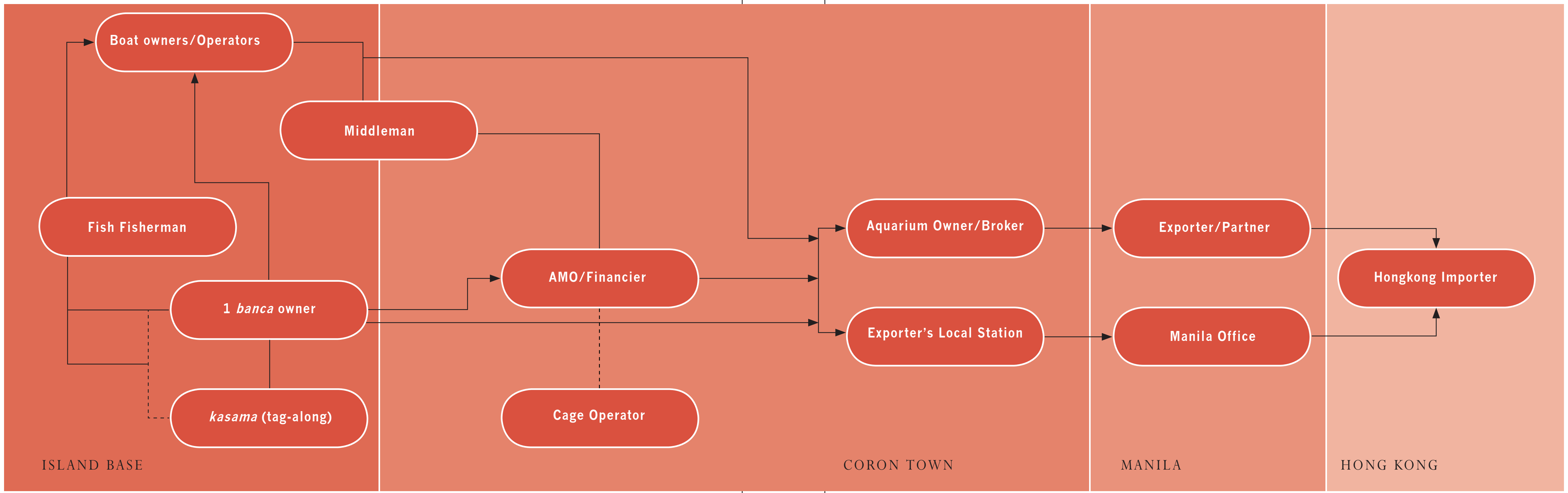


Figure 1.2. *The Live Reef-Fish for Food Industry In Calamianes Islands, Palawan (survey data)*

the operation of middlemen in the islands. They also maintain fish cages for growing juvenile fish purchased at PhP20 per piece. The fish is sold to buying stations when the desired weight or size is reached.

While arrangements are not clear, the *amo* reportedly gets PhP100 from the buying station for every fish sold regardless of size. The ties between the *amo* and the buying station are not exclusive. The *amo* can go to and strike deals with other buying stations if the latter offer better deals.

There are five exporters and buying stations in Coron – Sea Dragon, Great Ocean, Kenneth Aquamarine, Yuki Aquamarine, and Kos Aquamarine. Three of them – Sea Dragon, Great Ocean, and Kenneth Aquamarine – are local offices of exporters based in Manila. The other two are brokers for some Manila-based exporters. Among them, Sea Dragon managed to firmly establish a stronghold in Coron by striking a partnership with one of the bigger *amos,* who is both politically and economically influential. Residents of Coron acknowledge this person as the most influential player in the LRFFI given his economic status and wide network of contacts. The partnership seems to work for Sea Dragon as it has managed to register the highest volume of live reef fish transported from Coron, according to PCSDS records.

Traders transport live fish to Manila in oxygenated plastic bags, which are loaded in styropor boxes. Two hours before airlifting, the fish is placed in cold water to induce sleep and minimize movements during travel, thus assuring that it arrives in Manila in good condition. The local government charges PhP0.50 per kg on gross weight. The cost of airfreight is fixed at PhP18,000 for 23 boxes and PhP36,000 for 43 boxes, depending on the capacity of the plane.

Major Exporters of Live Food Fish

Of the four major export firms based in Manila, three – Sea Dragon, Great Ocean, and Kenneth Aquamarine – are registered as fully owned by Philippine nationals, at least on paper. On average, the firms have been in LRFF business for at least 7 years, and have been in the export of other marine products for at least 9 years. Other marine products exported by these firms include lobsters, crabs, eels, and tropical aquarium fishes.

Except for Fordelon, the exporters operate buying stations at different parts of the country, including Cuyo Islands and Taytay in Palawan, Surigao, Tacloban, Samar, and Albay. Marketing arrangements vary depending on local situation. Immediate destination of the exported fish is Hongkong.

In the Calamianes, some exporters forged tie-ups with established local buyers to get their supply of LRFF. The local buyer sells LRFF exclusively to an exporter. Arrangements can include sharing on operating costs, or the exporter alone shoulders the operating costs. The other firms have their own facilities in the area and buy directly from middlemen, fishermen, or people who directly sell their LRFF to the buyer or exporter of their choice.

In terms of forward marketing channels, three of the four firms sell their LRFF to their respective importers in Hong Kong while one firm deals with three different importers to spread the risks and possibly to obtain better prices.

All firms use their own funds to run their business. Capitalization ranges from PhP1.5 million to PhP9 million. The disparity is attributed to the scale of operations, measured by the number of buying stations in the source islands. Three of the four exporters also maintain stations in different areas of the country where LRFF is collected.

Operating costs of exporters are difficult to estimate, but transport costs are easy to verify. Airfreight from Manila to Hong Kong is US$0.60–US$0.70 per kg (gross weight).

Exporters secure export commodity clearance, export declaration, and an export permit. Insurance fees – called security service charge and airway bill – are also paid for each export transaction. Taxes for live fish exports are not assessed.

4. Fisheries and Trade-Related Policies

The Philippines, with its abundant labor and potentially productive marine waters, has a comparative advantage in the perennially increasing global fish trade. To harness this advantage, the government provides a supportive trade policy environment. The Fisheries Code of 1998 forms the foundation for the country's trade in export-oriented fisheries industry. The signing of treaties such as the Philippine-Japan Treaty of Amity, Commerce, and Navigation (TACN) in 1974 and the Philippine-Taiwan Sea Lane Passage enhanced foreign participation in the industry.

In 1988 the implementation of the Comprehensive Agrarian Reform Program (CARP) shifted Philippine focus back toward social equity. However, CARP exempted from distribution huge corporate lands devoted to aquaculture, since they provided the economies of scale needed in export-oriented aquaculture production. The period of CARP also saw the implementation of foreign-assisted projects aimed at increasing fish production to meet international demands

Expansion of the fishing industry continued into the 1990s. The government built more support infrastructure for the industry. The Central Bank removed the quantitative import restriction on fish products. Other significant laws were passed, including the Medium-Term Development Plan (MTDP), which called for more extensive agriculture; the Agriculture and Fisheries Modernization Act (AFMA), which recognized key fisheries production areas; and the Fisheries Code of 1998, which extended the lease durations on fishponds, thus delaying their redistribution to small fishermen. Technology advancement policies, such as the Board of Investments-Investment Priority

Program (BOI-IPP) for infusion of capital, were also formulated.

Specific to trade policies, tariff liberalization was the most significant policy reform program over the past few decades. The first Tariff Reform Program (TRP), implemented in 1981, lowered the levels of protection and eliminated the distortions created by protectionist trade practices in the 1970s. TRP was complemented by the Import Liberalization Program (ILP), which removed and/or equalized differential sales taxes and abolished all taxes on exports, except logs.

The second TRP carried out in the 1990s sustained or preserved the gains of the first TRP and the ILP. The second TRP introduced two noteworthy executive orders (EOs). The first, EO 470 issued in July 1991 sought a more neutral tariff policy by reducing the number of commodities with high tariffs and increasing the number of commodity lines with low tariffs. However, it did not provide any tariff reduction for fishery commodities. The second, EO 8 issued in July 1992 was developed in anticipation of the lifting and replacement of quantitative restrictions (QRs) by equivalent tariffs to make trade policy more transparent.

Policy transparency was also achieved with the liberalization of the foreign exchange market. The partial lifting of QRs in January 1992 affected most controls on trade and non-trade transactions. This removed some requirements by the Central Bank in the buying or selling of foreign exchange. It also allowed exporters to retain 100% of their foreign exchange and to freely use export proceeds. Toward the end of 1992, the capital account in the balance of payments was also liberalized, leading to free entry and exit of portfolio funds. However, some countries later re-implemented exchange controls to avert the risks due to volatility of the exchange rate.

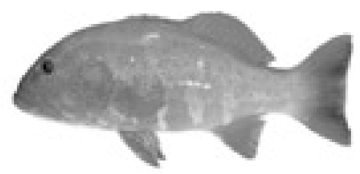
Two more rounds of tariff reforms were applied from 1996 to 2001 in response to the Philippine government's unilateral commitment to implement a 5% uniform tariff rate by 2004. Two more significant EOs were issued. EO 288 issued in January 1996 resumed the tariff reductions made in the fishery sector. EO 465 issued in January 1998 further reduced tariffs on fish-related products toward a set uniform rate of 5%.

Implementation of these policies resulted in short run benefits, but they had detrimental effects the country's environment in the long run. Policies that encouraged export-oriented production without effective fisheries management regimes led to the depletion of the country's fish stocks. Destructive fishing practices and the conversion of mangrove areas for aquaculture development to meet increasing international demand threatened coastal biodiversity. Increased fishing efforts also brought pollution to coastal and marine areas. Expanded operations of commercial and municipal fishing boats brought more oil and gas emissions. Aquaculture brought harmful chemicals and accumulated sludge from feed. Growth of settlers in coastal areas built up the wastes.

From a socioeconomic standpoint, the rewards of trade posed a threat to domestic food security. Due to price differences, the majority of locally caught fish products of good quality were sold to international markets, leaving lower quality products for domestic consumption. In addition, the cost of global fishing operations may have already exceeded the value of catch due to fishing subsidies doled out by developed countries to their fishing industry to get a greater share of global fish production. This aggravates the depletion of global fish stocks. Subsidies are a major issue in liberalized global trade.

Another issue is inequitable distribution of benefits. Those who have greater access to the resource base have more benefits. Boat owners reap the largest share of fishing income, while the lowest deck hands are left with minimal compensation. Sharing of gains is also unequal. International investors sometimes benefit more in terms of bigger returns than the local industry players.

The small fishermen are usually the worst hit by problems of the fishing industry. Depletion of stocks, increased competition for stocks due to proliferation of local and international commercial fishermen, and dumping of cheaper fish products to local markets threaten the survival of fishermen, their families, and the local industry as a whole.



Part II Ecological Sustainability Assesment[3]

1. Introduction

Trade in live reef fish for food in the Calamianes Islands in northern Palawan, Philippines is the focus of this ecological assessment. It aims to identify the biological and ecological attributes (variables and indicators) of live fish trade in the area and analyze the status of the traded commodity (live fish stocks) and its ecological habitat.

The ecological assessment integrates into the SA the physical and biological elements of the trade. It identifies key attributes of the bio-physical elements and examines them systematically and scientifically. Findings of the ecological assessment would allow a synthesis of the trade's impacts on the bio-physical elements, how these relate to and strike a balance with and among other essential elements of the trade such as the economic and social aspects.

2. Variables and Indicators of Ecological Impacts

The ecological sustainability assessment uses the bio-physical attributes of an ecosystem to characterize the conditions of an ecological resource. Maximum sustainable yield (MSY) is an important concept in this assessment because it gives a measure of the critical level of fishery harvest and the ecological consequences of exceeding that level (or the carrying capacity). Another key element of SA is the establishment of ecological impacts on the ecosystem by anthropogenic (e.g., cyanide fishing) and natural causes (e.g., algal dominance).

Ecological sustainability assessment of LRFFI in the Calamianes involves two broad sets of indicators. First is the fishery resource, which is identified and assessed qualitatively (i.e., biology) and quantitatively (i.e., stock assessment) to show the status and dynamics of the resource as influenced by trade. Second is the resource habitat, conditions of which as a result of the impact of live reef fish collection will be described. Any negative impact of the trade will be highlighted. The ecological assessment, therefore, will provide a general overview of the fishery resource dynamics (e.g., Russ 1991) and

[3] *This section was written by S. Mamauag*

the ecological consequences on the resource habitats (e.g., Saila et al. 1993, Roberts 1995, Mous et al. 2000).

The variables identified in this assessment are overfishing (Pauly 1984) and habitat degradation, mainly through cyanide fishing (Barber and Pratt 1997).

2.1 Indicators of overfishing

Fisheries worldwide have been heavily exploited (Pauly et al. 1998) and will collapse if unabated overexploitation continues. The LRFFI in Coron is no exception. Present levels of live fish catch suggest overexploitation (Mamauag et al. 2002). Overfishing is elucidated in several forms – economic, growth, recruitment, ecosystem, and "Malthusian" overfishing (Russ 1991). Economic overfishing occurs when cost of fishing (effort) exceeds that of yield (catch). Growth overfishing is represented by the reduction of mean body size and faster growth rate for a certain age of fish due to intense fishing. Fisheries approach recruitment overfishing when fishing pressure on fish population is so high that it diminishes the potential recruitment of larvae due to severe reduction of moderate to large-sized sexually mature fish, which affects reproductive output. Further increase in exploitation levels results in ecosystem overfishing when depletion of target species leads to changes in fish assemblages (Russ and Alcala 1989) and in subsequent effect ("cascading" effect) on the reef community structure as a whole (Roberts 1995). Finally, "Malthusian" overfishing occurs when fishermen resort to destructive fishing practices (such as blast fishing or cyanide fishing) to compete for fish catch and/or earn profits amid declining stocks.

Preliminary assessment reveals that most of the targeted reef fish in the LRFFI are groupers (*lapu-lapu*, Family Serranidae) (Pratt et al. 2000). Groupers worldwide are highly susceptible to overfishing due to their slow growth, maximum longevity and low rates of natural mortality (Ralston 1987), moderate-scale migration (Zellar 1998), spawning aggregation behavior (Shapiro 1987, Samoilys 1997), and sequential hermaphroditism (Shapiro 1987, Sadovy and Roman 1994).

a. Catch and fishing effort

Long time-series data (over several years) on fishery catch and effort can be used to examine trends in catch or catch rates (such as declining stocks or catch per unit effort [CPUE]) (Pauly 1984, Russ 1991), which can initially address the issue of economic overfishing. Catch data include species composition and total weight (in kg or tons) while effort data are number of fishermen and fishing vessels, types of fishing gear, fishing duration (hours or days), and fishing area. However, collection of CPUE data is not easy due to problems such as absence of data in some months and years, difficulty of data collection up to the level of species (multi-species fishery), variation in type of fishing vessel or gear used among areas, spatial variation of fishing grounds, differences of

catch data from landing and collection sites, and unreported catch (Russ 1991). Nonetheless, some studies have assessed fisheries using catch and effort data. Alcala and Russ (1990) report a significant decrease in CPUE (from 1.98 kg man^{-1} $trip^{-1}$ to 0.99 kg man^{-1} $trip^{-1}$), after protective management of a coral reef marine reserve in Sumilon Island broke down.

b. Travel distance and duration of fishing

Any increase or expansion in the distance of travel by fishermen to fishing grounds indicates that stocks may be declining (e.g., Pauly and Chua. 1988). Consequently, an increase in fishing time also occurs.

c. Maximum Sustainable Yield (MSY) and Yield-Per-Recruit (YPR)

Knowledge of MSY primarily ascertains the status of the fishery, whether present fishing levels are sustainable or not. MSY can be determined from catch and effort data. In the absence of these types of data due to limitations enumerated above, a different approach – the Yield-Per-Recruit – can be used to gain an idea of a sustainable yield (though not exactly an estimate of MSY) and of exploitation status. YPR estimates the yield that can be obtained from a given number of recruits (late fish larval stage about to settle or enter the adult habitat) and a given fishing regime. An estimate of yield based on catch and effort data can be generated by using the Surplus-Production model of Schaefer (in Pauly 1984) while the YPR model of Beverton and Holt (1957) and Thompson and Bell (1934) uses fish size and age-based growth parameters to predict yield estimates. Gayanilo and Pauly (1997) created the computer program FISAT (FAO-ICLARM Stock Assessment Tool) to perform fish stock analysis. It includes estimation of yields in various models. If collection of primary data is not possible, secondary data can be used for analysis, the results of which depend on some limitations discussed above.

d. Variation in species composition in the fishery

Any change in species composition in the fishery suggests a shift in target species due to depletion of the dominant species (Russ 1991). This has cascading effects on the reef community structure, which may adversely affect the stability of the community (Roberts 1995).

e. Fish population growth rate and reduced mean size

Information on fish growth is essential to stock assessment (Brothers 1982, Longhurst and Pauly 1987). Growth of fish can be derived from size-at-age data, among others (Pauly 1984). In this study, only size-at-age or age data is used since it is the most appropriate to determine growth in slow-growing, long-lived species (Pauly 1984) such as the groupers (e.g., Ferreira and Russ 1994). Age of fish is determined from visible growth rings in calcified or bony structures such as the otoliths or "ear bones" (Panella 1971, Brothers 1984). Validated annuli or annual rings have been observed in otoliths of most grouper species, for which information is available (Ferreira and Russ 1994, Mamauag 1997). To describe growth of fish, the non-linear Von Bertalanffy Growth Function, $L_t = L_\infty (1-e^{-K(t-to)})$ (Pauly 1984) is employed.

f. Fish mortality rates

Fish mortality rates (*Z* and *M*) are established mainly with age and growth data (Pauly 1984). Total mortality, *Z*, is derived from the descending plot of the regression of the age and the number of fish per age group, or what is generally known as the age-based catch curve analysis (Beverton and Holt 1957, Chapman and Robson 1960). Natural mortality, *M*, of grouper stocks can be determined from the equation of Ralston (1987): $M = 0.0189 + 2.06\ K$, which was derived from the relationship between *K* and *M* of 17 stocks of groupers and snappers (Family Lutjanidae). Fishing mortality, *F*, can be generated from the equation $Z = M + F$ (see Pauly 1984). Exploitation ratio or rate, *E*, of a fish stock can be estimated from the equation $E = F/Z$ (see Pauly 1984). Yield or *MSY* of fish stock can be estimated from the YPR model. Analysis for YPR is done using FISAT.

g. Fish reproductive biology

High fishing pressure affects reproductive patterns of fish populations. McGovern et al. (1998) show a reduction of size (and age) at sexual maturity (indicator) of the Atlantic grouper *Mycteroperca microlepis* after a long exposure to high levels of exploitation. In addition, sexually mature groupers aggregate to spawn (Samoilys 1997). This is induced by the behavior of the population (Ferreira 1995). Groupers are also reported to show high fidelity to previously selected aggregation sites (Samoilys 1997, Zellar 1998). However, previous reports on spawning aggregation sites reveal overexploitation in some grouper species (Colin 1992, Beets and Friedlander 1998) as the fidelity of fish to these sites increases their vulnerability to overexploitation through fishing.

Reduced size at sexual maturity can be determined based on size, age and reproduction data of fish in a population (stock). Data on reproduction include sex, sexual transition, and gonad development status (for example, female and male immature, maturing, ripening, ripe, spawning, spent gonads), which are ascertained from histological sections. Data on these aspects are gathered from a previous study on the reproduction of *P. leopardus* collected from Calamianes Islands (Mamauag 1997).

2.2 Indicators of cyanide-fishing

Sodium cyanide has been reportedly used to collect live fish since the establishment of LRFFI in the Philippines (Barber and Pratt 1997). Cyanide impairs respiratory and photosynthetic activities in organisms (Jones and Hoegh-Guldberg 1999). A small concentration of it can stun fish, making it easier to capture and handle during transit and to keep alive before it is consumed (Bentley 1998). Cyanide fishermen reportedly use crowbars to rip reef features apart to collect stunned fish. Hook-and-line is the traditional fishing gear to collect live fish, but some fishermen have resorted to cyanide fishing because of high catch with minimal fishing effort (Robinson 1996, Bentley 1998). Increased demand escalates supply levels and leads to overexploitation of stocks if harvest exceeds MSY (Pauly 1984).

The ecological risk to reef habitats from use of cyanide is high. Loss of, or changes in, habitats may affect the community structure of coral reefs and subsequently alter fish groupings (e.g., Saila et al. 1993). In addition, target and non-target fish species as well as invertebrates are also damaged or killed by exposure to cyanide (Hall and Bellwood 1995, Barber and Pratt 1997, 1977, Burke et al. 2002).

a. Coral bleaching and its spatial extent of damage

Anecdotal reports contend that patches of coral colonies have been adversely affected by exposure to cyanide (Barber and Pratt 1997). In laboratory experiments, Jones and Stevens (1997) and Jones and Hoegh-Guldberg (1999) found substantial evidence of coral bleaching due to cyanide exposure. Loss of symbiotic algae (*zooxanthellae*) was observed from experimental coral colonies due to impairment in their respiration and photosynthesis. Subsequent dissociation in coral-algal symbiosis led to discoloration or “bleaching” in affected corals.

Bleaching of coral reefs, however, can be attributed to a range of factors, including climate change (Wilkinson 1998), sedimentation and pollution (Burke et al. 2002), and predation by starfish *Acanthaster planci* (Wilkinson 2000) and other sea urchin species that affect the complexity of reef substrates (Carpenter 1986). Some studies have singled out the effect of cyanide on impacted reefs. Studies in Indonesia, for example, have demonstrated minimal effect (Erdmann and Pet-Soede 1996, Pet and Pet-Soede 1999, Mous et al. 2000).

Although bleaching is not necessarily an indicator of reef degradation exclusively by cyanide fishing, these studies have provided insights on the approaches and mechanisms to understand the many variables in cyanide-impacted areas. Mous et al. (2000) closely monitored cyanide fishers at Supermonde Archipelago and Komodo National Park in Indonesia to estimate reef degradation (in %-points loss per year). The estimate was based on the area of reef destroyed (1 m^2) per fish caught with cyanide. This was multiplied by the estimated total number of fish caught with cyanide per sq km per year. Estimate for total number of fish caught per year was based on three independent variables: production and yield of fish, fishing effort and CPUE, and volume of fish in LRFFI of Indonesia. For yield variable, the estimate used was based on average yield of groupers in other coral reefs, which was 1000 kg/km^2 per year (Russ 1991, Jennings and Polunin 1995). The calculated amount of area (in sq km) in each independent variable was then divided by the total surface area of coral cover to express percent cover change (%-points loss).

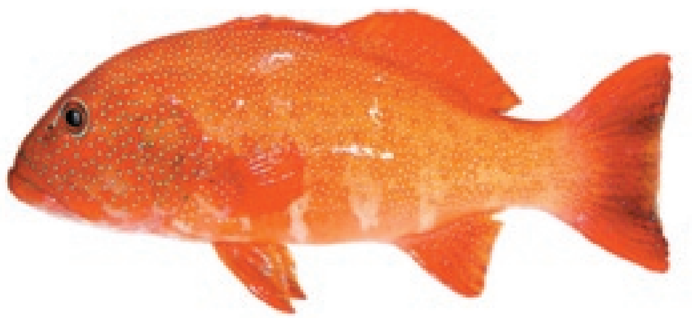


Fig. 2.1. The coral trout, Plectropomus leopardus, the most dominant species in the LRFFI in the Calamianes Islands. (Source: Pratt et al. 2000).

b. An estimate of damage in coral cover

It is possible to examine signs of the impact of destructive fishing (such as cyanide) on the health of coral reef areas. Sampling sites can be identified based on prior knowledge of the frequency of cyanide use by fishers. This information can be generated from a questionnaire/survey of the fishing community's perception of cyanide use, or from secondary data or literature. Underwater surveys by SCUBA can be carried out in these areas. In particular, line intercept transects (LIT) (English et al. 1994) can determine benthos cover on cyanide-impacted areas. Variation in percentage of coral cover (such as live coral, dead coral, dead coral with algae) (English et al. 1994) among selected sites can also be assessed.

3. Methodologies for Estimating Indicators

Initial steps taken in this ecological assessment of LRFFI in the Calamianes involved a compilation of related literature and past information on fisheries and coral reef conservation initiatives in the area.

Overfishing

Fishery data on LRFFI in the Calamianes (major fish landing site) – such as species composition, fish production in the form of catch landings in kilogram weight, date and area of collection, fishing gear used, and age and reproduction data – were gathered from the database of IMA-Philippines. Until recently, IMA has been monitoring the fishery of live fish caught in the LRFFI. In particular, IMA research has been more focused on determining and generating age data of the dominant grouper species in the LRFFI, the coralgrouper *Plectropomus leopardus* (Figure 2.1), collected from several areas in the Philippines, including the Calamianes in which Coron is the major "landing site." These size-at-age data were used for stock assessment.

To gather information on socio-economic and bio-physical attributes of the LRFFI, the research team conducted a rapid assessment in the Calamianes Islands between 9 and 20 April 2002 using survey questionnaires. For the bio-physical component, information on species composition, fish production, CPUE per species, location of fishing habitats, fishing gears used, destructive fishing practices, and grouper spawning aggregations were asked in the questionnaires. Questions pertaining to fishers' perception of the difference in various indicators – such as diminishing catch, declining income, increasing distance and time spent in fishing, within the past five years – were emphasized. The survey sampled 120 respondents from three major areas – Coron, Linapacan and Nangalao – where LRFFI is the major source of livelihood. The sampling protocol is discussed at length in the socio-political and economic sections of this SA.

Additional data were collected from the Coron offices of the Municipal Agricultural Office, the Palawan Council for Sustainable Development, and the Bureau of Fisheries and Aquatic Resources (BFAR). Pertinent data were collected from Conservation International (CI), which has produced substantial reports on environmental management and conservation issues in Coron.

To determine the fishery status of live fish caught in the LRFFI on a temporal scale (temporal variation), a stock analysis was undertaken based primarily on FISAT (Gayanilo and Pauly 1996). Virtually no secondary long time-series data of catch and effort were available due to difficulty in collecting and monitoring these types of data in the LRFFI. An estimate of CPUE was derived from information gathered from the survey questionnaires.

In the absence of catch and effort data, YPR was estimated from size-at-age data of a dominant grouper species (*P. leopardus*) using "knife-edge selection" of YPR Analysis (Relative YPR) in FISAT. The Biomass-Per-Recruit Analysis (Relative BPR) was also determined. Growth rate parameters (K, L_∞, t_o, L_c) were derived using the generalized form of the Von Bertalanffy Growth Function (VBGF) in FISAT. Total mortality, Z, was calculated using the age-based catch curve analysis (Beverton and Holt 1957, Chapman and Robson 1960). Natural mortality, M, was estimated using Ralston (1987) mortality equation: $M = 0.0189 + 2.06 K$). Fishing mortality, F, was computed from the equation $Z = M + F$. Exploitation rate, E, ($E = F/Z$) for *P. leopardus* was also determined. E_{max} (exploitation level which maximizes YPR), $E_{0.5}$ (exploitation level which results in a reduction of the unexploited biomass by 50%), and $E_{0.1}$ (level of exploitation at which the marginal increase in YPR reaches 1/10 of the marginal increase computed at a very low value of E) were all provided in the YPR analysis of FISAT.

Secondary data on *P. leopardus* reproductive biology were used to determine sequential hermaphroditism of the species, size (and/or age) at first reproduction and at sex transition, and, finally, spawning periodicity (gonado-

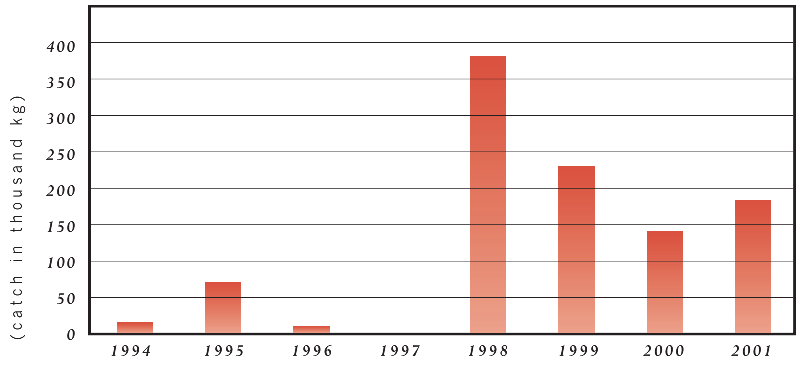


Fig. 2.2. *Catch of live fish in kilogram weight in the Calamianes Islands from 1994 to 2001. (Sources: PCSDS/IMA)*

somatic index) (Shapiro 1987) to corroborate timing of spawning aggregations. Some of the data were derived from Mamauag (1997) and from IMA database.

Cyanide fishing

Estimates of reef degradation (indexed as %-points loss in live coral cover) due to cyanide fishing were determined following Mous et al. (2000). An important assumption for this estimate was that a sq m of coral reef area was destroyed for every one live fish (*P. leopardus*) collected by cyanide fishing, and the total impacted area was the product of the total number of live fish caught (presumably by cyanide) per year multiplied by 1 sq m. Total number of fish caught with cyanide per unit area per unit time was derived from a) potential production and yield of live fish (e.g., *P. leopardus*), b) fishing effort and CPUE (if available), and c) volume of trade (for *P. leopardus* only). The computed value of each variable was then divided by the total surface area of coral cover and expressed in percentage loss in live coral cover. Estimate of total coral cover in the Calamianes reef areas was gathered from secondary data.

To correlate cyanide exposure with coral bleaching in the Calamianes reefs, it was important to identify and consider a range of intervening variables that could contribute to the "bleaching" process. Site selection was crucial for this assessment. Results from the survey on the perception of respondents about frequency of cyanide fishing per area were assessed. Informal interviews were conducted with former cyanide users, with emphasis on the specific sites they had visited more than once. Secondary data and literature on cyanide fishing in Coron (such as those from Conservation International) were also examined in conjunction with the survey results. Based on these criteria, three major sites in the Calamianes Islands were identified: Tempel reefs, Cabugao reefs, and Siete Pecados Island (Figure 1.1).

Tampel reefs is relatively closer to the town of Culion than to Coron. This site has been visited by cyanide users because it is relatively far from any inhabited town or baranggay in the Calamianes with anti-cyanide monitoring groups. The Cabugao reefs, which has been impacted by cyanide, lies on the eastern side of Coron. The Siete Pecados Island, a pristine site less than a mile from Coron, has informally been designated as a protected area by diving shops in Coron to boost local diving tourism. This informal designation means that no destructive fishing practices and only minimal fishing activity are allowed. Siete Pecados Island was included in the sampling for comparative purposes.

"Manta tows" (see English et al. 1994) were carried out at the outset of each sampling to reconnoiter the selected site. Two replicate 50-meter transects was made at each site, except for Cabugao reefs which was sampled with only one transect (N = 5). Line-Intercept Transect technique was performed in all replicate transects. Life-form attributes (live coral, dead coral, algae, abiotic, and others) were assessed and considered in percent-ages during each underwater census of a transect.

Sampling was also tried to minimize other factors that may obscure the effect of cyanide on impacted areas. Although 2002 was identified as an El Niño year, recent trends in climate suggested that the effect El Niño might not be as strong as those in 1982-83 or 1997-98 episodes. It was assumed that the proposed sampling period in 2002 would eliminate any intervening effect of climate change on the bleaching of coral reefs. Selection of sites for sampling also took into account sedimentation and pollution factors. The sites had no significant source of sediment and pollution loading (both from adjacent and distant sources). In terms of the predatory effect of *Acanthaster planci*, the major sites selected were known to have very low abundance of the crown-of-thorns.

4. Results and Discussion

4.1 Overfishing

a. Catch trends

Fish catch for the LRFFI in the Calamianes has decreased. Figure 2.2 shows the trend in catch (in kg weight) between 1994 and 2001. Catch data for 1994 to 1996 appear to be relatively low than for later years. There is no data for 1997. Catch levels have peaked in 1998 and have dropped since then. The differences in volume of data are partly attributed to the variation of data sources and of the sampling strategies. Data from 1994 to 1999 were collected by IMA, but sampling was more intensified in 1998 and 1999. Data from 2000 and 2001 were collected from PCSD.

The LRFFI in the Calamianes started in mid-1980s but data was scarce prior to 1994. Despite differences, the decreasing trend in catch was consistent with the trend in the export of live fish collected from several areas in the Philippines (Figure 2.3). The Fisheries Quarantine Service-BFAR (1999) independently collected the data on live fish export. There was a high live fish export of almost 4,000 metric tons in 1995 but gradually declined to 1500 metric tons in 1999. No data was

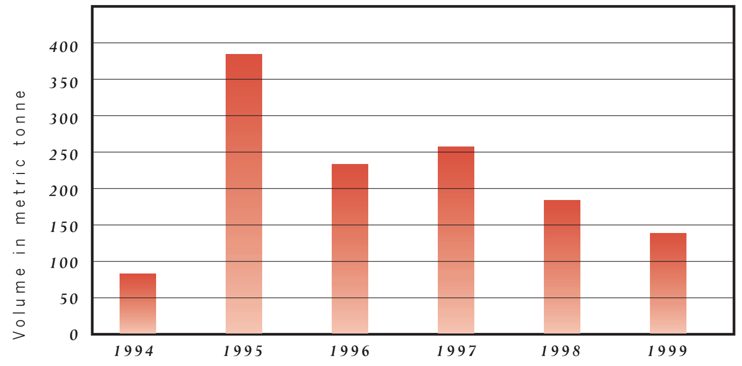


Fig. 2.3. *Volume of live fish in the Philippines exported from 1994 to 1999. (Source: BFAR-Fisheries Quarantine Service).*

collected after 1999. This trend reflects the initial effect of overexploitation of fishery stocks. Russ (1991) had described the effect of high fishing pressure on the abundance of a species or stock and suggested that its subsequent reduction is a direct effect of such pressure.

b. Catch per unit effort (CPUE)

No data on fishing effort in the LRFFI was available, probably due to: a) the difficulty in monitoring live fish collectors around the large expanse of the Calamianes reefs, b) the lack of initiative of concerned local government agencies to require fishers to collect fishing effort data, and c) cyanide fishing, which has never been totally eradicated and has remained a clandestine and undocumented activity. Long time-series data on fishing effort could provide information, such as status of fisheries and estimates of yield, to improve management and achieve sustainability.

An estimate of the mean CPUE in the LRFFI, which commonly uses hook-and-line, is shown in Table 2.1. The estimate is based on the knowledge of fishers of several attributes of fishing effort (such as number of boats, fishers per boat, fishing hours per day or year, and fishing gears used) and amount of catch per unit time (day/month/year) derived from the survey. The mean CPUE (1.52 kg man^{-1} hr^{-1}), although generated through indirect and less systematic approximation, provides an initial CPUE value for the LRFFI and is observed to be relatively high. Russ et al. (1998) gave CPUE estimates for *P. leopardus* in the Great Barrier Reef (GBR), Australia, which ranged from 0.41 to 0.89 fish man^{-1} hr^{-1} mainly using hook-and-line. If initial CPUE for the LRFFI were converted into number of fish instead of total weight (number of fish = total kg/mean individual body weight, 0.8 kg) then mean CPUE in the LRFFI (1.90 fish man^{-1} hr^{-1}) (Table 2.1) is indeed higher than those in the GBR.

This does not necessarily mean, however, that there is a higher yield and biomass of *P. leopardus* in the Philippines than in Australia. In fact, the opposite is true, suggesting that there

Area	*no. of boats w/ 2 fishers*	*no. of kg*	*no. of fish*	*no. of hrs*	*CPUE kg/man hr*	*CPUE fish/ man hr*
Canipo	20	1458.00	1822.50	98	0.7439	0.9298
Coron	2	57.50	71.88	12	2.3958	2.9948
Delian	28	1338.00	1672.50	121	0.3949	0.4937
Nangalao	142	6590.00	8237.50	611	0.0760	0.0949
Panlaitan	42	2129.00	2661.25	193	0.2626	0.3283
Poblacion	2	62.00	77.50	8	3.8750	4.8438
Baranggay 1	4	337.00	421.25	29	2.9052	3.6315
mean					1.5219	1.9024

Table 2.1. *Catch-per-unit effort of the LRFFI in the Calamianes based on the survey*

are less unexploited reefs in the Philippines than in the GBR. Other possible reason for this is that Philippine reefs, such as in the Calamianes, are under high fishing pressure while most reefs in the GBR are lightly to moderately fished (Russ 1991). The high CPUE estimate for the LRFFI also raises the possibility that cyanide fishing plays a major role since it yields high catch with minimal fishing effort and presumably targetting spanning aggregation sites[4].

c. Fishing travel distance and duration

Results of the survey indicate that a large proportion of respondents (78%) believe that desired fishing areas are farther away in 2002 than in five years ago (Figure 2.4a). This suggests that stocks in the Calamianes reefs have been declining due to high fishing pressure and that fishermen trying to meet increasing demand of the trade are traveling farther distances to unexploited areas. Associated with increase in distance is an increase in duration of overall fishing activity. Many respondents (58%) believe that it now takes longer to reach areas with fish than it did five years ago. This indicates a drop in abundance of stocks in areas where they used to fish (Figure 2.4b).

d. Species composition and dominant species in the LRFFI in Calamianes

The coral grouper *Plectropomus leopardus* was observed to be the most dominant species in the fishery, with some close relatives having less than considerable catches (Pratt et al. 2000). Table 2.2 provides a list of species in LRFFI over the entire Philippines. Species caught in the Calamianes are particularly noted. Owing to the dominance of *P. leopardus*, it appears that the LRFFI in the Calamianes is a single species fishery.

Examination of catch data from IMA database indicates that the majority of catch at any time is *P. leopardus*. Although some closely associated species (particularly Napoleon wrasse *Cheilinus undulatus*) are observed in the catch landings,

[4] *Such practice, however, may lead to decreasing CPUE time.*

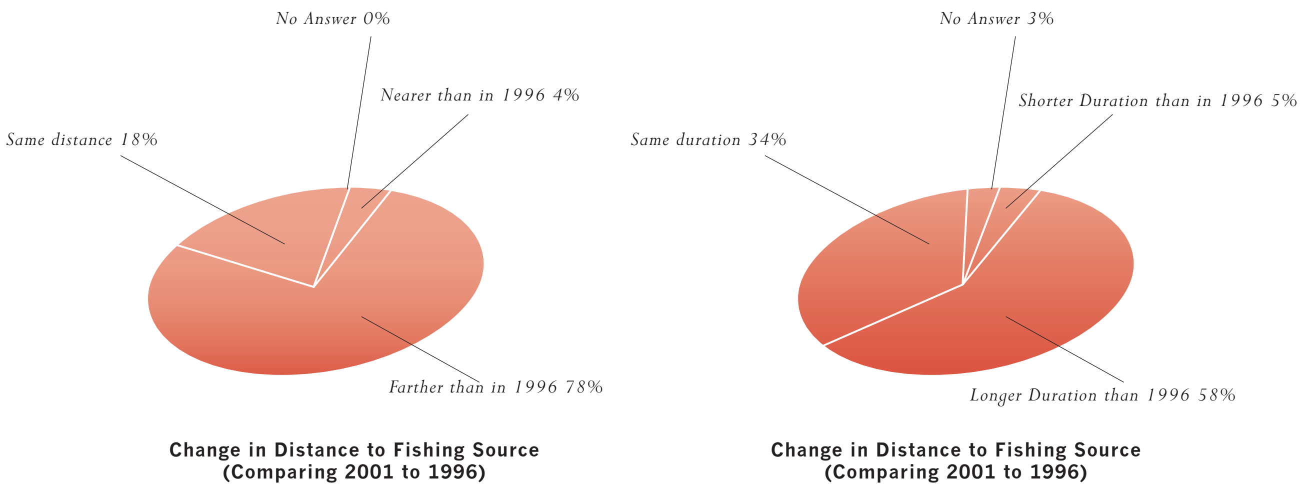


Fig. 2.4. *Perception of survey respondents on the difference of fishing in terms of (a) travel distance and (b) duration between 2001 and 1996 (Source: Survey data)*

their almost consistent absence in the catch and low abundance did not allow analysis such as in *P. leopardus*. It was not possible, therefore, to detect any changes in species composition in the fishery. Unlike in some areas of LRFFI in the Philippines, such as Guiuan for example, a number of species of coral reef fish are as abundant as *P. leopardus*. These include *P. areolatus*, *Epinephelus fuscoguttatus* and *E. polyphekadion*. However, IMA discontinued the monitoring of LRFFI in Guiuan due to logistical problems. Resuming the monitoring of LRFFI in the Philippines and addressing research gaps (such as variations in species composition) can provide insights on effects of fishing (e.g., live) on the community structure of reef systems where populations of apex predators like *P. leopardus* are depleted by exploitation.

e. Reduction of mean body size

There was a reduction of mean size of *P. leopardus* in the Calamianes. Figure 2.5 shows the difference of mean size of *P. leopardus* in 1998 and 1999 while Figure 2.6 presents the decrease in the ratio of total catch (kg) and abundance of *P. leopardus* in 2000 and 2001. Reduction in mean size of the fish reflects the effect of high fishing pressure on fish populations. This elucidates a compensatory mechanism in the population, in which juveniles and young adults in the population, responding to pressure from fishing, increase initially their growth rates to offset the reduction of larger-sized adults usually selected for fishing (size selection) but ultimately with reduced body sizes (Gulland 1957).

f. Size, age and growth of P. leopardus in the Calamianes

Age range of the catch was between two and eight years, with a corresponding size range of between 24.0 and 47.0 cm total length. The growth curve, which was engendered by fitting the non-linear Von Bertalanffy Growth Function

Species	Common name
Family Serranidae	
Plectropomus leopardus ¶	Leopard coral trout
Plectropomus areolatus ¶	Squaretail coral trout
Plectropomus maculatus ¶	Spotted coral trout
Plectropomus laevis ¶	Blacksaddled coral trout
Plectropomus oligacanthus ¶	Highfin coral trout
Epinephelus bleekeri *	Duskytail grouper
Epinephelus coioides *¶	Orange-spotted grouper
Epinephelus malabaricus *	Malabar grouper
Epinephelus fuscoguttatus ¶	Brown-marbled grouper
Epinephelus polyphekadion	Camouflage grouper
Epinephelus fasciatus	Blacktip grouper
Epinephelus lanceolatus	Giant grouper
Epinephelus ongus	White-streaked grouper
Epinephelus cyanopodus	Speckled blue grouper
Cromileptes altivelis ¶	Humpback grouper
Cephalopholis miniata	Coral hind
Anyperodon leucogrammicus	Slender grouper
Family Labridae	
Cheilinus undulatus ¶	Napo leon humphead wrasse
Family Scaridae	
Scarus sp.	Parrotfish
Family Lutjanidae	
Lutjanus sebae	Snapper
Family Scorpaenidae	
Synanceia sp.	Scorpionfish
Family Panuliridae	
Panulirus sp.	Lobster
Parribacus sp.	Flat Lobster

¶ *Species collected in the LRFFI in the Calamianes Islands.*
• *Also traded as fry or fingerlings (Source: Pratt et al. 2000)*

Table 2.2. *List of species collected in LRFFI in the Philippines*

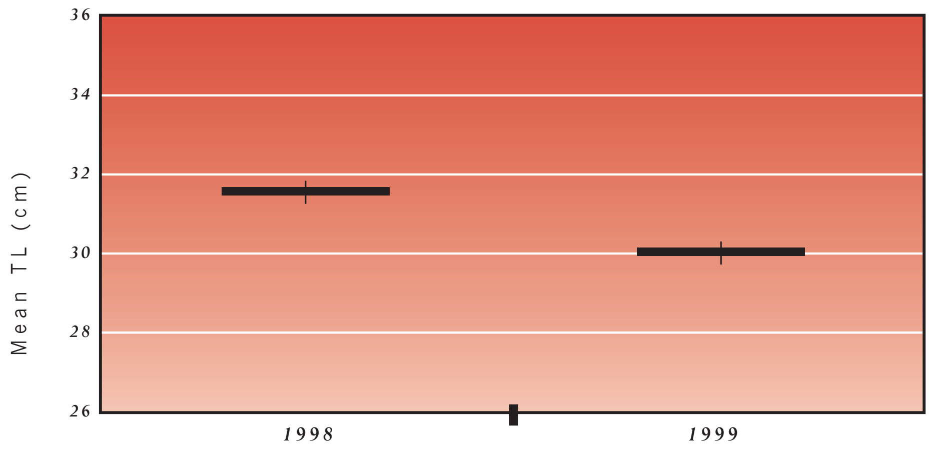


Fig. 2.5. (a) Mean size (total length in cm) of P. leopardus in the Calamianes in 1998 and 1999. (Source: Mamauag et al. 2002).

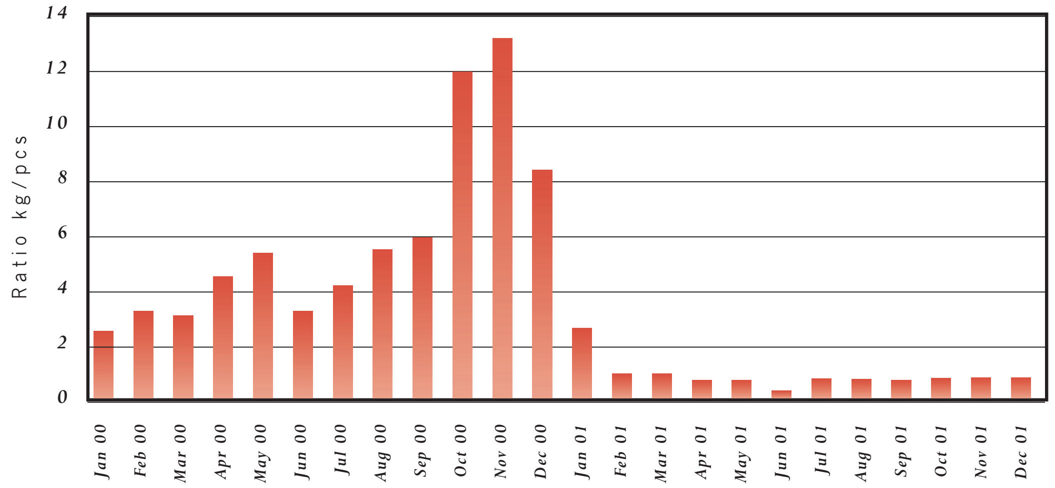


***Fig. 2.6**. Ratio of total catch (kg) and abundance of P. leopardus in Calamianes between 2000 and 2001.(Source: Palawan Council for Sustainable Development)*

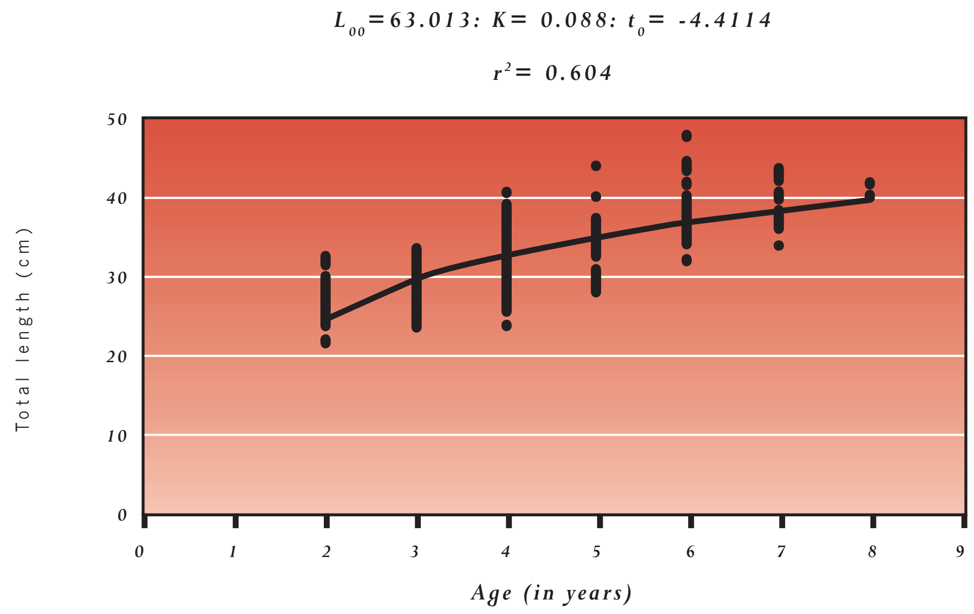
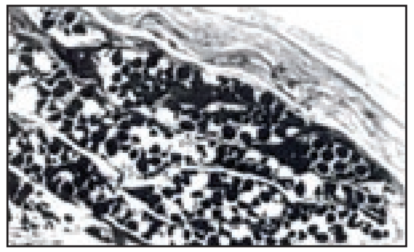
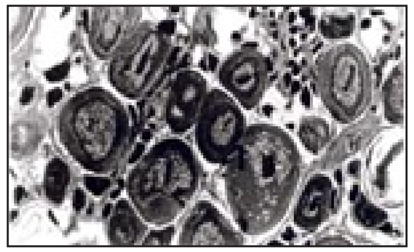


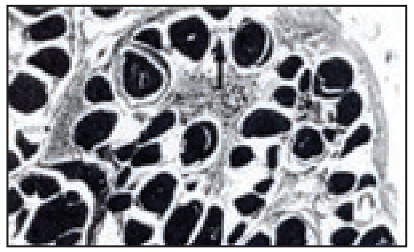
***Fig. 2.7**. Size-at-age data and growth curve estimate for P. leopardus in the Calamianes Islands. (Source: Mamauag et al. in 2002).*



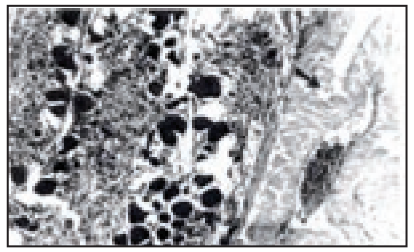
Section of the gonad of an immature female *P. leopardus*, (magnification= 100x). lu=lumen, po=previtellogenic oocytes. (Mamauag 1997, unpublished)



Section of the gonad of an ripe female *P. leopardus*, (magnification= 100x). lvs=late previtellogenic oocytes. (Mamauag 1997, unpublished)



Section of the gonad of a transitional *Plectropomus leopardus*, showing proliferation of sperm crypts in degenerating ovarian tissue with fragmenting previtellogenic oocytes (magnification= 100x). spc.=sperm crypts, po=fragmented previtellogenic oocytes. (Mamauag, 1997, unpublished)



Section of the gonad of an immature male *P. leopardus*, showing proliferation of testicular tissue and formation of a dorsal sperm sinus (magnification= 100x). ss=sperm sinus, psp=primary spermatocytes. (Mamauag 1997, unpublished)

Fig. 2.8. *Gonadal status of various reproductive stages of an immature female (top left), mature female (top right), transitional individual (bottom left), and young male (bottom right) of P. leopardus. (Source: Mamauag 1997).*

into the size-at-age data, provided an estimate of growth coefficient K at 0.088, total length at infinity L_∞ of 63 cm (this is the asymptotic length, or the mean length the fish of a given stock would reach if they were to grow indefinitely) and t_0 at –4.411 (the age of fish at zero length following the growth curve). The estimated growth coefficient for *P. leopardus* in the LRFFI appears to be slower when compared with those from the Australian stocks. Ferreira and Russ (1994, 1995) reported growth rates for *P. leopardus* ranging from 0.101 to 0.321. Growth rate for the local stocks, however, suffered from incomplete age representation. Since fishing harvested only 2- to 8-year-old fish, stock analysis disregarded 0+ and 1-year-old fish, which were reported to exhibit fast growth rates (Ferreira and Russ 1994). Hence, K was underestimated (Mulligan and Leaman 1992). Inclusion of these fast-growing individuals in estimating the growth rate of Calamianes populations should reveal a faster rate than the one detected in this study, based on the theory that size selection enhances rates of growth (Gulland 1983). Although K may have been underestimated, this result indicates that using age data to determine growth rate for the commercially targeted *P. leopardus* in the Philippines is possible. This provides more reliable estimates than using length frequency data for stock assessment.

g. Size selection in LRFFI in the Calamianes and its biological implications

The age and size distributions of *P. leopardus* in the catch (1998 data) are between two and eight years and between 24.0 cm and 47.0 cm total length, respectively. One biological implication of this is that the fishery has been targeting not only large-sized adults but also young, sexually immature to maturing individuals. Mamauag (1997) provides initial data on the reproductive biology of *P. leopardus* collected from the Calamianes. Figure 2.8 presents the gonadal status of various reproductive stages of female, male, and transitional individual *P. leopardus*. Figure 2.9 shows the size frequency distribution of these sexual development stages. Size (range) at sexual maturation or first reproduction is between 28 cm and 32 cm total length. Size at sexual maturation is determined from the size class distribution, at which 50% are mature females (Ferreira 1995). Comparing this size range with the size frequency distribution of the catch in the LRFFI in 1998 (Figure 2.10), it can be clearly seen that the fishery has been targeting those individuals that are approaching maturity or at first reproduction. This further suggests recruitment overfishing, as expounded by Russ (1991), in which fishing pressure is so high that it greatly reduces the number of spawning individuals.

The age and size distributions of *P. leopardus* in the LRFFI are also highly influenced by pricing dynamics. Table 2.3 shows the price of live *P. leopardus* in the LRFFI in the Calamianes Islands. It appears that price is at maximum at around 1 kg body weight of live fish. Any additional weight does not receive

Total Mortality, Z	0.932 (± 0.157)
Natural Mortality, M	0.200
Fishing Mortality, F	0.732
Exploitation rate, E	0.785
E_{max}	0.684
E_{10}	0.564
E_{50}	0.338

Table 2.3. *Mortality and exploitation rates of P. leopardus in the LRFFI in Calamianes. (Adapted from Mamauag et al. in 2002)*

any value. This prompts fishers to collect many fish with weight not exceeding 1 kg to increase profits, although this is not always the case.

In addition, it is widely recognized that *P. leopardus* (and other species of groupers for which information is available) form aggregations to spawn (Shapiro 1987; Sadovy and Roman 1994; Samoilys 1997; Zellar 1998). This phenomenon is highly influenced by the behavior of fish populations to enhance reproductive success (i.e., natural selection) (Warner 1975). It has also been observed that aggregating fish, *P. leopardus* in particular, show high fidelity to previously selected aggregation sites (Samoilys 1997; Zellar 1998). However, reports show that aggregation sites for spawning have been overfished and wiped out, such as in the Caribbean region, (Bannerot et al. 1987; Beets and Friedlander 1992) as the fidelity of fish to these sites increases their vulnerability to overexploitation through fishing.

h. Mortality and exploitation rates

Estimated mortality (*Z*, *F*, *M*) and exploitation rates of *P. leopardus* in the LRFFI are shown in Table 2.3. Rates of total mortality *Z* and, thus, fishing mortality *F* are high. Using figures generated by previous studies, Russ et al. (1998) provide mortality rates for *P. leopardus* in the GBR at a range of 0.12 to 0.68 covering lightly fished to moderately fished areas. Results for local stocks in the Calamianes, however, are only preliminary due to the absence of some age classes in the population and to small sample size for some age classes in the analysis. Thus, they should be taken with caution. Nevertheless, these results should provide a close approximation of mortality rates for *P. leopardus* in the Philippines. Coral reefs in the Philippines are more exploited than those in the GBR (Munro and Williams 1985; Russ 1991). Thus, mortality rates for *P. leopardus* in the Philippines are

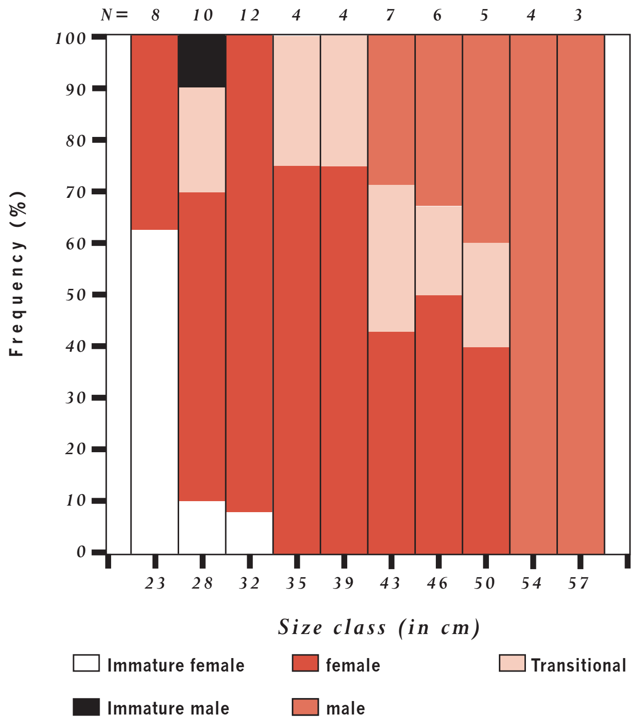


Fig. 2.9. Size frequency distribution of sexual developmental stages of P. leopardus. (Source: Mamauag 1997).

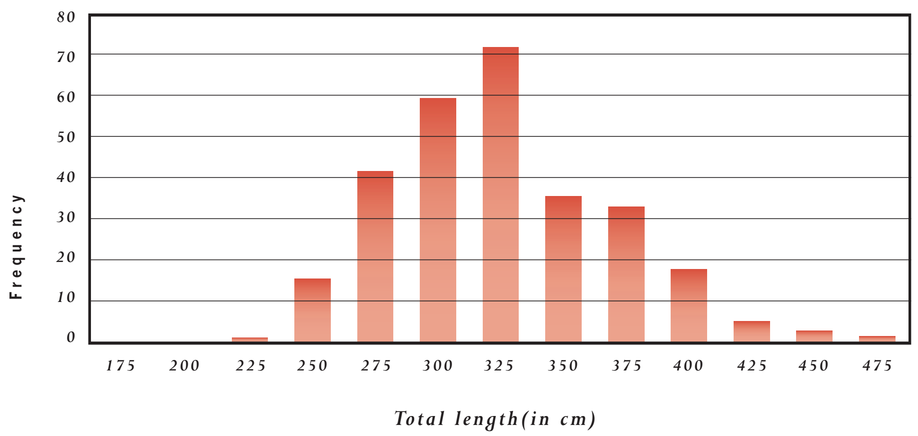


Fig. 2.10. Size frequency distribution of P. leopardus in the LRRFI in the Calamianes Islands in 1998. (Source: Mamauag et al. 2002).

high, especially in live fish for food trade where demand is always high (Barber and Pratt 1997). This gives a high estimate of exploitation rate (E), which is slightly greater than the E_{max} (Table 2.3), suggesting that stocks of *P. leopardus* in the LRFFI are overexploited. This unsustainable catch levels call for measures that would arrest the depletion of stocks.

i. Relative Yield-Per-Recruit and Biomass-Per-Recruit

Estimates for relative YPR and BPR, with corresponding exploitation rates (E), of *P. leopardus* in the Calamianes are provided in Table 2.4. Relative YPR is highest at 0.024 (the proportion of yield per recruit since number of recruits is not known), which is observed to be between exploitation rates of 0.60 to 0.80. This implies that YPR for present exploitation rate (E = 0.785) does not differ with YPR for E_{max} (0.684). Relative BPR values, however, decreased at that range of E, indicating that despite the similarities in YPR, there was a reduction of fish biomass as exploitation levels increased.

j. Cyanide fishing

An estimate of reef degradation due to cyanide exposure

Table 2.5 presents the sensitivity analysis for values estimated as degraded reefs due to cyanide fishing. Following Mous et al. (2000), only two independent variables (yield and volume) were used in the estimation. No information on the unit of fishing effort in cyanide fishing (e.g., number of bottle or amount of cyanide) was available to allow estimation of reef degradation. Both variables provided best estimates, ranging from 0.094% to 0.11%-points loss yr^{-1}, which were small, hence, less significant.

An estimate of reef degradation mainly through coral census

Figure 2.11 gives the results in percent coral cover of the underwater survey of cyanide-impacted and non-impacted areas in the Calamianes. Results show that live coral cover in non-impacted areas is relatively higher than in impacted areas. Similarly, there are higher proportions of dead coral in impacted than in non-impacted areas, presumably due partly to long cyanide exposure. This also suggests that although physically damaged, dead or bleached portions of coral colonies are present in both types of areas, impacted reefs show more visible bleached corals than non-impacted ones. It is particularly noted in impacted reefs that visible but small portions of bleached corals (e.g., branching *Acropora*) are found in patch-like conditions, not in large spatial scales. This may be due to the manner in which cyanide is used on reef corals. Barber and Pratt (1997) and Mous et al. (2000) reported that cyanide users select coral heads, patches, and crevices to pursue fish taking refuge under or inside these coral features. These results, however, are far from conclusive. Other major damage-causing factors, such as blast fishing, may have played a role in the reef conditions. After death, affected coral colonies are known to recover depending on the type of

E	Y/R	B/R
0.10	0.007	0.836
0.20	0.012	0.686
0.30	0.017	0.548
0.40	0.020	0.425
0.50	0.023	0.317
0.60	0.024	0.224
0.70	0.024	0.146
0.80	0.024	0.083
0.90	0.023	0.035
0.99	0.021	0.003

Table 2.4. *Exploitation levels, with corresponding r8elative yield-per-recruit and biomass-per-recruit values, of P. leopardus in the Calamianes using the FISAT software*

species, duration, and amount of disturbance. In this regard, it is difficult to assume that all "dead corals" are in fact caused by cyanide. There is a need to carry out further investigations with a more refined resolution. Blast fishing results in coral fragmentation. This should be particularly taken into account in future research. Also, fragmentation due to blast fishing, bleaching due to poison (e.g., cyanide), and coral recovery rates may be species-specific. Therefore, observations should be based on species.

5. Summary and Conclusions

The coral grouper *P. leopardus*, the most dominant species in the trade of live fish for food in the Calamianes, is overfished. Recent catch and export records are declining. There is also a reduction of the mean size of *P. leopardus,* which indicates "growth" overfishing. This is confirmed both by YPR analysis, which further shows corresponding decrease in biomass at present exploitation levels, and by survey results (i.e. decreasing ratio of catch to abundance). However, absence of historical series data of fishing effort in LRFFI precludes an estimate of MSY. Results for relative YPR imply that a proportion of sustainable yield (per recruit) is a function of exploitation ratio *E*, hence of fishing mortality *F*, and that present exploitation levels exceed the maximum proportion of YPR. Also, data on some age and size classes are deficient, and limited sample sizes for analysis of growth, mortality, and exploitation rates are noted. Inclusion of extreme age and size classes in the population through fishery-independent sampling scheme will improve parameter estimation. Monitoring and sampling for these assessments should be routine work, which should also include data on fishing effort, among others. The survey-engendered estimate for CPUE in this study is quite high. This may appear counter-intuitive, as overfished stocks should reflect decreasing, thus small, CPUE (Russ 1991). Large catch with

	best	conservative	worst case
area of coral cover lost per fish caught (m^2)			
Variable			
yield (kg km^{-2} yr^{-1})	750	563	1000
mean weght (kg)	0.8	1.2	0.4
reef degradation (%-point loss yr^{-1})	0.094	0.014	0.75
total volume (mt)	190	127	285
mean weight (kg)	0.8	1.2	0.4
reef degradation (%-point loss yr^{-1})	0.11	0.014	0.936

Table 2.5. *Results of the sensitivity analysis for the estimation of reef degradation in the Calamianes Islands, expressed as loss of live coral cover in %-points per year, caused by LRFFI.*

high fishing effort, however, may be due to the expansion in spatial scale of LRFFI fishery in the Calamianes. Anecdotal reports reveal that fishermen collect live fish as far south as the Cuyo Island. Fishermen may be currently fishing at distant, unexploited reefs. This may also reflect the apparent increase in catch from 2000 to 2001. At the rate live fish are being caught, however, stocks may become overfished and the fishery may collapse. Absence of historical data did not permit analysis of variation of species composition. The LRFFI in the Calamianes seems to be a single-species fishery. Although very few other species are captured, the fishery is dominated by the coral trout *P. leopardus*. Unsustainable catch, however, will deplete their stocks, and other close relative grouper species are expected to replace *P. leopardus* and so forth, an indication of cascading effects or fishing-down-the-food-web phenomenon (Pauly et al. 1998).

Although population parameters estimated for *P. leopardus* are preliminary, present age and size distributions in LRFFI catch, in tandem with data on reproductive biology, suggest recruitment overfishing. Most catch consists of sexually immature to maturing individuals. Like most grouper species on which information is available, *P. leopardus* is a protogynous hermaphrodite (Ferreira 1995; Mamauag 1997). This means that the fish changes from functional female to functional male at some stage of its life cycle. This sex transition is induced by the behavior of the population, in which the reproductive success of a female increases if it is a male (Warner 1975). In addition, Ferreira (1995) believes that size selectivity for *P. leopardus* in the GBR results in depletion of large-sized males, thus inducing sex reversal. Although complicated, management of the sequential hermaphrodite *P. leopardus* can still be predicted (Bannerot et al. 1987). In the LRFFI in the Calamianes, either the populations are composed of smaller-sized individuals with presumably faster growth rates (i.e., growth overfishing) or the fishery is highly size selective

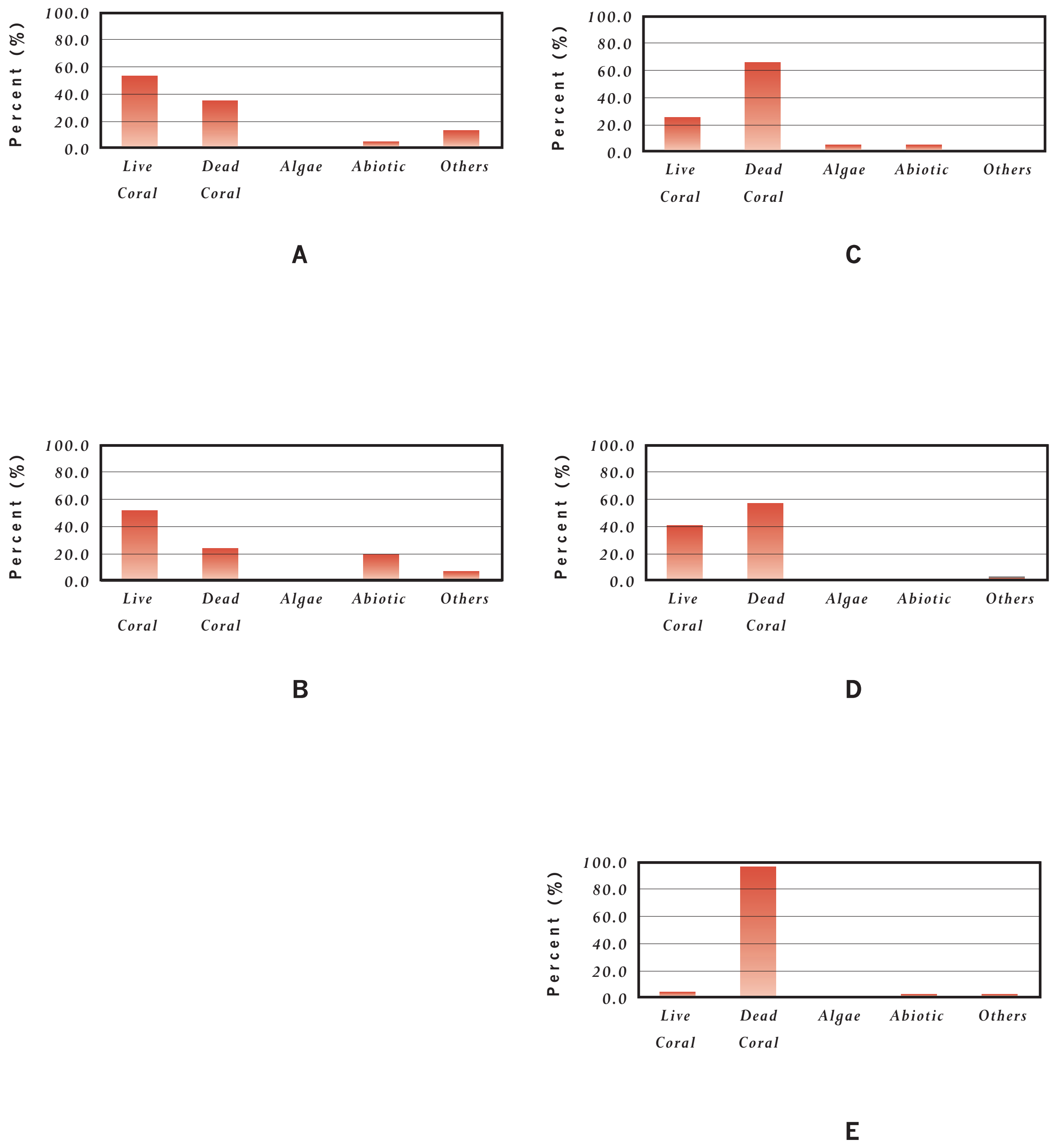


Fig. 2.11. *Percent coral cover of non-impacted areas (A, B) and cyanide-impacted areas (C, D, E).*

but biased toward small to moderately sized individuals because of the influence of pricing dynamics. This differs from the scenario in the GBR. There is, therefore, a need to understand better the implications of these emerging trends in LRFFI catch. On the other hand, these results are common and indicative of exploited stocks of grouper species worldwide due largely to their long life span, slow growth, and low rates of natural mortality (see Ralston 1987).

Detecting the effects of cyanide on coral reefs at the Calamianes has been difficult. A number of factors may be interacting to override and mask the sole effect of cyanide. Zeroing in on this sole effect has provided tangible results, but they are either less significant or preliminary. Underwater surveys have documented several localized "bleached" coral colonies among the "cyanide-impacted sites." Whether cyanide fishing has actually degraded these reef substrates is a matter of further investigation. On the other hand, the results initially showing less significant effect of cyanide imply that cyanide impact may have been reduced by intervention efforts of certain monitoring groups, such as IMA-Philippines, to abate cyanide fishing in the LRFFI in Calamianes. Barber and Pratt (1997) enumerate the initiatives to lessen the actual use and effect of cyanide fishing in the LRFFI. These include random cyanide detection test among live fish samples, increased enforcement of regulations on cyanide fishing, education and training in local fishing communities where destructive fishing is practiced, strengthening the legal basis for monitoring the LRFFI, and promoting reforms in export and import trade policies.

There is a need to undertake a management intervention for LRFFI. Economic policies for sustainable trade should consider the ecological issues identified in this study. In particular, the inclusion of small individuals (24.0–47.0 cm total length) in the present size distribution of the catch poses ecological risks for the stocks or populations of the vulnerable *P. leopardus*. It is, thus, recommended that size limit of the catch be increased to at least 35.0 cm total length. At this size, sex transition has been detected and some fish may have undergone several spawning activities. This size also appears to fetch a near maximum price in the market.

Fishing effort is high. Consequently, the present exploitation rate is beyond sustainability. To revert back to the level of near maximum yield, exploitation rate or fishing effort should be reduced (see Russ 1998). High fishing effort does not reflect low CPUE but rather high catches because fishermen travel to distant, unexploited areas. It could be that these areas are aggregation sites for spawning. Spawning sites of *P. leopardus* in Australia have been determined (Samoilys 1997; Zellar 1998). Aggregation sites, however, are at risk of overexploitation and decimation (Beets and Friedlander 1992). It is, thus, crucial that spawning sites for local stocks be identified and protected. Protective management on these sites must rely on the knowledge of the seasonality and periodicity of spawning aggregation of *P. leopardus* or any grouper species captured for

Indicator	General trend	Study results
Catch	Decreasing	• Live fish catch (in kg weight) in the Calamianes, predominantly of *P. leopardus*, decreased from 1998 to 2001. • Export of live fish also decreased from 1994 to 1999.
CPUE	No trend established due to absence of previous data	• Present estimate of CPUE in the harvest of live fish was higher relative to estimates found elsewhere in the tropics.
Fishing travel distance	Increasing	• Survey respondents believe that they travel farther to fish than in the past.
Fishing travel duration	Increasing	• Respondents affirm that they spend longer periods to reach fishing grounds than in the past.
Species composition	No observed shift in catch composition	• *P. leopardus* remains most dominant species in live fish trade at the Calamianes.
Fish body size	Reduced	• Mean body size of *P. leopardus* decreased from 1998 to 1999. • There was a reduction of the ratio of total weight (in kg) to total number of individuals in the catch (abundance) of live fish from 2000 to 2001. • Both results suggest growth overfishing.
Fish growth rate	No significant change in growth rate was observed	• Present estimate of growth rate for *P. leopardus* in the Calamianes was low and similar to other stocks in the tropics. • Estimate of growth rate was preliminary due to absence of fast growing 0+ and 1-year-old individuals in the analysis. Their inclusion in the analysis may reveal a relatively higher rate.
Size/age at sexual maturity	Reduced	• Live fish trade targets size range of 28.0 cm–32.0 cm TL, which are young and sexually immature to maturing individuals. Size at maturity of *P. leopardus* from the GBR of Australia was greater than 32.0 cm TL. • High catch rates of small-sized individuals in the stocks may lead to recruitment overfishing.
Fishing mortality rates	High	• Although estimates are preliminary, mortality rates for *P. leopardus* in the Calamianes are relatively higher than those in the GBR of Australia.
Exploitation rates/YPR	Exceeded “maximum yield”	• Results suggest that stocks of *P. leopardus* in the Calamianes are overfished.
Habitat degradation due to cyanide exposure	No spatial significant effect	• Estimate of habitat degradation was small. • However, dead coral cover was greater than live coral cover on cyanide-impacted areas and vice versa on non-impacted areas

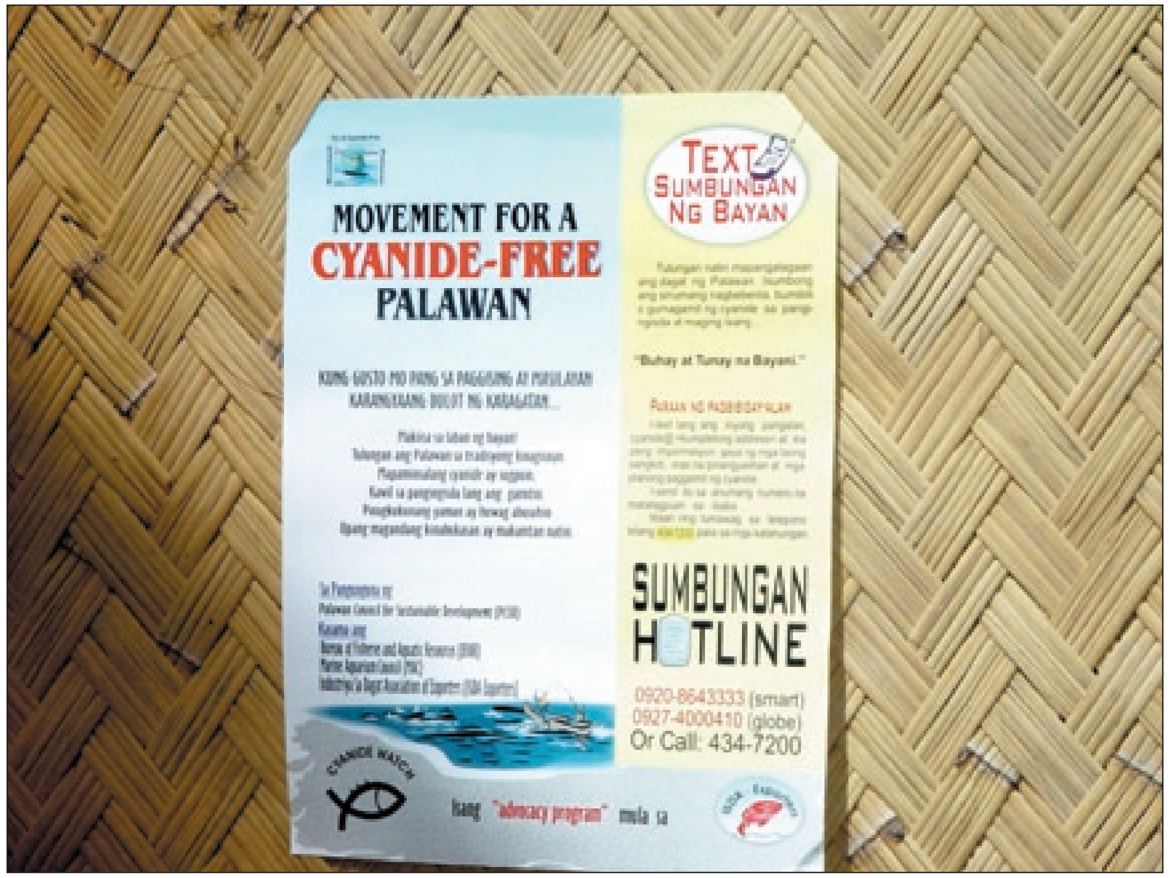
Table 2.5. *Summary of biological and ecological indicators and results*

LRFFI. Routine assessment, therefore, should include reproductive biology such as sex, gonadosomatic index (GSI), and gonad development stage of the fish through gonad histology to infer timing and periodicity of spawning. This is the idea of temporal formation of aggregations. Aside from this, it is necessary to determine the spatial scale of spawning aggregations (i.e., the area of aggregations) and whether the spawning is single-site or multi-sites. High exploitation levels, or overfishing, may be avoided if the management schemes for sustainable fishery will include closure seasons or reduction of fishing effort at aggregation sites or during spawning.

Initiatives to lessen cyanide fishing in LRFFI must continue. These initiatives include random cyanide detection test among live fish samples, increased enforcement of regulations on cyanide fishing, education and training of local fishing communities on non-destructive and traditional fishing techniques, strengthening the legal basis for monitoring the LRFFI, and promoting reforms in export and import trade policies. Although evidence of its environmental impact is inadequate, cyanide fishing should not be ignored. Doing so poses risk since cyanide is a broad-spectrum poison the long-term effect of which is not yet known. It is recommended that future investigations should prioritize more refined research sampling protocol to flesh out the cyanide effect on reef habitats from among other factors. Assessment of coral reef habitats shows various extent of damage, and cyanide fishing may be liable. Blast fishing is also a major cause of reef degradation (McManus et al. 1997), although this particular destructive fishing is not practiced in LRFFI. One important management initiative is the establishment of marine protected areas (MPAs) in LRFFI. This reduces the stress factors (e.g., cyanide exposure, overfishing) on the reef biota and allows degraded coral habitats to recover mainly through population replenishment by way of larval dispersal and recruitment to areas both inside and outside of MPAs (Russ and Alcala 1992).

To ensure success of the aforementioned management initiatives, a community-based participatory approach (Salm and Clark 2000) is imperative. Stakeholders in LRFFI – such as LGUs, fishing communities, national government agencies, traders, exporters, etc. – should undergo capability building on social, legal, technical, and scientific aspects of management.

A typical motorized fishing vessels used in the collection of live fish.



Movement for a Cyanide-Free Palawan Poster - As an offshoot of the "Movement for a Cyanide-Free Palawan" launched by the Palawan Council for Sustainable Development last 25 September 2003, a three-day Planning Convention on "Conscientious Live Fish Trade: Challenges, Opportunities, and Options" was held on 14-16 October 2003 at the Barcelo Asturias Hotel, National Highway, Puerto Princesa City as a follow-on activity to sustain the movement's momentum. The PCSDS spearheaded the said exercise together with partner agencies such as Conservation International, Bureau of Fisheries and Aquatic Resources, Industriya sa Dagat Association or ISDA-Exporters, Marine Aquarium Council, and law enforcement agencies.

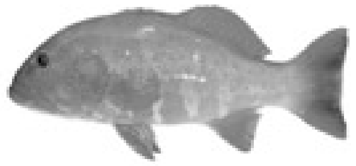
Collected live fish are kept in styropor boxes with seawater below).Weight of live fish is measured at buying station in Coron (bottom).

Live fish are temporarily kept in holding facilities in Coron belonging to Manila-based exporters before these are flown to Manila.

The fish are packed in preparation for transport to Hongkong.

Live fish wrapped in plastic bags with oxygenated seawater packed in styropor boxes are brought to the local airport on board any possible means of transportation (e.g., tricycle).After measuring the weight of the styropor boxes, it is loaded unto a small plane bound for Manila.

The P. leopardus *or coral trout along with other fishes inside an aquarium in a restaurant in Hong Kong, its final destination.*



Part III Economic Sustainability Assesment[4]

1. Introduction

One pillar of sustainability in live reef fish trade is the ability of resources to provide a long-term source of income to industry stakeholders. This report presents a conceptual derivation of economic sustainability indicators, estimates the values of these indicators, and presents recommendations to improve the economic sustainability of the fishery.

2. Indicators of Economic Sustainability

Basic economic tools are used to derive appropriate indicators of economic sustainability. Figure 3.1 shows a supply-demand curve for a typical fishery on a price-output axis. The demand curve has the usual downward slope. The supply curve for fishery is "backward bending,"[5] which means that the output (catch) first increases with price, reaches a maximum, and eventually decreases at a threshold price. Bioeconomic derivation of the fishery supply curve indicates that the ascending part of the supply curve corresponds to a fish biomass (or stock) closer to the unexploited biomass, while the backward bending part corresponds to a depleted fish biomass. The backward bending fishery supply curve is due to the biophysical characteristics of the fishery, in which sustainable catch (output) first increases with the level of fishing effort, reaches a maximum sustainable yield (MSY), and eventually decreases. In other words, there is a limit to the regenerative capacity of the fish stock.

Conceivably, the supply curve for the fishery could shift given the changes in parameters that affect the regenerative capacity of fish stock, such as environmental variables. Habitat degradation from pollution, sedimentation, and loss of habitat reduces the capacity of the environment to support any form of aquatic life, thus decreasing sustainable yield and shifting the supply curve to the left, say from S_0 to S_1.

Focusing on the curves S_0 and D_0, the equilibrium price and quantity for the fishery are, respectively, P_0 and Q_0 at point A. It should be noted that the equilibrium is on the backward bending part of the supply curve. Further, the same level of output would have been forthcoming at a lower supply price, which is a point on the ascending part of the supply curve S_0. The significance of this lies in the management regime for the fishery. Under open access, in which entry and exit of fishing vessels are uncontrolled, the equilibrium level of fishing is at zero economic rent. If economic rent exists, fishing continues to expand until fully dissipated.

The exposition thus far indicates that the open access equilibrium is characterized by overcapacity and depletion of fish stocks. In the Philippines and in most fisheries in developing countries, the institutional regime for fishery is similar to, if not actual, open access. This points to the importance of regulating the fishery through command-and-control, economic instruments, or a combination of both to correct the situation. Without regulation, the fishery will always gravitate to open-access equilibrium (with too many boats and fishers), where rents are fully dissipated and catches are low.

International trade may be represented in the model by a shift in the demand curve from D_0 to D_1. The outward shift in the demand curve means that a higher output is needed for every price level. How far the demand curve shifts to the right depends on the importance of the fishery to the local and international markets that it serves, and on the magnitude of the international market. If the fishery serves a huge international market, then the demand curve moves far to the right. Using the same assumption for an open-access regime of exploitation, the new equilibrium will settle in a point where S_0 and D_1 intersect. The new equilibrium price will be higher and the output lower. Pressure from higher demand due to international trade will worsen the conditions in fishery. A simple analysis shows the negative impact of trade if there are no effective controls on entry to and exit from fishery.

This model can be used to identify indicators to assess the impact of trade policies on the fisheries sector. These indicators, as identified by Padilla et al. (1995), are also called "stress indicators" (Table 3.1). In fishery, sustainability involves physical or biological, economic, and social dimensions. These dimension are adopted in the sustainability assessment of trade-related fisheries policies and are used to identify indicators. Each economic indicator is discussed below.

Output/catch

Trade is a primary vehicle for increasing effort in fisheries, particularly if the barriers to trade are relaxed. Long-run impacts indicate that catches would decline as a consequence of increased effort and deteriorating ecosystem for an exporting country with an open-access regime. Figure 3.1 exhibits the decline in catches from Q_o to Q_1. Trend in catches, specifically of species for export, can be determined. The surplus yield model can be used to verify if MSY has been exceeded.

Price

The price of fish from exporting country should increase due to increase in demand on

[4] This section is written by J. Padilla and D. Yu. A. Morales conducted the field survey.

[5] The derivation of the backward-bending supply curve may be found in Copes (1972).

Indicator	Relationship to Model	Qualitative Behavior Under Stress	Data Requirement
Output (Catch)	Direct	Decrease (critical as soon as decline is evident)	Secondary catch data
Price	Direct	Increase	Secondary data on ex-vessel prices
Catch per unit of effort (CPUE)	Direct	Decrease (critical when 50 per cent of initial level)	Secondary data (should be verified with primary survey data)
Employment	Direct	Increase	Secondary data (no. of fishers)
Investment	Direct	Increase	Secondary data (no. of vessels)
Labor productivity	Indirect	Decrease (critical when less than opportunity cost of labor)	Secondary data (should be verified with primary survey data)
Capital productivity	Indirect	Decrease (critical when less than opportunity cost of capital)	Secondary data (should be verified with primary survey data)
Income distribution	Indirect	Increase (positive skew)	Primary survey data

Source: from J. Padilla et al (1995)

Table 3.1. *Summary of bioeconomic indicators of stress on an open-access fishery (Source: from J. Padilla et al , 1995)*

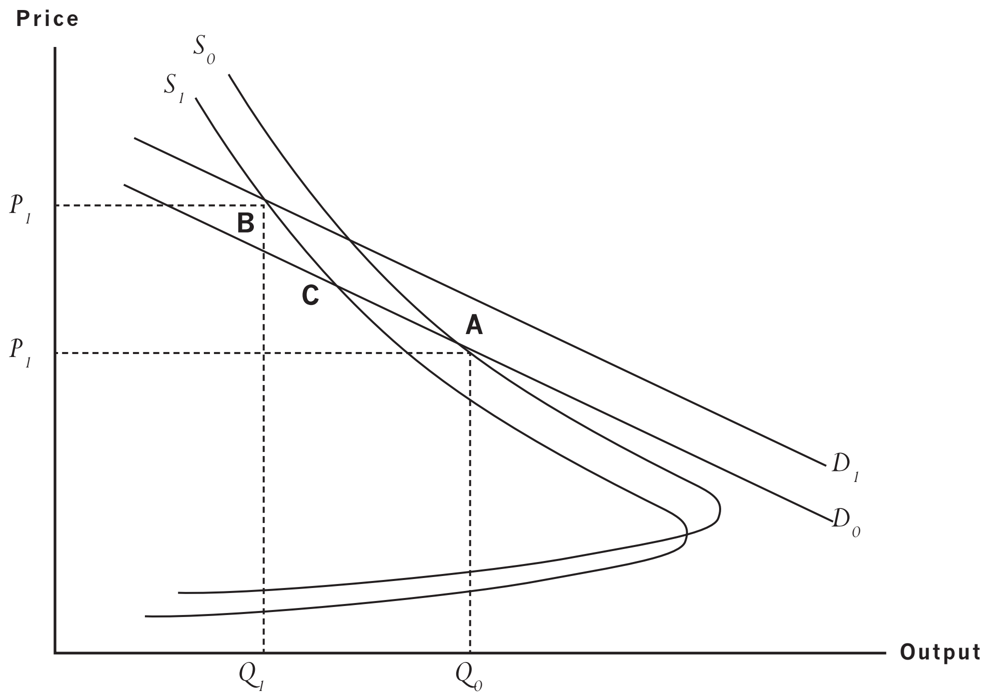


Figure 3.1. *The supply and demand curve for a typical fishery (from Copes 1972).*

account of bigger international market and the resulting decline in catches. The change in price is shown in the movement from P_o to P_1, placing the new equilibrium price at Point B from the initial condition, Point A. From society's viewpoint, a positive price increment benefits a fisher or the exporting country. However, the social impacts are detrimental to the society or people of the exporting country in general.

Investments and employment

Open access fisheries are characterized by unregulated entry of labor and capital. The increase in prices would drive up profits, thus attracting more investments. If investment flows are liberalized, as in the case of the Philippines, foreign investments would likely start to flow in.

In terms of employment, an increase in capital investments would expectedly result in a corresponding rise in employment. The magnitude depends on labor-capital requirements of fishing technology. Marginalized domestic labor is expected to enter the fishery especially if macroeconomic conditions are unfavorable.

Catch Per Unit Effort, Capital and Labor Productivity

Increased effort and declining catches would result in a decrease in the productivity of the factors of production, such as CPUE, an indicator of fishing performance. Based on the Schaefer model, a 50% decline in CPUE indicates that excess effort has been expended in obtaining MSY. As trade is likely to increase fishing intensity, CPUE declines under open-access conditions. Consequently, productivity also declines.

Income distribution

Smith (1990) observes that in most fisheries where stocks are scarce, catch distribution, and thus fishing income, is skewed in favor of larger and more efficient producers. The latter are more adept at hunting fish, able to move to other fishing grounds, and are generally more adaptable to changing conditions. Competition for more harvests will ease out inefficient fishers in the long run. Those with more sophisticated technologies will likely get a higher share of catch from declining catches.

3. Methodology

This study used both secondary and primary data. Secondary data were sourced from records of PCSDS, the municipalities of the Calamianes Islands, BFAR, and NGOs such as IMA. However, most of the data presented here came from a sample survey of fishermen, traders and exporters conducted as part of this project. The survey is described below.

Sampling

Covered by this study are 120 fishers – 71 from Linapacan, 28 from Coron, and 21 from Busuanga. The sample reflects the geographic distribution of fishers in the Calamianes. Although Culion is not covered due to time constraint, the covered municipalities are representative of the entire island group. Information on the distribution of fishers was based on a rapid assessment cum site reconnaissance visits. Members of the newly formed Calamianes Live Fish Operators Association were prioritized for interviews after consultations with stakeholders during reconnaissance trips

Most traders based in the islands were interviewed. All exporters/traders (4) based in Manila were covered in the study. The exporters chosen were operating in 2001.

Primary data collection and processing

A questionnaire in the national language (Filipino) was developed for fishermen-respondents on April 8-25, 2002. The questionnaire was pre-tested in the islands and then finalized. To facilitate data gathering, the project hired four enumerators from Coron. They underwent a one-day orientation workshop on the objectives of the survey and on some basic techniques in interviewing. The survey of exporters based in Manila was conducted in May 2002.

Details of operations of fishers, traders and exporters for 2001 were collected in the survey. As this was a recall survey, the most recent year was covered. The implicit assumption was that 2001 was a representative year for the industry in terms of operations.

Survey data were encoded in such a way that each variable represented answers to survey questions. Answers came in the form of either numerical values or the non-numeric string values. Some numerical values represented either a volume or monetary amount while others represented an answer (e.g., 1=Yes; 2=No) or a perception (e.g., 1=Agree; 2=Not sure; 3=Don't Agree; among others). String values represented non-numeric answers such as suggestions, titles, names, and the like, which were elicited by questions such as species of live fish caught, seminars attended, etc.

Secondary data collection

Existing literature and initiatives of other groups that were similar or complementary to this study were extensively reviewed to further validate the data and to figure out the projections for the future of LRFFI.

Profile of respondents

Of the 120 respondents, the majority (60%) were from Linapacan, 21 (16.7%) from Busuanga, and 28 (23.3%) from Coron. About 86%, or 103, of the respondents indicated that they had been in their current location for the past five years, while 14% were recent migrants. A large number had settled in the area for more than five years. Most of the migrants originated from Cebu, Leyte, and Masbate.

The average respondent had been engaged in the collection of live reef fish for five years. Some had been in the industry much longer, and some were recent entrants. The majority (92 or 77%) indicated that they spent about a day out in the sea. A day of fishing was roughly equivalent to 9 hours.

All the respondents belong to various Christian religions and sects.

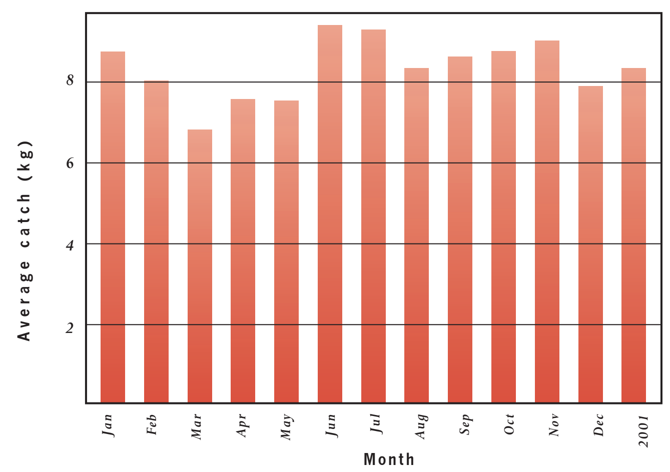


Figure 3.2. *Monthly catches of sample fishers, 2001 (survey data).*

4. Results and Discussion

Most indicators are based from survey data, supplemented by available secondary data. Some indicators are discussed in both the ecological and economic sustainability assessment sections, and these are cross-referenced where applicable.

Output/catch

Collection of data on live fish production in the Calamianes has been inconsistent over the years. Hence, the time-series data earlier presented in Figure 2.2 show no production in some years. However, it is clear in recent years that production has been declining. This trend is validated by the survey. Of the respondents, 90% indicated that the volume of live fish caught declined significantly between 1996 and 2001.

For 2001, average annual catch was almost 100 kg, or equivalent to over 8 kg per month (Figure 3.2). As demand was relatively higher around Chinese New Year, it was expected that catches would peak around December to February. However, this was not shown by the monthly catch data, indicating that fishers were primarily hunters and they caught fish whenever they found one. The variation may be more a function of weather, as shown by frequency of trips (Figure 3.3), and biological factors such as spawning season of groupers, at which time they aggregate and are more vulnerable to fishing.

Average total catch for 2001 was about 100 kg. The distribution of sample in terms of catch is shown in Figure 3.4. Most fishers are clustered around the lower catch levels, but a few are outliers. The situation has gotten dire among survey respondents. Almost 80% say they go to more distant fishing grounds in search of fish, signifying that they have overfished the fishing grounds around their residences. Fishing trips (about 60%) are taking longer on account of longer travel and search time. Frequency of fishing trips in 2001 was about 8 per month. This could be less frequent than in previous years due to longer fishing trips.

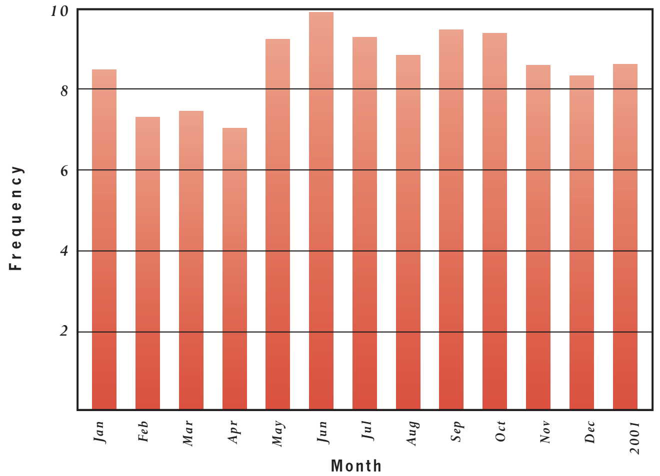


Figure 3.3. *Average number of fishing trips per month, 2001 (survey data)*

Prices

Based on interviews with exporters, traders, and fishermen, demand had increased, but production had declined (at least in the Calamianes). This must have put an upward pressure on prices. Survey respondents perceived that demand increased between 1996 and 2001, and 68 respondents said they were earning more in 2001 than in 1996, indicating that the decline in volume of production was more than offset by the increase in prices. This comparison, however, is nominal.

The above perception is supported by time series price data (Table 3.2). Prices increased more than ten-folds over a 10-year period. The Table also shows significant price differences according to size of fish. The preferred size is from 500 g to 1 kg, which commands a premium. Undersized fish is priced much lower but still higher than fresh or frozen fish. It is grown in a cage to marketable size. In Table 3.2, the price of oversized fish is higher because the data includes prices for all fish species. Some grouper species are more expensive than others regardless of size.

Prices received by sample fishers vary within the year. As shown in Figure 3.5, prices start to increase toward the end of the year, peaking in December, although prices are still high in January and February during the Chinese New Year.

Employment and investments

Fishermen perceive that their ranks increased over the years. Part of the increase is due to migration of about 14% of respondents to the Calamianes mainly because of available work and of the perceived abundance of target fish species. Not only the number of fishermen but also the number of exporters and traders increased.

Over half of the respondents mentioned that availability of work was the main reason for their decision to reside in the Calamianes. Other reasons included opportunity to improve

Year	Prices by size/weight (PhP / kg)		
	Undersize 300 grams - 499 grams	Good Size 500 grams to 1 kilo	Oversize 1 kilo and above
1994	70	90	90
1995	80	90	100
1996	250	1,000	1,100
1997	200	800	900
1998	250	900	1,000
1999	300	1,100	1,200
2000	300	1,200	1,300
2001	350	1,400	1,300
2002	300	1,150	1,050

Table 3.2. *Average prices of coral trout, Calamianes Island Municipalities. (Source of data: PCSDS)*

their quality of life and presence of relatives in the area who would assist them in finding employment. Some were random seekers who tagged along with friends looking for fishing-related work. These were the years of rapid expansion in LRFFI, when fishermen from other provinces were brought to the Calamianes.

The increase in number of fishermen brought about a corresponding increase in investments in fishing equipment. Average investment for a fishing unit, consisting of a boat and engine, amounted to PhP36,600, although bigger boats with more powerful engines cost as much as PhP96,000.

Increase in employment and investments was triggered by financial assistance extended by traders and exporters, who were responding to increasing demand for live fish for food in their export markets. Aside from cost of fishing equipment, exporters and traders also lent working capital to fishermen to cover fishing expenses.

Catch per unit effort, capital and labor productivity

As mentioned, there has been an increase in the number of fishermen employed in LRFF trade. In addition, there has been an improvement in technologies used to catch live fish. The trend in these two indicators provides sufficient evidence that there has been a short-term increase in catch due to higher fishing intensity. This is shown by production data over time, particularly from the 1990s.

With sustained increase in fishing intensity, total production eventually declined over time, as was observed from 2000 onwards. This brought about a decline in productivity for all fishermen, traders, and exporters involved in the industry. Fishermen responded by spending longer search time for fish and by traveling to distant fishing grounds. All this, as perceived by the fishermen, resulted in the deterioration of fishing operations.

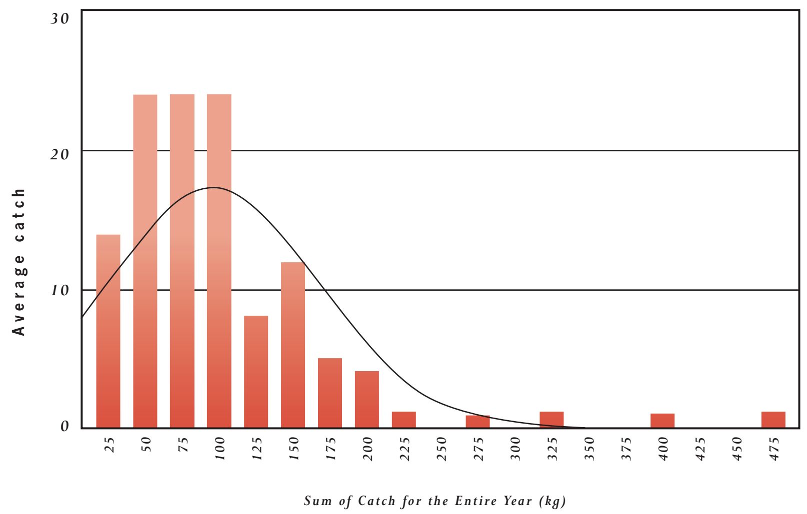


Figure 3.4. *Distribution of respondents in terms of total annual catch (survey data).*

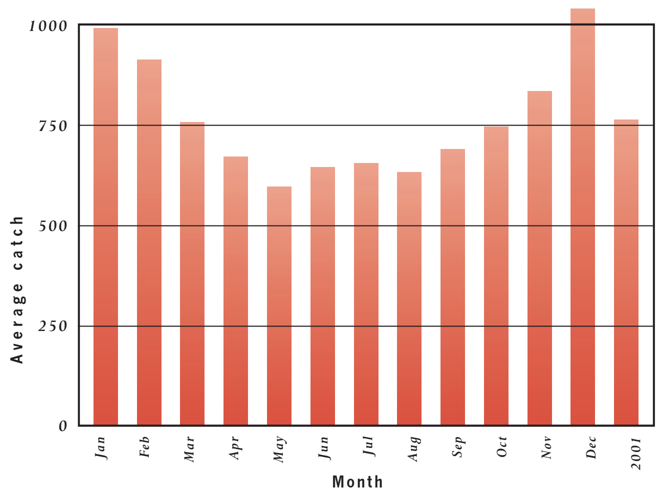


Figure 3.5. *Average monthly prices of live red grouper, 2001 (survey data).*

Municipality	Boats (no.)	Catch (kg)	Fishing Days	Hours	CPUE (kg/hr)
Coron	28	3,252	51.3	268	0.433
Nangalao	71	6,590	67.1	611	0.151
Panlaitan	21	2,129	36.0	193	0.525
All Sites					0.370

Table 3.3. *Catch per unit effort by municipality, 2001 (survey data)*

Table 3.3 shows the CPUE expressed in kg per hour of fishing. Notably, fishing hours do not include travel time. While no time series data exist, it may be concluded that CPUE has gone down significantly over the years due to declining catches and increase in the number of fishers. However, given the high prices of live fish, the revenue per hour of fishing is still attractive, on the average. There is a significant difference in CPUE across sites but this is because fishermen in Panlaitan and Coron have already moved to more productive fishing grounds far from their residences.

Level of income and its distribution

Computation of annual profits each fisherman made in 2001 involves subtraction of the annual revenue of each fisherman from the costs incurred in his fishing activities for the whole year. Annual revenue was computed by multiplying the average fish caught in kg from January to December 2001, with corresponding average price per kg. The resulting values of each month were totaled to come up with the fishermen's annual revenue for 2001.

Maintenance costs of each fishermen on their boats, engines, hook and line, and other equipment, and their variable costs (gasoline, kerosene, engine oil, ice, bait, rent on boat and engine, repairs, commissions of workers, food, and other materials purchased for fishing endeavors) were converted to annual values to be consistent with the data needed to compute for annual values. Depreciation values for boats and engines were also computed. All these elements of cost were totaled to come up with a value for the fisherman's annual costs. Performance was computed annually and per trip.

Table 3.4 contains the figures while Figure 3.6 shows the distribution of the sample in terms of annual revenues. Annual revenue of fishermen reached as much as PhP417,000. Average annual revenue was P82,770 for live fish and P13,718 for by catches. On the other

	Per Annum	Per Fishing Trip
Gross Revenues	96,288	2,227
Live Fish	82,770	2,097
Other Catch	13,718	130
Variable Cost	71,057	672
Net Revenue	25,431	1,555

Table 3.4. *Average revenues and costs, 2001 (survey data)*

hand, highest annual total cost for 2001 was P240,430, while the average was P71,000. Average annual profit from operations amounted to over PhP25,000. However, it is noted that 52 of the 120 fishermen lost money in 2001.

One reason some fishermen are more efficient than others is the more advanced technologies and techniques they use in operations. Some fishermen indicated that they had undergone training on correct ways of catching fish, thus giving them a comparative advantage over fishermen who had not attended such training.

The same reason can be applied to those who have more advanced fish-catching equipment. Further information on and knowledge of locations of spawning aggregations also contribute to the difference in distribution of income. Again, those with knowledge of where the fishes are plenty have a comparative advantage over those who rely on luck. This is evident among outliers who earn as much as PhP316,104 in a year, as shown in Figure 3.7.

Profits are net of cash expenses in fishing operations. Expenses do not include fixed costs and the cost of time of fishermen. If investments in fishing equipment are considered "sunk," the profits would represent payment for labor, which amount to a little over PhP2,000 per month. Indeed, the earnings from fishery of the average fisherman in 2001 were small even relative to prescribed minimum wages.

5. Summary and Conclusions

This section assessed the performance of fishers in the LRFFI using primary survey data. The indicators identified in Table 3.1 of section 2 are summarized below (Table 3.5), and the survey data results are compared with qualitative behavior under stress.

The summary below indicates that the fishery is no longer economically sustainable. The situation is expected to worsen in the coming years unless something is done.

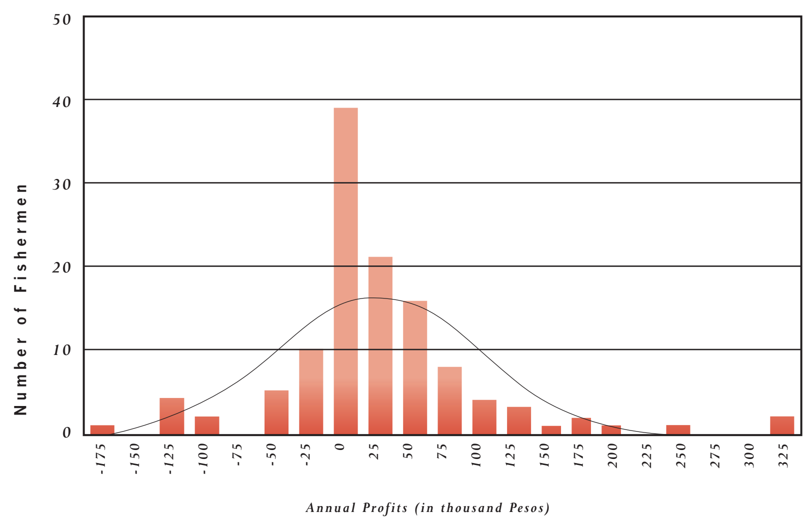


Figure 3.6. *Distribution of respondents in terms of annual revenues, 2001 (survey data)*

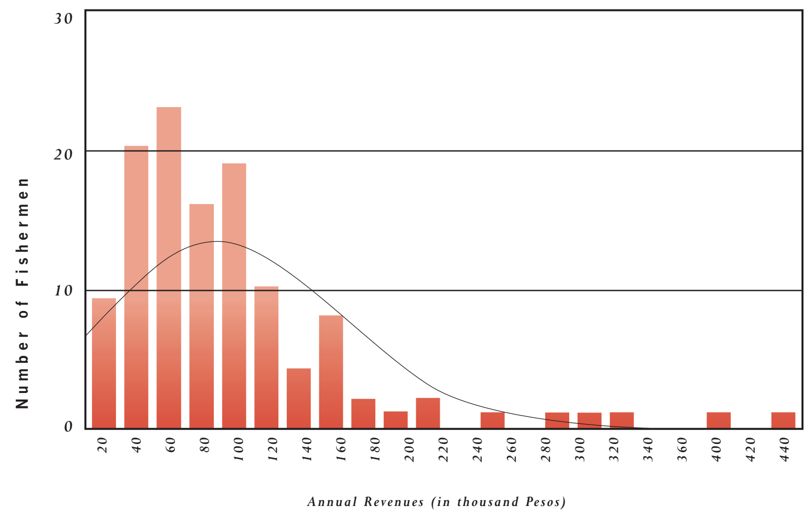
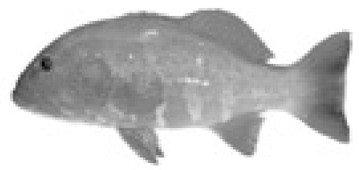


Figure 3.7. *Distribution of respondents in terms of annual profits, 2001 (survey data)*

Indicator	Qualitative Behavior Under Stress	Survey Data Results (2001)
Output (Catch)	Decrease	Declined significantly over time
Price	Increase	Increased significantly over a 10-year period
Catch per unit of effort	Decrease	No earlier data, but must have decreased significantly due to decline in catch and increase in number of fishers
Employment	Increase	No time series data, but current number is estimated at over 1,000 artisanal fishers, composed primarily of migrants
Investment	Increase	As the number of fishers increased, so did investments. No census data exists, but considering fishermen-boat ratio of 3 persons, there should be at least 300 boats engaged in the industry,
Labor productivity	Decrease (critical when less than opportunity cost of labor)	Average annual gross profit amounted to over PhP25,000 in 2001. This is lower than the legal minimum wage rates. Fishermen remain in the industry for lack of other employment outside fishing.
Capital productivity	Decrease (critical when less than opportunity cost of capital)	In fishing, the boat is considered a sunk investment. The engine may have other uses. Returns on investment are very low on the average.
Income distribution	Increase (positive skew)	Quite a number of fishers are already losing. Data on benefits derived by traders are not available at this point.

Table 3.5. *Behavior of economic sustainability indicators from survey data*



Part IV Community and Social Sustainability Assesment[6]

1. Introduction

There has recently been a growing concern over increased exploitation of live reef fish for export, especially since the Calamianes has the most number of fishers engaged in live fish collection. Although live reef fishing is relatively a recent development in resource exploitation, the number of fishing communities has significantly multiplied over the last five years. An increase in the number of fishing vessels from neighboring provinces and islands has also been observed. There is an enormous pressure on the fragile resource. The emergence of trade policies related to the fisheries sector resulted in a perceived overexploitation of fisheries resources, with adverse impacts on communities. There is a need to carefully look into the issue objectively, especially in the context of sustainable development. An appropriate social impact assessment is, thus, developed and applied to better understand the forces that impinge on social, economic, and environmental sustainability.

The primary objective of the community and social impact assessment is to determe how a particular economic activity has or may have affected a community's way of living and its struggle to achieve a comfortable quality of life. Thus, a social impact assessment is a way of better understanding the relationship between economic activities, such as live reef fishing, and their social nuances, especially at the community level where their impact is conspicuously manifested and has a bearing on sustainability.

2. Social Impact and Sustainability Indicators

This social impact assessment on live reef fish trade in Northern Palawan looks into four main social sustainability areas: socio-institutional, socio-economic, gender, and quality of life. These areas provide a basis for determining whether the current practice of live reef fishing is socially sustainable.

[6] *This section is written by G. Braganza*

Socio-institutional

This social sustainability area refers to the capacity and capability of key institutions and agencies to ensure the proper administration or conduct of live reef fishing. It is important in determining whether services and assistance from government agencies, such as enforcement of agreed upon policies and regulations, are being properly provided. This may be determined through the following key questions: *Which groups and agencies are directly or indirectly related to the administration and proper conduct of live reef fishing? Do these groups and agencies have the appropriate manpower, budget and office to develop and implement policies and programs that would ensure the proper administration of live reef fishing activities? How are the activities of these groups and agencies perceived by the communities in terms of effectively providing support and assistance?* Moreover, stable socio-institutional relationships are important in determining overall institutional impact. Unless there is clarity in the roles, functions, working relationships, and arrangements between these groups and institutions, sustainability may remain a challenge. It is, therefore, important to ask the following key questions: *What level of coordination and relationships exists among the major live reef fish industry actors? Has there been any conflict, overlap, or gaps in terms of functions and roles? What mechanisms have been put in place to ensure proper coordination and complementation? What are the different property rights regimes and who is responsible for what?* For live reef fishing activities to be socially sustainable, they must have institutional stability, which is determined by functional clarity and capability between and among major agencies and offices, such as local governments, national government agencies, and civil society groups.

Socio-economic

This social sustainability area reflects the complex trade and market relations and processes that define the relationship between key stakeholders. This focuses on the relationship in terms of economic significance, and determine whether the relationship empowers the local fisherfolk and allow equitable distribution of benefits. These can be understood by asking the following questions: *Do local and ordinary fisherfolk have access to venues by which they can contribute to the decision-making process critical to live reef fish trade? Are there interventions or occasions through which local fishers participate in the development of policies pertinent to live reef fishing? Have communities been actively and effectively enforcing live reef fishing rules and regulations? How are the benefits, such as income, shared among the stakeholders? Do local fisherfolk feel that current live reef fish trade arrangements are potentially beneficial to them? Does the fisherfolk community have tenurial security or actual property rights over the resource?* For live reef fishing to be socially sustainable, it must have the capacity to motivate local fisherfolk toward greater self-reliance and self-determination by ensuring their access to greater decision-making and that benefits are appropriately distributed. Therefore, key ingredients of social sustainability are those that are determined by active involvement of the community in decision making, and the security provided by balanced or equitable distribution of benefits.

Gender

This social sustainability area refers to social roles and responsibilities under the demands and conditions exerted by major economic activities and institutional forces. It mainly tries to understand how social capital undergoes changes to cope with certain economic and social limitations and potentials. If particular roles and functions can work with certain constraints and, thus, undergo a process of adjustment, then a sense of gender balance and complementation is achieved. Gender balance and complementation are expressed through perceived changes in specific roles and functions. Thus, they provide a clearer opportunity to achieve a degree of social sustainability. In the case of live reef fishing, it would be interesting to note how the industry-related activities have contributed to achieving a gender based coping mechanism that would make it relatively easier to respond to related demands and challenges. For example, since males have to travel farther to fish, females increasingly take over the domestic and economic duties of males, or females increasingly acquire greater responsibility over key economic decisions in the household.

Quality of Life

This broad social sustainability area refers to cultural stability, food security, and access to and use of basic social services. A peoples' way of life is greatly affected by the introduction of a new technology that accompanies new patterns of income generation, such as in live reef fish trade, which is relatively a recent introduction. The extent and significance of live reef fishing undoubtedly places a significant toll on peoples' culture and local relations. The socio-cultural make up of the Calamianes Islands presents a great challenge. It is important to determine, in terms of cultural stability, how the various socio cultural groups relate to each other: *How are decisions in the community reached? What impact do the indigenous cultural communities have on the overall decision making processes within the community? Who prevails and in what context? How are conflicts managed? Who is mainly responsible for overall coordination and collaboration?* In terms of food security, some of the main points that need to be addressed are: *Do the fisherfolk feel that they are able to provide food for their families all year round? Does the live reef fish activity provide constant food on their table? What alternative activities have been undertaken to ensure that food is provided at the time most needed?* Finally, with regard to access and use of basic social services, the key questions are: *Have government agencies been able to provide basic services such as education (e.g., provision of teachers, construction of schools, etc.) and health (e.g., appointment of rural health workers, provision*

Part 3 Economic Sustainability Assesment

of medical supplies, construction of health centers, etc.)? How do communities perceive government? What groups and institutions have been able to provide assistance and support? Hence, for live reef fishing to be socially sustainable, it is imperative that respect and relevance are placed on cultural values, that avenues are provided and used for working with cultural communities; that a degree of security is provided in terms of access to food or that communities feel assured about where and how they can sustain access to food; and that communities actually enjoy the basic social services provided, or should be provided, by government agencies and organizations.

The Social Impact Assessment Framework (Table 4.1) presents the impact and sustainability indicators, operational dimensions, and tools for assessing live reef fishing according to each sustainability area. The impact and sustainability indicators show how each sustainability area may be assessed. Impact indicators serve as basis for determining whether live reef fishing has a positive or negative social impact and whether it is socially sustainable. The operational dimensions show how these indicators behave and are manifested. Operational dimensions are objective and verifiable expressions of a specific sustainability area. The framework as a whole provides a sense of manageability and practicality to a potentially overwhelming task. It enables decision makers and planners to gain a clearer understanding of whether economic activities such as live reef fishing are socially sustainable.

3. Results and Discussion

Results of the study are presented in three major discussions. First, there is a brief presentation of the history and development of live reef fish trade in the Calamianes. The discussion traces the early beginnings of the trade, noting the rapid level of resource exploitation, the accompanying levels of technology, and the consequent effect of marked and immediate economic benefits. Second, resource management initiatives for live reef fish trade in the area are discussed. The discussion focuses on the resource management initiatives undertaken at various institutional levels, and on the enormous challenges faced by efforts to address an economic activity that is potentially damaging to the ecology. Finally, the discussion takes up the social impact of live reef fish activity in the Calamianes.

3.1 Resource Management Initiatives: Policy Issues and Concerns

Live reef fishing primarily uses simple hook, line, and PVC pipe, but the prevalent and increasing use of ecologically destructive and illegal fishing methods has raised serious concern about the future of live reef fish trade in the area and the well being of fishing communities. Of late, increasing awareness of the need to protect the fragile ecosystem of groupers and to sustainably manage the dwindling resource has prompted stakeholders to take concrete resource management initiatives at various institutional levels. At the national level, Presidential Decree

Social Sustainability Areas	Impact and Sustainability Indicators	Operational Dimensions	Tools/Approaches/ Methodology	Information Source
Socio-Institutional	• National government's capacity and capability to respond to changes brought about by live reef fishing • Ability and effectiveness of various government units and agencies to coordinate their activities and programs • Level and quality of coordination between government and civil society groups	• Who are the key decision makers in the local government? • What particular office(s) is (are) tasked to handle trade-related development activities? • How many staff members are involved in this office? • How much budget is allotted for this office? • What are the staffing and budget characteristics and concerns of offices tasked to provide basic services?	1. Focus group discussions (issues and concerns mapping, institutional relations diagram, etc.) 2. Key informant interview	• Local government officials • PO members • Community members • Fisherfolk • Fish traders • Market vendors • NGO members
Socio-Economic	• Benefits brought about by economic activity is equitably distributed • Empowerment and self-reliance of fishers over certain local trade-related linkages	• How are fisherfolk and traders related? • What are the activities that allow stakeholder participation? • What are the relations and linkages involved between levels of activities? • What are the financial and social benefits and costs of such linkage and how are they distributed? • What are the emerging economic and social concerns?	1. Focus group discussion (resource mapping, issues and concerns mapping, problem tree analysis, conflict mapping, etc.) 2. Key informant interview	• Local government officials • PO members • Community members • Fisherfolk • Fish traders • Head of household • NGO members
Gender	• Current, expected, and emerging roles and responsibilities that compliment demands and challenges	• What roles and responsibilities were commonly practiced? • What were the changes and adjustments? • What were the effects of such changes in terms of economic and social aspects?	1. Focus group discussions (gender mapping, problem and issues tree analysis, etc.) 2. Key informant interview	• Women groups • Heads of household • PO members • NGO members
Quality of Life	• Communities' access to and utilization of basic social services • People and communities have adequate supply of food all year round • Participation of indigenous cultural communities in local decision making through active collaboration with other local residents	• What are the relationships between cultures? • What office or organization is assisting in cultural stability? • What are the issues that affect culture and social relations? • What basic services are available or lacking? • What are the other forms of economic activity?	1. Focus group discussions (social issues mapping, conflict mapping, problem tree analysis, etc.) 2. Key informant interview	• Fisherfolk • Heads of household • Women's groups • PO members • NGO members

Table 4.1. *Social impact and sustainability assessment framework*

704 issued in 1975 was for a long time the premiere law that governed the whole fish trade industry. The landmark Republic Act 7160, or the Local Government Code of 1991, facilitated the decentralization of resource management functions to local government units, making them more responsible and accountable for the use and maintenance of their natural resources. The Agricultural and Fisheries Modernization Act (AFMA) identified agricultural and fisheries zones that have great potentials for development. The Indigenous Peoples Rights Act (IPRA) primarily aimed to enable indigenous communities to determine and apply resource management practices that are culturally based and ecologically sound. At the local level, resource management initiatives are contained in local development plans, ordinances, and resolutions.

At provincial level, Republic Act 7611, or the 1991 Strategic Environment Plan (SEP) for Palawan, enabled the provincial government of Palawan to lead resource management and development efforts. It established the Palawan Council for Sustainable Development (PCSD), which was tasked to ensure that local development initiatives were consistent with the province's development agenda. This coordinative body was further made operational at municipal level through the Environment Critical Action Network (ECAN), which works closely with municipal governments for sustainable management of local resources.

For live reef fish trade, a number of specific ordinances are in place. They are mainly regulatory and are directed toward controlling overexploitation. For example, PCSD Administrative Order (AO) No. 3 specifies guidelines for accreditation, regulation, and monitoring of live fish collection, culture, transport, and trade. Provincial Ordinance (PO) No. 2 issued in 1993 prohibits the catching and gathering of certain live reef fish species.[7] This ordinance created much discussion among live reef fish traders and operators, who initiated moves for exemption. Pressure from the live fish trade sector in Coron prompted local officials to eventually amend PO No 2 and prescribe a system of compliance for shipping and transporting of live reef fish. A Community Fisheries Board based in Coron was created through PO 29 and Municipal Ordinance No. 4 to conduct studies and consultations to determine the maximum allowable yield for accredited fishing operators and fishermen, enforce a system of accreditation, and determine spawning period to ensure adequate stock, etc. Members of the board included representatives from civil society groups and LGUs. However, the board did not have the capacity or capability to perform its functions. Finally, PCSD passed various resolutions requiring all live reef fish catchers, fish cage operators, traders, and carriers to get permit or accreditation from PCSD. This led to the establishment of Calamianes Fishermen's Association, which was accredited by the government to facilitate accreditation and the processing of permits for fisherfolk, traders, and operators.

[7] .... 1. Family: Scaridae (Mameng), 2. Ephinephelus Fasciatus (Suno), 3. Cromileptes Altivelis (Panther or Senorita, lobster below 200 grams and spawning), 4. Tridacna Gigas (Giant Clams or Taclobo and other species), 5. Pictada Margaritifera (Mother Pearl Oysters), 6. Penaeus Monodon (Tiger Prawn – breeder size or mother), 7. Epinephelus Suillus (Loba or Green Grouper), and 8. Family: Balistidae (Tropical Aquarium Fishes) for a period of five years in and coming from Palawan waters.

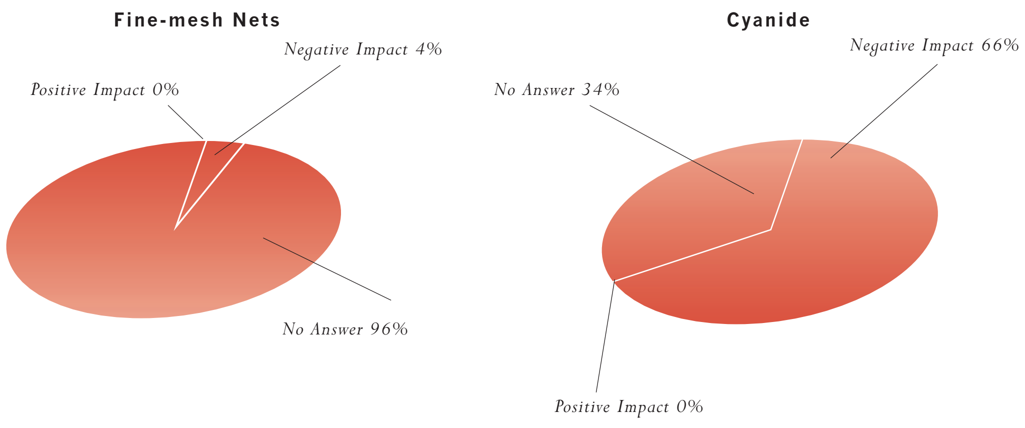


Figure 4.1. *Perceptions on destructive practices in fishing operations (survey data).*

The overall policy and institutional make up of governing live reef fish trade in the Calamianes is regulatory. Yet, illegal fishing practices and incursion of large fishing vessels into municipal waters remain prevalent. This reflects a lack of capacity to enforce policies and the absence of a pro-active sustainable resource management strategy.

3.2 Social Impact and Sustainability Issues of LRFFI

The following discussion on social sustainability is based on findings from focus group discussions, interactions with key stakeholders, various participatory appraisal activities, and the socio-economic survey. The discussion provides an initial understanding of determining the level of social sustainability of live reef fishing and of indicating what responses or interventions may be undertaken to ensure overall sustainability of the trade.

The introduction of live reef fishing in the islands certainly provided economic benefits to stakeholders. But it also induced greater competition among fisherfolk, leading to exploration of new fishing grounds and the use of fishing methods that cause substantial damage to the ecosystem. Among those surveyed, there is generally a negative perception on the use of destructive and illegal fishing practices in live reef fishing operations (Figure 4.1) despite the benefits of such use in terms of bigger catch and, consequently, larger income. This negative perception is mainly due to the observed impact of such practices on the fishing grounds and on the broader ecosystem. In many fishing grounds where cyanide is used the corals are bleached while in areas where dynamite is used the corals are scattered and scarred. The use of dynamite and cyanide in fishing significantly depleted the live reef fish resource and the other organisms linked to the growth and propagation of live reef fish. Fisherfolk perceive that there was better regard for live reef fishing in the past, when destructive fishing methods were not yet prevalent, than at present (Figure 4.2).

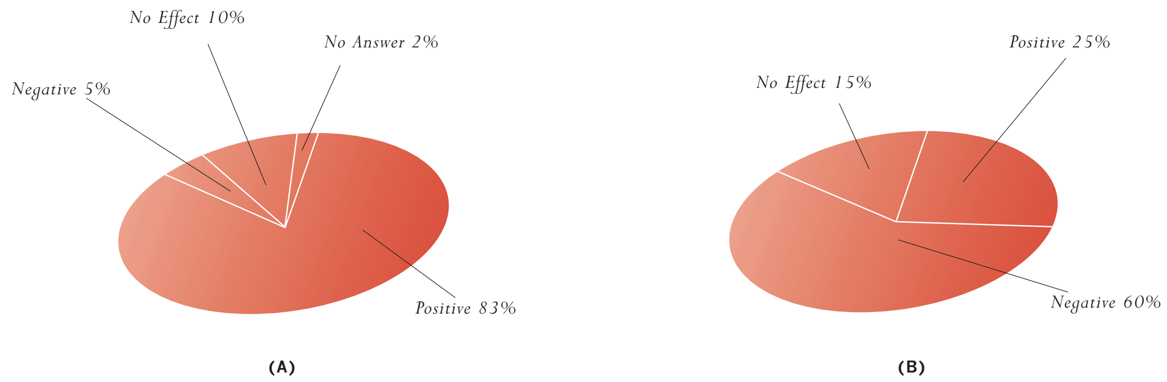


Figure 4.2. *Perceived environmental effect of live reef fish industry (survey data).*

In essence, there is a relatively significant and growing awareness of the various issues that affect live reef fish trade and the environment.

The survey also shows that destructive fishing methods and the intrusion of large fishing vessels from other provinces have a great impact in terms of volume of catch, earnings, fish source distance, and fishing time of fisherfolk. Fish catch in 2001 was observed to be much lower than when the trade started sometime in the mid-1990's (Figure 4.3). But despite this decrease in fish catch, earnings seem to have increased (Figure 4.4).

This is due to the significant increase in price of live reef fish, from a mere P50 per kg for a good-sized live grouper in the early 1990's to the current average of P1,000 per kg. Hence, even with a limited catch, a relatively high-income return can be gained from the sale of live reef fish. But there is a marked perception that live reef fish collection has become more difficult. In terms of distance (Figure 4.5), fisherfolk have to travel farther to find more productive fishing grounds since many of the nearby fishing grounds have either been depleted by illegal and destructive fishing practices or become too competitive due to the presence of more fisherfolks.

Many relatively well-stocked areas situated farther from the islands have been identified. As a result, it now takes longer to catch live reef fish because of travel time. In mid-1990's, catching a substantial yield took only less than a day. At present it takes about three to five days (Figure 4.6).

Socio Institutional

A number of agencies and institutions are involved in live reef fish trade. The degree of their work and relevance depends on their level of significance. Prominent among them are PCSD, BFAR of the Department of Agriculture, Department of Environment and Natural Resources (DENR), and the municipal governments. PCSD provides development policy and program frameworks for the provincial government of Palawan. It thus coordinates development and natural resource management

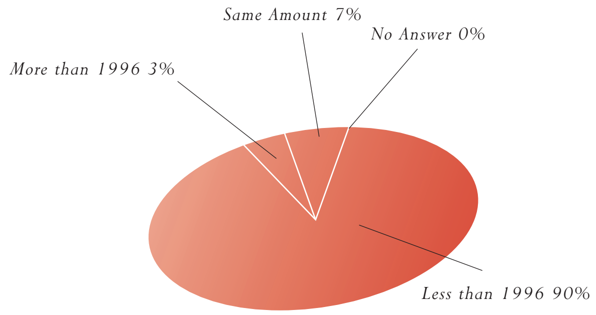


Figure 4.3. *Perceived change in total catch of livefish, comparing 2001 to 1996 (survey data).*

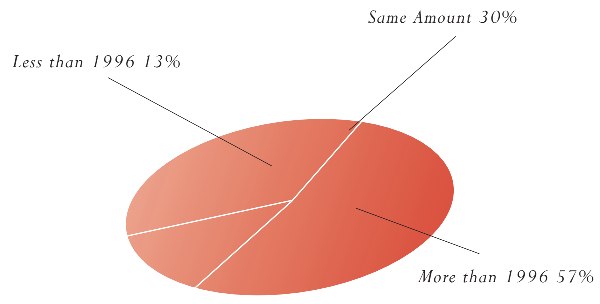


Figure 4.4. *Perceived change in earnings from sales of livefish, comparing 2001 to 1996 (survey data).*

initiatives and ensures that they are consistent with sustainable development principles. Government line agencies are expected to provide strategic and technical assistance to local governments and communities. Municipal governments are seen as key implementers of development and resource management initiatives. Given these levels of involvement, consistent performance and coordination at these institutional levels are critical in achieving maximum impact. Unfortunately, this has not been so.

Weak institutional significance and coordination – It is observed that key sectors in the broader community have very low regard for formal government agencies and institutions (refer to Figures 4.7, 4.8 and 4.9 – Womenfolk, Fisherfolk, and Indigenous Peoples Perception Diagrams of Relevant Institutions and Agencies). The diagrams on the level of significance of various agencies and institutions in relation to local concerns and issues show that they are so "distant" in terms of how the communities' feel their significance. Interestingly, agencies and institutions commonly regarded as having direct relations to live reef fish trade are the ones not providing strategic interventions and assistance needed to respond to local issues and concerns, especially in terms of law enforcement and apprehension of illegal and destructive fishers. Although there is an appreciation of local government in terms of relating to communities, this is mainly determined by access and immediacy. Hence, the barangay local government is regarded as having more significance and potential relevance than municipal and provincial governments. Agencies and institutions that do not have direct links to live reef fish trade but provide basic social services are perceived to be of most help.

Despite the presence of institutions and agencies tasked to ensure sustainable development and natural resource management at provincial and local levels, many stakeholders feel that pressures on the delicate resource base and inequitable economic arrangements persist, and that these may eventually impact

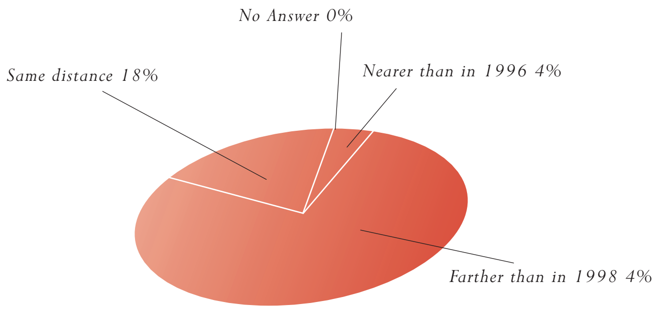


Figure 4.5. *Perceived change in distance to fishing source (survey data).*

on the sustainability of live reef fishing in the area. Interestingly, stakeholders perceive these institutions to be inept and lacking a clear working relationship to appropriately regulate illegal activities and to strictly enforce policies and rules. For example, the local governments and the PCSD are perceived to be ineffective against illegal fishing practices and the intrusion of "other" fishing vessels. In the municipality of Busuanga, the enforcement agency has only two personnel, a boat, and a limited supply of fuel. Hence, live reef fishers have a very low regard for local government. Clearly, communities view relevant government agencies as lacking the capability and capacity to enforce appropriate regulations, and the qualities needed to coordinate among themselves.

Lack of institutional capabilities – From the diagram drawn by stakeholders, only the cultural communities are aware of the PCSD despite its being an institutional body of the provincial government. Also, the diagram shows stakeholders feel very little support and assistance from line agencies that are supposed to provide needed services. Instead, agencies not directly involved in natural resource management or in live reef fish trade are regarded as more relevant to communities. Meanwhile, stakeholders indicate that municipal governments are considered responsive, but this is qualified to be just potentially rather than actually providing assistance. Survey results indicate that stakeholders have very little regard for local governments because of officials' vested interests and control by local financial and political elites. These observations are based on stakeholders' experiences about the continuing use of illegal fishing methods and the unabated increase in the number of fisherfolk engaged in the trade. With all the agencies and institutions working on similar scopes and agendas, there is much to be desired in terms of coordination and collaboration. This is more pronounced on the issue of property rights regimes, that is, in terms of access to live reef fish resource

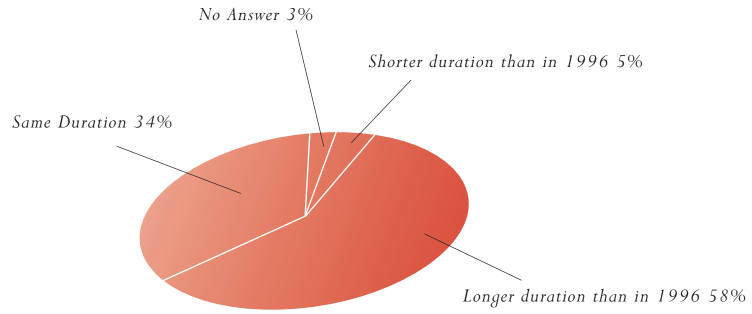
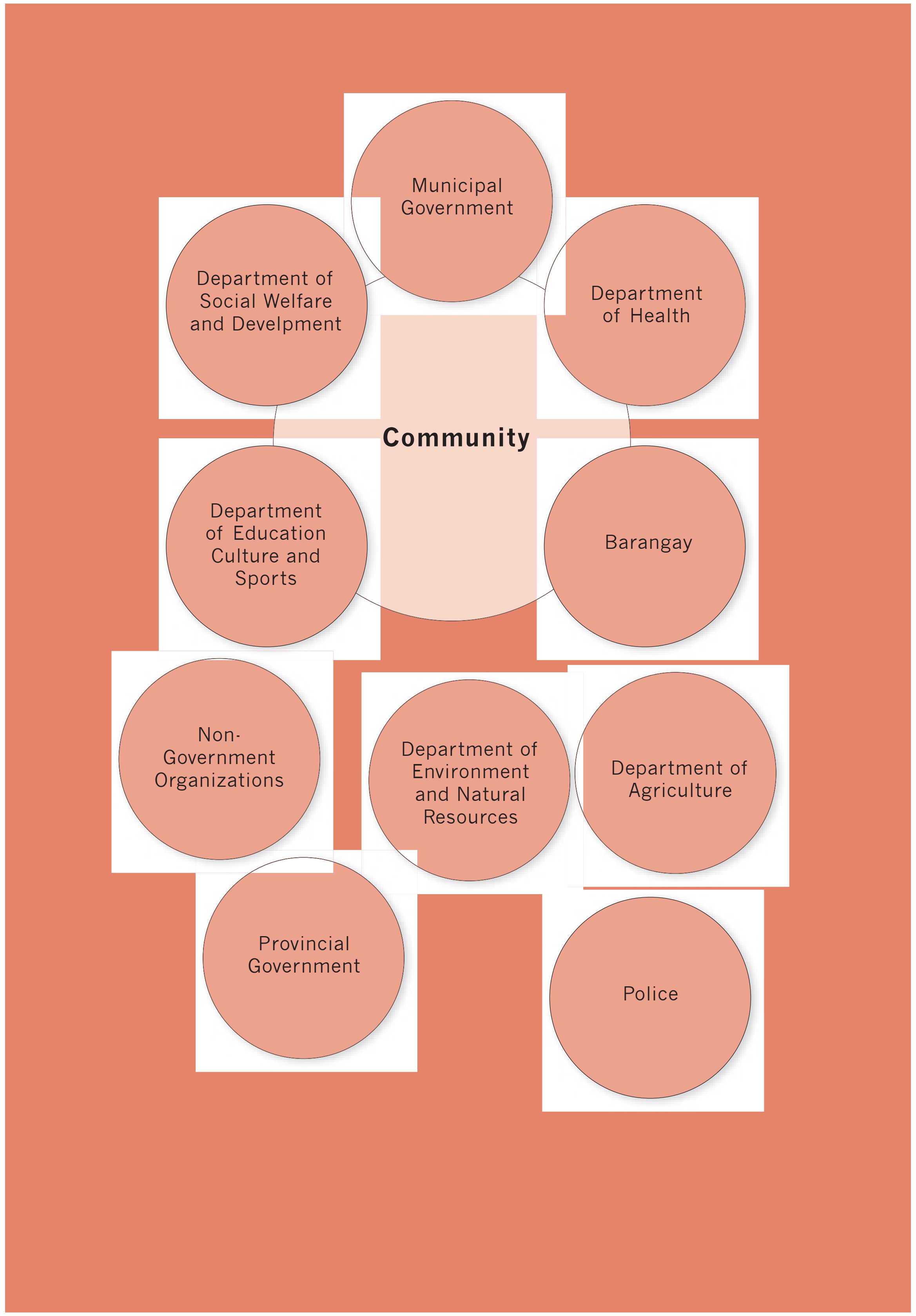


Figure 4.6. *Perceived change in duration of fishing, comparing 2001 to 1996 (survey data).*

and management. In live reef fish trade, the most evident role of PCSD has been to provide accreditation to fisherfolk and organizations wishing to engage in the trade. But municipal governments also provide accreditation and seek greater responsibility over access to and management of their resources. What emerges then is a multi-layered bureaucratic procedure, highly regulatory without clear accountabilities. Except for cultural communities' claim over recognized ancestral domains (terrestrial, coastal, and water), there is very little that municipal governments can do beyond their boundaries. Although PCSD works at the municipal government level through ECAN, the function of this body has in some instances conflicted with local development agendas and thus had limited impact on sustainable management of local resources.

Interestingly, the diagram on institutional and agency relations with communities shows that live reef fishers recognize the significant role of local governments, but the impact of this role, especially in providing support and assistance to communities and in ensuring the sustainability of their economic activity, is hardly felt. Communities are essentially marginalized from the decision-making process, which is perceived to be controlled by local political and financial elites. Although the perception of those interviewed is not conclusive about local government's effectiveness in stopping illegal fishing activities, this reflects the communities' uncertainty about how local governments respond to local concerns and needs. This is more evident in how communities regard law enforcement agencies. From the diagram of institutional relations, the police are situated farthest from the community, indicating a very low level of significance. During focus group discussions, participants indicated that the reason why illegal activities persist was the strong link between unscrupulous traders/ operators and law enforcement agents. This was further stressed by the survey results, in which respondents were asked about the LGUs'

Figure 4.7. Womenfolk perception diagram of relevent institutions/agencies



Part 3 Economic Sustainability Assesment

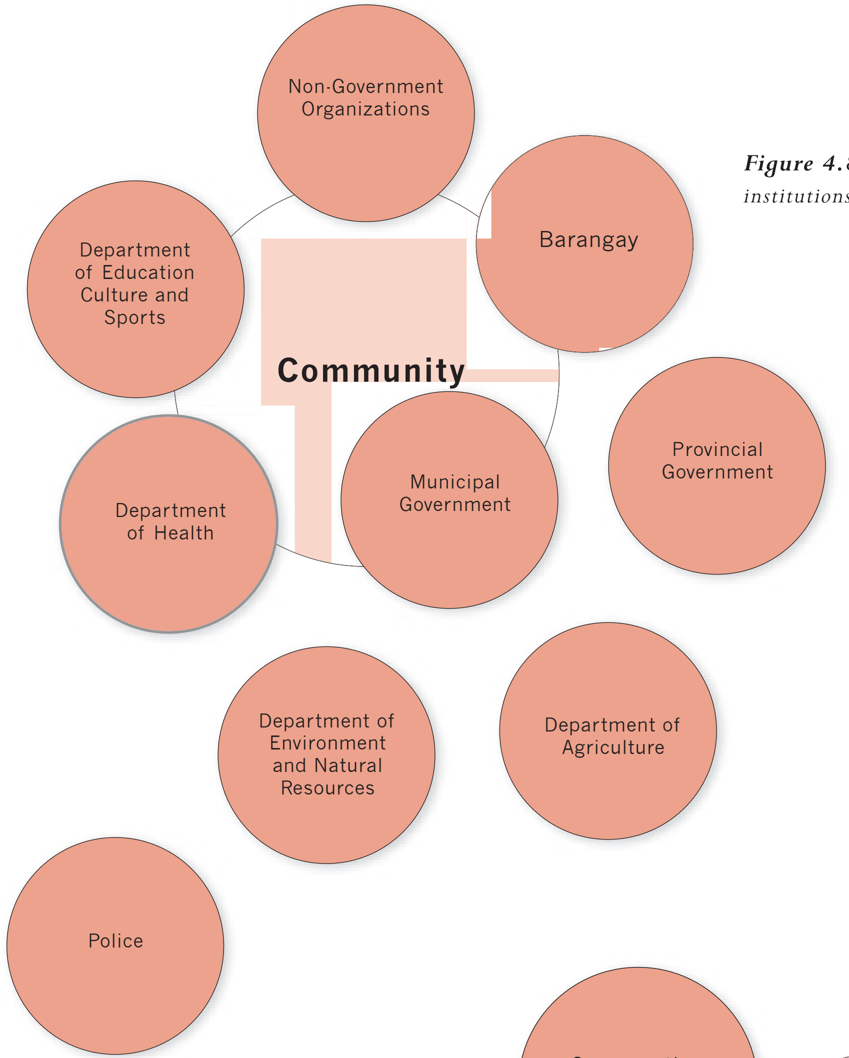


Figure 4.8. Fisherfolk perception diagram of relevent institutions/agencies

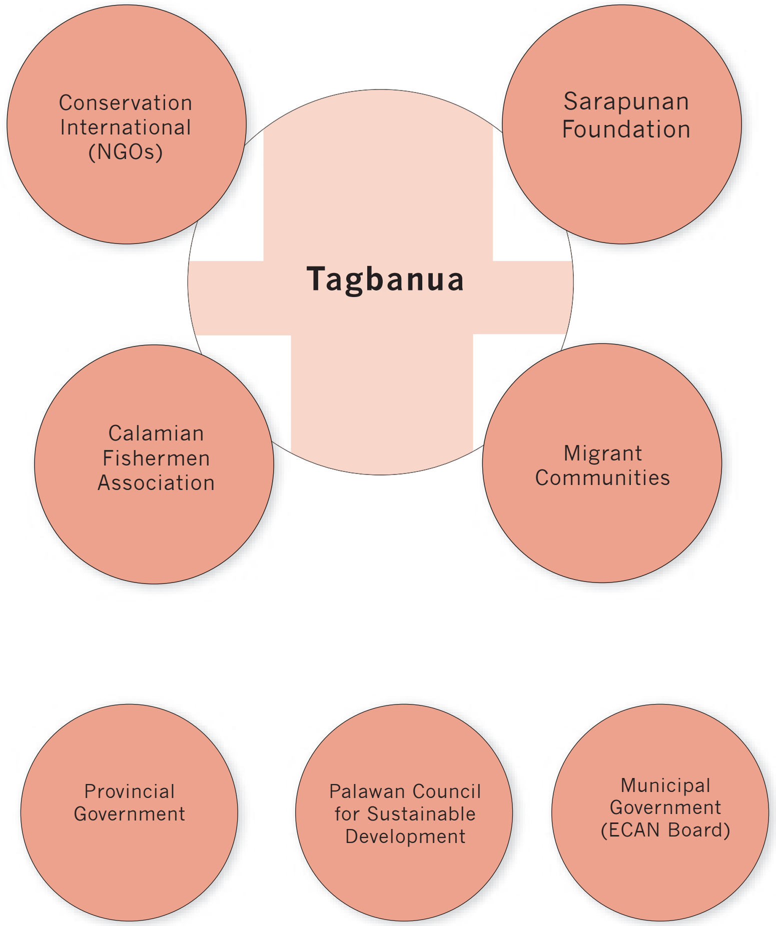


Figure 4.9. Indigenous peoples perception diagram of relevent institutions/agencies

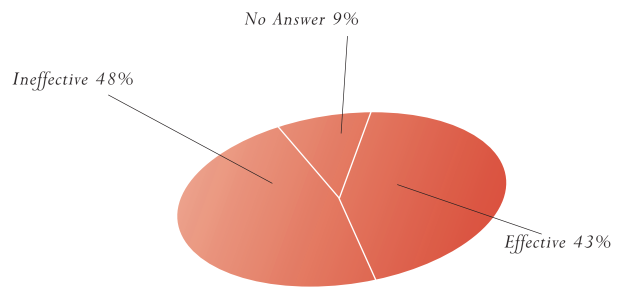


Figure 4.10. *Perceived effectivity of local government units in stopping illegal fishing operations (survey data).*

effectiveness in responding to illegal fishing issue (Figure 4.10). Although the results are not conclusive, they highlight the mixed, if not indifferent, view of communities on the impact and enforcement function of local governments.

Socio Economic

Live reef fish trade in the Calamianes has become very sophisticated and relatively highly beneficial economically. This has greatly affected the relation between and among people and communities, which is now considered more in terms of their survival. In the last few years, changes in relationship of communities have been brought about by keener awareness of two key concerns – their role in decision-making processes as a form of empowerment and the level of equity of benefits from live fish trade that would allow them to enjoy the fruits of their labor. In these two concerns, the study shows, there is much to address.

Absence of empowering mechanisms Generally, fisherfolk have very little regard for their role in overall decision-making and for their relations with LGUs regarding live reef fish trade. Most fisherfolk believe that only local and financial elites have the capacity to make decisions. Yet, despite the felt presence of institutions and agencies tasked to ensure the sustainability of development and natural resource management at both the provincial and local levels, many stakeholders consistently feel that pressures on the delicate resource base and the inequitable economic arrangements persist. Interestingly, these institutions are perceived to be inept and lacking a clear working relationship to appropriately regulate illegal fishing activities and to strictly enforce policies and rules. For example, communities perceive local governments and PCSD to be ineffective in enforcing laws against illegal fishing and intrusion of "other" fishing vessels.

In the municipality of Busuanga, the enforcement agency has only two personnel, a boat, and a limited supply of fuel. Hence, live reef fishers have very low regard for local

Summary of Responses from Survey Regarding Decision Making Processes

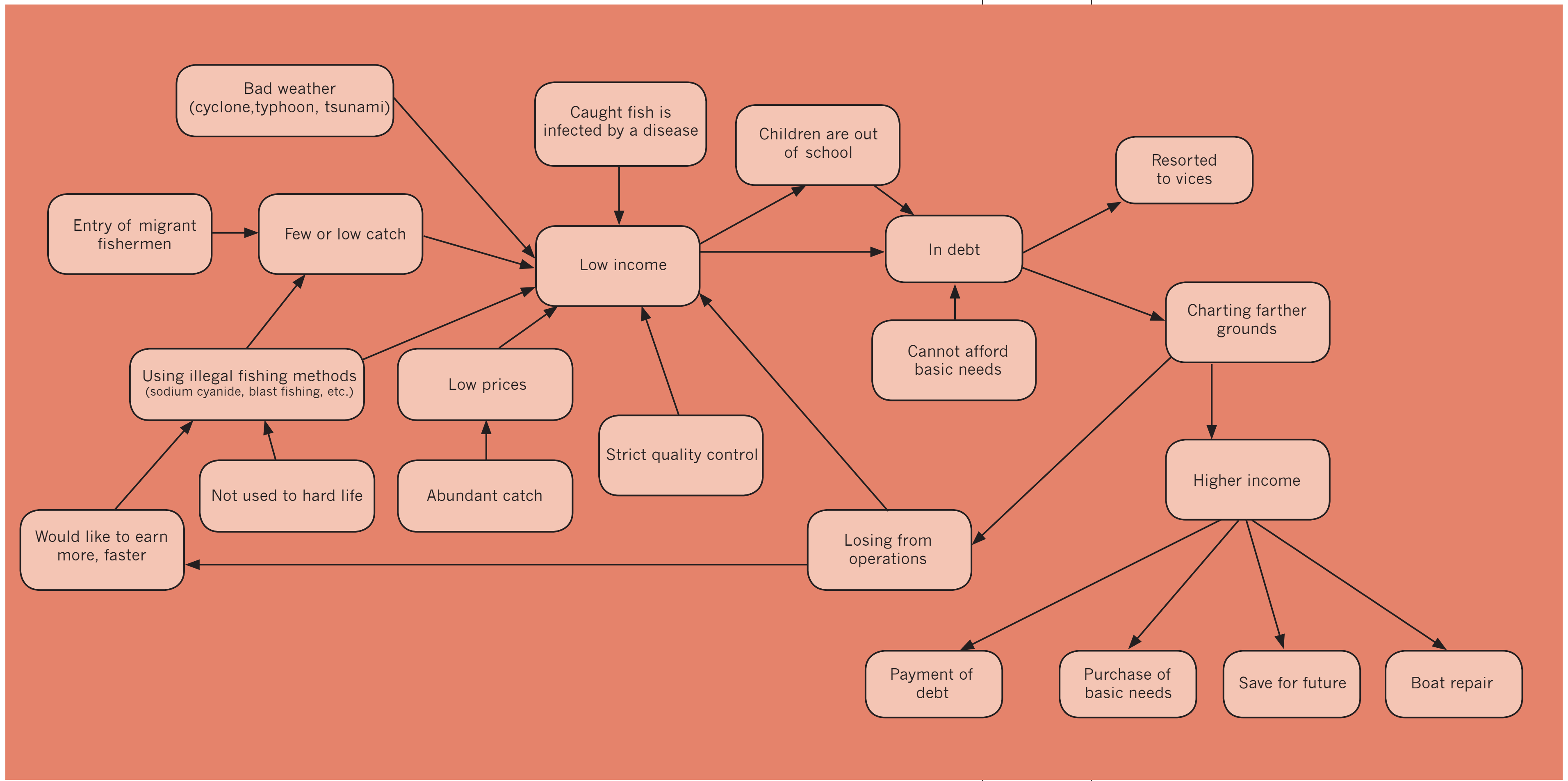
DECISION MAKING
- Only a few people local elite
- Not enthusiastic
- Pessimistic about getting/reaching a consensus
- Not informed on issues and organizations

LOCAL GOVERNMENT
- LGU (municipal) responsibility
- Local government makes organization response difficult: Barangay
- Barangay must start by holding meetings
- Prevailing conflicting interests

government. Clearly, communities view relevant government agencies as lacking the capability and capacity to enforce appropriate regulations, and the qualities needed to coordinate among themselves and to make significant decisions. Hence, communities lack the enthusiasm and motivation to participate in decision-making. Reaching a consensus among fisherfolk is also perceived to be difficult, and there is a prevailing sense of pessimism. This is attributed to the lack of opportunity for fisherfolk to understand and articulate their issues and concerns, and to the limited information they have of organizations and institutions that may provide support and assistance. Thus, fisherfolk communities are marginalized from the decision-making process and from accessing potential support. Their indifference and their negative impression of local governments indicate that communities do not see anyone taking effective responsibility over the issues on live fish trade. Although there is awareness of the critical role of local government, since communities still regard the municipal government as the unit most responsible for issues concerning live reef fishing, this awareness has not been translated into concrete actions and impacts. But active involvement of local governments requires the commitment and initiative of the barangays in ensuring the conduct of local decision-making. Unfortunately, communities do not have positive experiences with barangay officials because conflicting interests have made organizational and decision-making processes difficult.

Inequitable distribution of benefits and growing sense of dependence – From the web diagram of issues and concerns in live reef fishing (Figure 4.11), it is evident that the dynamics and arrangements in the relationship between fisherfolk and financiers perpetuate a cycle of dependency. Financiers decide on the value of resources and provide support to fisherfolk to enable them to engage in live fish trade. The level of sophistication and the intense competition in live reef fishing compel fisherfolk to constantly seek a level of security to sustain their livelihood.

Figure 4.11. *Web of local concerns and issues.*



Hence, they enter into arrangements and working relationships with financiers that are characterized by patronage and loyalty. This is especially true for those who are newly engaged in the trade. In the process, they incur constant debts. Patronage and loyalty are reinforced by the extreme difficulty and risk that accompany the catching of live reef fish. Fisherfolk have to travel long distances and to stay at sea for long periods to catch an adequate supply. In many cases, there is no catch. Fisherfolk borrow money from financiers to provide for their family while they are away. With returns uncertain, costs are compounded and the debts increase. To ensure needed support, they offer loyalty to operators, and a vicious cycle of dependence is perpetuated. Thus, fisherfolk become increasingly disempowered and marginalized.

Consequently, given the dependency of ordinary fisherfolk on those who have technology and financial resources, the distribution of benefits, particularly profits from fish catch, become inequitable. Survey results strengthen this observation. In 2001, only about 56% of those interviewed gained earnings. The rest incurred losses, which eventually translated into further debts. Although this may be attributed to efficiency, the underlying concern is who

has access to resources and technology and to information that determine efficiency. Clearly, comparative advantage is one the side of those whose social and economic arrangements have reached a level of sophistication that ensures them optimal profits. Consequently, ordinary fisherfolk are left out in the dynamics and continue to experience losses. Thus, they sustain a relationship based on debt and indebtedness.

Gender

Live reef fish trade has greatly affected the domestic and economic roles of females in fishing communities. Interactions with community members indicate that the current difficulties experienced by fisherfolk in earning a living through live reef fishing have led to adjustments in domestic activities, such as in time spent on child care and home management. Common domestic activities have been overtaken by more economically oriented, or income-earning, activities. Despite large income from live reef fishing, the inconsistency and uncertainty of fish catch consequently force women to find alternative sources of income. This adjustment has resulted in further rationalizing the critical contribution of women in ensuring domestic stability. Unfortunately, this emerging adjustment has not been optimized toward promoting greater social and economic stability within the communities. It would have been an opportune moment to enable the process of articulating local social and economic issues that would lead to greater local response. Now that there is a sense of balance between roles of genders in terms of equal levels of significance in overall economic stability of the family, there is a need to seek opportunities that would lead to overcoming the difficulties associated with live reef fishing.

3.3 Quality of Life

Live reef fishing has become the major economic activity for most of the communities in the Calamianes Islands. Thus, much of the local concerns and issues, especially on the quality of life, are centered on their experiences in live reef fish trade.

EFFECT	RELATED SOCIAL FACTORS	SOCIAL SUSTAINABILITY INDICATORS								
		Socio-Institutional			Socio-economic		Gender	Quality of life		
		Gov't capacity and capability	Gov't agency coordination	Civil society-gov't coordination	Equitable distribution of benefits	Self reliance and empowerment of fishers	Complimenting roles and functions	Access to basic social services	Food security	Cultural stability
Scale	Increased number of fisherfolk	– –	–	–		– – –	+ +	– –	– – –	– – –
	Movement/shift to farther fishing grounds					– – –	+ + +		– – –	
	Increased number of fisherfolk from other areas	– – –	– – –		– –	–	+		– – –	– –
Technology	Increased use of hook and line method								+ + +	+ + +
	Increased use of cyanide and dynamite fishing methods								– – –	– – –
Regulation	Required Provincial accreditation	+ +	+ + +	+ + +					+	
	Required Municipal permit	+ +		+ +						
	Unclear property rights regimes	– –	– – –	– – –		– – –				– – –
	Absence of resource management strategy	– –	–	– –	–	–			– –	

Table 4.2. *Matrix of Social Sustainability Impacts*

+ + + : Very high positive impact
_ _ _ : Very low negative impact

Threat on food security The "issues" web diagram has in its center the issue of lack of income, which is explained as caused by a number of factors but mainly by uncertainties of live reef fish catching and trade. Concerns such as low yield or few catch due to illegal fishing and intrusion of other fisherfolk, quality of catch, and weather conditions affect the amount of income. Lack of income results in failure to send children to school, inadequate basic necessities, falling into vice, and greater indebtedness. Getting into debt either leads to alleviation of the dire condition or deeper indebtedness, which perpetuates the cycle of poverty and dependency. There thus emerges a wide social and economic gap between those who have financial resources and those who do not. This inequitable economic and social dynamics threatens food security. The threat is aggravated by the lack of proper response from concerned agencies.

Limited access to basic social services One key issue presented in the "institutional relations" diagram is how certain government line agencies provide basic social services to fishing communities. Some government line agencies appear to be appreciated not necessarily because they adequately deliver services but because they are visible to the communities. For communities, a social service is associated with presence and visibility, not so much with impact. The lack of social services and other forms of support that could contribute to the improvement of the quality of life is evidenced by the absence of key service infrastructures such as health centers and primary schools in the islands' communities. Community members also note the lack of information on alternative livelihood opportunities and of trainings for skills and capacity development, which are considered valuable inputs in allowing them to improve their situation. Communities note that the national government makes its presence felt only during election periods.

Weak cultural cohesion and social instability In less than a decade, the live reef fish trade has grown from a simple, high-risk but high-return economic activity to a multi-level, sophisticated, and complex trade. This phenomenal growth, however, has created social pressure and tension. This is evident in how local residents relate to migrants and indigenous peoples. The present social and cultural equilibrium is perceived to be fragile. In the island of Delian, for example, residents are trying to negotiate with the indigenous community for the construction of a school building. The indigenous community has consistently rejected the proposal in the belief that it could weaken their tradition and culture. This is a cause of social tension. Local NGOs are aware of this concern but have not been able to fully respond due to a limited understanding of local cultural dynamics.

4. Summary and Conclusions

Four social sustainability areas were used in determining the social impact of live reef fish trade in the Calamianes. These areas are: socio-institutional (capability, capacity, and coordination), socio-economic (empowerment and equity), gender (balance and complementation), and quality of life (cultural stability, food security, and access to or utilization of basic services). To determine their overall usefulness as impact indicators, a matrix was used in which they were qualitatively assessed in terms of how they are linked with the various effects (i.e., scale, technology, and regulatory) of live reef fish trade.

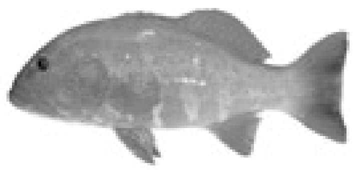
The Matrix of Social Impact of Live Fish Trade presents how the impacts of economic activity are linked with social sustainability indicators (Table 4.2). The scale effects refer to changes in intensity, frequency, or number of specific characteristics brought about by the live fish trade. The technology effect presents the level of sophistication or technical applications related to the trade. Finally, the regulatory effects pertain to policies and guidelines on the conduct of economic activity. In the table, each of the effects has a corresponding impact on certain social sustainability indicators. A positive impact contributes to its significance. A negative impact constraints or hinders attention to it. The table shows that the current state of live reef fish trade in the Calamianes is socially unsustainable.

This conclusion is further explained by the key insights provided by the study. First, despite numerous national and local policies that govern live reef fish trade, there is no pro-active and sustainable resource management policy that takes into account the development of local social capital. Social assessment exercises and the survey indicate that communities are aware of the need to work with the government to establish a sustainable resource management strategy. They acknowledge the growing difficulties and risks associated with current fishing practices, the intrusion of illegal fisherfolk, and the increasing use of destructive fishing methods. This presents an opportunity to seek ways of giving the communities greater control – in terms of management responsibility and accountability – over local resources. This is where NGOs can provide effective support. Community organizing efforts should be directed toward increasing people's awareness of the biophysical character of the trade, and toward establishing collaborative arrangements between government and communities.

Second, the policies are clearly not matched by strong and able institutional capabilities, particularly in enforcement and in responsive governance. This is an indication of unempowered local government and of top-heavy development initiatives. It is important to re-orient provincial government involvement in live fish trade toward more facilitation rather than regulation. This can be achieved if the municipal governments, through technical and financial assistance, are made to fully understand the state of their resources. This may eventually prompt them to make concrete responses to the problems, such as greater enforcement, and to move toward a more responsive form of governance.

Finally, the dependency arrangements, inequitable distribution of benefits, and weak socio-cultural cohesion create a significant level of social instability. Present relations among stakeholders are clearly based on achieving efficiency to gain a comparative advantage in the face of stiff competition over scarce resources. Efficiency requires technology and resources. Consequently, the distribution of benefits becomes inequitable since only those who have resources to efficiently catch fish gain the most. Fisherfolk who wish to ensure substantial catch enter into debt or patronage arrangements with financiers can provide the needed technology. However, income from live fish trade is not guaranteed. Sometimes fisherfolk earn very little or no income, which leads them to further indebtedness. This perpetuates the dependency relations.

Dependency and low net benefit affect socio-cultural relations in communities. As fishing communities continue to expand, the lack of social services creates tension over access to and use of resources. This is more conspicuous between indigenous communities and local residents since both have different uses for common resources. Given the unstable nature of social relations in the community, greater efforts must be exerted to establish social cohesion and stability and promote responsive governance.



Part V Conclusions and Recommendations

1. Conclusions

The biological/ecological, economic and social/community indicators are summarized below. Table 5.1 shows clearly that LRFFI, as indicated by the assessments of the *P. leopardus* in the Calamianes, is treading an unsustainable path.

Biological and ecological indicators suggest that the industry is "mining" and degrading its resource base, greatly compromising its present and future regenerative capacity. Catch has lately been declining; any short-term increase in catch comes from fishing grounds outside the Calamianes. Fishermen have been in search for more productive fishing grounds and have been spending more time at sea. The mean size of fish collected is getting smaller, and exploitation rates indicate serious overfishing.

Economic indicators present the same results. Income from fishing has been dissipated by declining catches due to overfishing and by the swelling number of fishermen in a regime of open access. Likewise, returns on capital and labor have greatly diminished over time despite increase in the price of fish, at least in nominal peso terms. Fishermen remain in the fishery primarily because of lack of non-fishing employment alternatives in the remote islands.

Social and political institutions are not adequately equipped to address the declining ecological and economic state of LRFFI. They have not adequately responded to the emerging problem despite past policy pronouncements. More recently, however, local institutions have shown resolve to address the problems before the situation becomes irreversible. A necessary approach to improve the situation of LRFFI in the Calamianes is multistakeholder commitment to do respective roles in managing the industry. However, the present social and political situation does not appear to support such a strategy.

Role of Trade

The Philippines with its abundant labor and potentially productive marine waters has a comparative advantage in the perennially increasing global fish trade. To harness this

advantage, particularly on the export of various fish products, the government provided a supportive trade environment in terms of liberalized trade policies. Economic benefits realized from implementation of these policies included foreign exchange earnings, jobs, and higher income for those directly involved in the export industry. However, these policies also brought about some detrimental effects.

First, the price premium on preferred size of fish results in targeting young and sexually immature fish, which in turn leads to recruitment overfishing. Second, the higher price of live fish drives the collection of reef fish well beyond limit, without regard to the capacity of the stock to regenerate. Third, provision of cheap capital from traders and exporters further fuels fishing frenzy.

Clearly, trade largely accounts for the unsustainable path of the industry. The possibility of harnessing trade itself to reverse this trend appears limited. The observed pattern of moving fishing operations from overfished to more productive reefs is due partly to transfer of investments by traders and exporters. Nonetheless, the success of any measure to address the problems of the industry needs the acceptance and active participation of traders.

2. Recommendations

From the framework of environmental impact assessment, the logical recommendation would be to impose a moratorium on the live reef fish industry and allow the fish stocks to recover. From the framework of sustainability assessment, which gives consideration to economic and social impacts, the recommendation is to rationalize the industry to address the problems of overfishing, cyanide fishing, and intrusion of migrant fishermen in Palawan waters, among others. In the context of participatory decision-making, the following steps, including the proposed roles of various stakeholders, are recommended:

Next steps[8]

- Presentation of results to local stakeholders.
- Conduct of dialogues for stakeholders decide on the specific measures to take to reverse the unsustainable path of the industry.
- Identification of mutually agreed roles and responsibilities of each stakeholder group.
- Formulation and subsequent implementation of necessary specific measures arrived at by the stakeholders to ensure the sustainability of the industry.
- Participatory monitoring and evaluation of the effectiveness of the measures to identify areas for improvement.
- Providing feedback to stakeholders.

Role of LGUs and civil society

- Implement, monitor and evaluate the management of the industry by stakeholders.
- Conduct multistakeholder dialogues and consultations.
- Enact necessary ordinances to formally implement the measures formulated and agreed upon by the stakeholders.

[8]Results of the study have been presented to all stakeholders in the Calamianes on December 10, 2002 About 90 stakeholders joined the discussion of results. This was followed by a first province-wide Live Fish Forum on March 10-11, 2003 organized by the Palawan Council for Sustainable Development. Over 100 participants from various sectors joined. A Technical Working Group was formed to formulate provincial guidelines on LRFFI.

Sustainability Indicators	Results in the Calamianes Islands Using Primary and Secondary Data
Catch	• Live fish catch (in kg weight) predominantly of *P. leopardus* decreased from 1998 to 2001.
Catch per unit effort (CPUE)	• Absence of benchmark does not allow trend analysis but must have declined significantly due to decrease in catch and increase in number of fishermen • Present estimate of CPUE in the harvest of live fish was higher relative to estimates found elsewhere in the tropics
Fishing distance and duration	• Respondents travel farther than in the past in search of new and productive fishing grounds, resulting in longer fishing trips/duration
Species composition	• *P. leopardus* remains the most dominant species
Fish body size	• Mean body size of *P. leopardus* decreased from 1998 to 1999. • There was also a reduction of the ratio of total weight (in kg) to total number of individuals in the catch (abundance) of live fish from 2000 to 2001. • Both results suggest growth overfishing.
Size/age at sexual maturity	• Live fish trade targets size range of 28-32 cm total length, from young and sexually immature to maturing individuals • High catch rates of small-sized individuals may lead to recruitment overfishing
Fishing mortality rates	• High, preliminary estimates of mortality rates for *P. leopardus* are relatively higher than those in the Great Barrier Reef, Australia.
Exploitation rates/yield per recruit	• MSY is exceeded; stocks of *P. leopardus* in the Calamianes are overfished
Habitat degradation due to cyanide exposure	• No significant spatial effect, estimate of habitat degradation was small, but dead coral cover was greater than live coral cover on cyanide-impacted areas compared to non-impacted areas
Price	• Increased significantly from 1994 to 2002, in nominal Philippine peso
Employment	• No time series data but current number is estimated at over 1,000 artisanal fishermen, composed primarily of migrants
Investment	• As the number of fishermen increased, so did investments. While no census data exists, considering fishermen-boat ratio of 3 persons, there should be at least 300 boats engaged in the industry,
Labor productivity	• Average annual gross income amounted to over PhP25,000 in 2001. This was lower than the legally prescribed minimum wage rates. Fishermen remain in the industry for lack of employment alternatives outside fishing.
Capital productivity	• In fishing, the boat is considered a sunk investment. The engine may have other uses. Returns on investment are very low on the average
Income distribution	• Quite a number of fishermen are already losing • Inequitable distribution of benefits – those who have greater access to and control of finances reap more benefits, while ordinary fishermen continue to incur debts year round
Government capacity and capability	• Weak due to lack of strategic management plan and of resources to do this • No real participatory decisions since local government structures, including enforcement agencies, are controlled by local financial and political elite • Barangay or village-level government is considered significant and relevant in facilitating the participation of fishermen • Coordination among government agencies is constrained by cross-cutting jurisdictional issues, ambiguous working relationships, and lack of institutional accountability • Perceived prevalence of irregularities in enforcement of regulations and ineffectiveness of concerned government agencies both at national and local levels
Self-reliance and empowerment	• Absence of mechanisms for substantive multisectoral consultations and multistakeholder dialogues, for other relevant consensus building activities at all levels, and for resource management use (at levels of fishermen, LGU, policy, etc.)
Gender – complementing roles and functions	• Gender roles have shifted. Both genders have achieved equal levels of significance in keeping economic stability within the family. • Uncertainties of income from LRFFI led women to assume more economically significant roles.
Access to basic social services	• Absence of key service infrastructures at the barangay (village) level (especially in the islands where fishing communities are located) • Presence and concern from government are only felt during election time
Food security	• Perceived uncertainties by communities on provision and acquisition of food due to inequitable trade and lack of services from concerned government agencies • Resource depletion due to unregulated exploitation of fish stocks, coupled by the unabated illegal and destructive fishing
Cultural stability	• Weak cultural cohesion and constructive awareness among ndigenous people • Unstable working relationships between migrants and indigenous people

Table 5.1. *Summary Results of the Ecological, Economic, and Social/Institutional Indicators on Sustainability of LRFFI*

- Monitor and evaluate the implementation of agreed upon measures.
- Facilitate continuing dialogues and consultations to "fine-tune" the measures.

Role of the private sector (fishermen, traders and exporters)

- Institute measures within their ranks to ensure implementation of ordinances and other regulations.
- Cooperate with other stakeholders in managing the fishery.
- Disseminate information about the ordinances and regulations through their marketing networks.

Role of the Project Team

- Aid in dialogues and consultations, especially in providing scientific inputs.
- Provide a "minimum" set of measures to ensure sustainability.
- Identify the implications of national and international trade policy decision-making and communicate them to concerned national agencies.

3. Follow-up Activities

This report has been presented twice to local stakeholders, first in the Calamianes Group of Islands, and second in Puerto Princesa for the first-ever Live Fish Forum in the province of Palawan.

Multistakeholder Consultation-Workshop in the Calamianes

On 11 December 2002, the preliminary results of this study were presented to the stakeholders in a consultation-workshop held in Coron. The PCSDS together with LGUs and the study team convened the workshop, which was attended by 90 participants from Coron, Busuanga, Culion, and Linapacan. They included 41 fishermen, 17 traders, 12 NGO representatives, and 20 local government officials. The workshop aimed to:

- Present and discuss the highlights of the study;
- Come up with proposed actions and solutions; and
- Spell out the roles and responsibilities of the stakeholders in ensuring a more sustainable industry.

To encourage spontaneous expression of views, the participants were broken into sectoral groups: fishermen, traders/exporters, local government units, and NGOs. Several issues and concerns that surfaced during the plenary became the basis for identifying the roles and responsibilities of the various stakeholders in implementing the recommendations for moving the industry toward a more sustainable path. Workshop results were presented and discussed in the afternoon.

Areas of concern identified by the participants

a. Poor enforcement of laws. The participants viewed law enforcement as more pressing

Sustainable Development. Over 100 participants from various sectors joined. A Technical Working Group was formed to formulate provincial guidelines for LRFFI.

than the issue of overfishing. They argued that the destruction of fishing grounds in the Calamianes was due to activities of illegal fishermen and the entry of non-resident fishermen.

b. Cyanide fishing. This practice persists due to the absence of cyanide detection test (CDT).
c. Limited alternative livelihoods. The traders and fishermen expressed reservation over a suggestion to declare a closed fishing season. If this is imposed, alternative livelihoods should be provided to tide them over during the closed fishing season.
d. Duration of closed fishing season. Fishermen and traders reacted against a proposal to impose fishing regulation twice a year, in June-July and November-December. Other participants suggested that the Palawan Council for Sustainable Development conduct further studies on stock assessment and replenishment to explore more reasonable basis for shutting off fishing during specified season.
e. Monitoring of non-resident fishermen. Participants claim that non-resident fishermen regularly poach into Calamianes waters or manage to secure fishing permits. Authorities should devise ways to identify resident from non-resident fishermen through a registry of legitimate local fishermen.
f. Complementary regulations to size restrictions. While participants agreed on the proposal to limit the size of fish to be caught live, they also suggested a ban on compressor fishing, which allegedly supported cyanide fishing.
g. Piracy. Not a few local fishermen have encountered armed pirates who forcibly took their catch. There were also instances of some fishermen being killed.
h. Lack of coordination in law enforcement and monitoring among the four municipalities in the Calamianes. The four municipalities share one body of water – the Calamianes waters – but they pursue different sets of regulations to manage their respective municipal waters. Participants proposed the creation of Integrated Fisheries and Aquatic Resource Management Council to address this issue.
i. Complex accreditation process. The PCSDS accredits industry players to monitor the industry. In some cases players do not seek accreditation anymore because of complex procedures and requirements. Participants suggested a review of the accreditation procedures.
j. Distribution of benefits. Some participants claim that only a few in the trade reap most of the benefits while others are left with very little to survive. They suggest further studies on income from the trade and the setting up of an export office that would ensure equitable distribution of benefits.
k. Conflict between indigenous peoples and migrant fishermen. A representative of the indigenous peoples remarked that the study should also take the issue of indigenous peoples. Ancestral waters have been destroyed due to illegal activities of migrant fishermen.

Recommended actions and the responsible institutions

For most issues, the participants recommended concrete actions and the responsible organizations and/or sectors. The (Table 5.1) matrix below illustrates the broad range of regulatory and non-regulatory measures that are perceived to be necessary. Entries in the last column of the matrix reflect the roles of various stakeholders in addressing the problems of the fishery.

Time constraints made impossible the exhaustive discussion of recommendations. However, they were useful in terms of the objective of the consultation-workshop – to provide a forum for discussing and validating the results of the study. Further, the consultation/workshop supports the recommendations outlined in this report.

Live Fish Summit

On March 10-11, 2003, PCSD hosted the first-ever Live Fish Summit in Puerto Princesa City, the capital. The forum was largely motivated by the results of this study and of the consultation-workshop. The biggest accomplishment of the two-day forum was the creation of a Technical Working Group on Palawan Live Fish Industry. The TWG is composed of major industry players and government and non-government organizations, including WWF. Terms of reference of the TWG include the following:

- Act as consulting and monitoring body of the live fish industry;
- Review and recommend changes on the existing monitoring system and procedures, emphasizing on the issue of cyanide as a major cause of current problems;
- Formulate short-term and long-term programs to sustain the live fish industry;
- Come up with recommendations on whether or not to lift the moratorium on the issuance of PCSD accreditation for live fish.

TWG held its first organization meeting in May 2003 and has since outlined its workplan.

Table 5.2. *Matrix of issues and propposed actions as identified by the stakeholders*

ISSUES	PROPOSED ACTIONS	RESPONSIBLE ENTITY
Poor enforcement of laws	• Monitor all suspected cyanide fishermen • Ban migrant fishermen in Palawan waters, especially Calamianes waters; apprehend all illegal and migrant fishermen • Ban compressor fishing • LGU to monitor law enforcement on fishing activities in Palawan waters • Harsh actions/punishment on law enforcers participating in illegal fishing • Include in the municipal budget for 2003 the purchase of 1 big boat each for the 4 municipalities, with each municipality contributing one law enforcer for continuous monitoring • Provision of equipment • Base radio for each barangay and ICOM radios for barangay tanods • Base radios for police • Speedboats • Monitor and strictly enforce laws against cyanide use • Organize composite team through Executive Orders • Pass a resolution/ordinance designating an area as fish landing point to monitor fish being traded • Pass a resolution to Provincial Council requesting additional funds for monitoring of fishing activities	LGU, PNP
Rampant cyanide fishing and absence of Cyanide Detection Test	• Install Cyanide Detection Test in Coron • Maintain CDT operations • Conduct information dissemination on CDT operation through trainings and seminars • Coordination between BFAR and local traders on fishermen and suppliers of live fish caught with cyanide • Random sampling of catches/ stocks of fishermen, operators, aquarium facilities, buyers • Fishermen to inform authorities of cyanide users • Paralegal training in each barangay	BFAR, PCSD, ELAC, Marine Aquarium Council

ACRONYMS:

PCSD Palawan Council For Sustainable Development
ELAC Environmental Legal Assistance Center
CDT Cyanide Detection Test
ECAN Environmental Critical Area Network
BFARMC Barangay (village) Fisheries and Aquatic Resource management Council
MFARMC Municipal Fisheries and Aquatic Resource management Council
IFARMC Integrated Fisheries resource Managemnt Council
BFAR Bureau of Fisheries and Aquatic Resources
PNP Philippine National Police
PMP Philippine maritime Police
SB Sangguniang Bayan (Municipal Council)member

ISSUES	PROPOSED ACTIONS	RESPONSIBLE ENTITY
Alternative livelihood if closed fishing season is declared.	• Further studies on closed season proposal and the alternative livelihood program to be implemented • Promote grouper fish cage culture as one alternative • Put up export association which would set up a cooperative program for the fishermen	PCSD, LGU, WWF, ELAC, BFAR, other concerned agencies, industry players
Duration of closed fishing season	• Conduct further study on stock assessment and replenishment to determine duration of open-close fishing • Pass a resolution requesting PCSD to expedite said study	SB-Committee on Environment
Monitoring of non-resident fishermen	• Draft a resolution to close Calamianes waters from non-resident fishermen	LGU, PCSD, ELAC, BFAR
Prohibit compressor fishing instead of imposing size restriction	• Standardize size (limited to sexually mature) to regulate catch • Further study on size restrictions • Strictly enforce use of hook-and-line and prohibit use of compressors in fishing	LGU, BFARMC, Fishermen, Operator, BFAR, PCSD
Permitting and licensing procedures	• Review licensing procedures • Maintain registry of legitimate locals • Provide barangay officials with official registry • Strictly enforce listing in the municipal registry of fisherfolk • Joint resolution/municipal ordinance in Calamianes banning non-resident fisherfolk • Devise ways to distinguish non-residents from locals • Regular patrol/monitoring by the Coast Guard	Composite agencies, Coast Guard, PCGA
Deriving equitable benefits from the industry	• Study the proposal to set up live fish export offices in Manila, Palawan and Hong Kong for monitoring of prices. This way a more transparent pricing system would allow better bargaining between traders and fishermen.	Coordination between fishermen association and other exporters

ISSUES	PROPOSED ACTIONS	RESPONSIBLE ENTITY
Integrated/ Unified FARMC among the CGI	• Come up with an integrated FARMC among all the four municipalities • Confer/lobby with local officials • Coordinate with MFARMC • Notice of Organization IFARMC • Organization of IFARMC	SB-Committee on Environment
Complex accreditation process by the Palawan Council for Sustainable Deveolpment	• Simplify accreditation process for fishermen and maintain requirements for traders, carriers, etc. • PCSD to set up Environmental Critical Area Network Board (ECAN) in every municipality to serve as monitoring body • Uniform format of accreditation • Strict enforcement of guidelines • Accreditation first before Mayor's permit • Identify gears and legal fishing methods • Submit volume/species list prior to shipment (per shipment) • PCSD to strictly enforce Administrative Order 5. s. 2000 regarding accreditation • LGU to strictly adhere to the mandate of PCSD especially on accreditation • Proper coordination of LGU and PCSD in implementation of PCSD Administrative Order	PCSD/S, LGU, ECAN Board (municipal), Live Fish Association (CLFOA)
Fishing is permitted even without PCSD accreditation	• Review institutional relations between LGU and PCSD • For PCSD to take further action on the following: • Accreditation issuances, suspension and cancellation with due process • Issues on migrant fishermen fishing on Palawan waters • Issues on alternative livelihood in light of proposal for closed fishing seasons • Issues on banning of compressor, specifically in the case of hook-and-line fishing	Municipal LGU, PCSD
Conflict between Indigenous Peoples and Migrant Fishermen	• Recommend the conduct of further study on this issue to competent agencies	LGU, PCSD, ELAC, CLFOA and other concerned agencies

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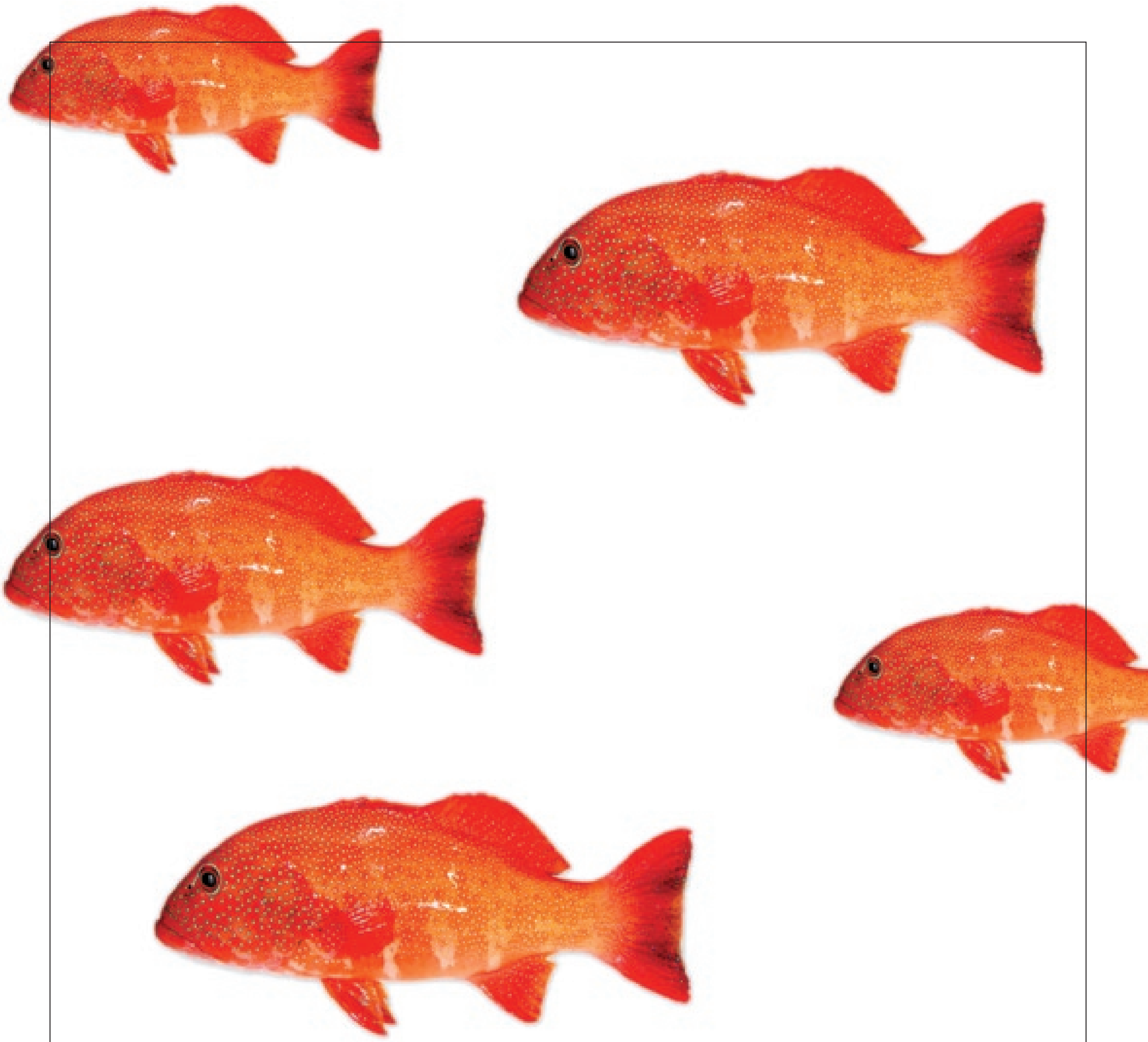

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