USAID FROM THE AMERICAN PEOPLE | PHILIPPINES

FISHERIES IMPROVED FOR SUSTAINABLE HARVEST (FISH) PROJECT

DEVELOPING A FRAMEWORK FOR ECONOMIC ANALYSIS OF CRM INVESTMENT: THE CASE OF UBAY, BOHOL

This publication was prepared by Rina Maria P. Rosales for the Fisheries Improved for Sustainable Harvest (FISH) Project through support provided by the United States Agency for International Development (USAID) under the terms and conditions of the Contract No. 492-C-00-03-00022-00.

FISHERIES IMPROVED FOR SUSTAINABLE HARVEST (FISH)

DEVELOPING A FRAMEWORK FOR ECONOMIC ANALYSIS OF CRM INVESTMENTS: THE CASE OF UBAY, BOHOL

Submitted By

Rina Maria P. Rosales

September 2008

This publication was made possible through support provided by the United States Agency for International Development (USAID) under the terms and conditions of the Contract No. 492-C-00-03-00022-00. The opinions expressed herein are those of the author and do not necessarily reflect the views of the USAID. This publication may be reproduced or quoted in other applications as long as proper reference is made to the source.

TABLE OF CONTENTS

LIST OF TABLES

ACRONYMS USED

BFAR	Bureau of Fisheries and Aquatic Resources
CBFMA	Community-Based Forest Management Agreement
CLE	Coastal Law Enforcement
CLEC	Coastal Law Enforcement Council
CPUE	Catch Per Unit Effort
CRM	Coastal Resources Management
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
EO	Executive Order
FISH	Fisheries Improved for Sustainable Harvest
HP	Horsepower
IEC	Information and Education Campaign
KG	Kilogram
LGU	Local Government Unit
LHC	Live Hard Coral
MFARMC	Municipal Fisheries and Aquatic Resources Management Council
MOA	Memorandum of Agreement
MPAs	Marine Protected Areas
PCRA	Participatory Coastal Resources Appraisal
PhP	Philippine Peso
PNP	Philippine National Police
PO	People's Organization
TEV	Total Economic Value
USAID	United States Agency for International Development
WTP	Willingness to Pay

DEVELOPING A FRAMEWORK FOR ECONOMIC ANALYSIS OF CRM INVESTMENTS: THE CASE OF UBAY, BOHOL

INTRODUCTION

The archipelagic state of the Philippines calls for the management of coastal and marine resources to form a major part of economic planning and environmental management. To date, more than half of the country's population is living in coastal areas, and a great number of these coastal municipalities and cities contain the poorer sections of Philippine society. In recent island-wide workshops for the formulation of the Philippine Plan of Action for the Coral Triangle Initiative, numerous issues and concerns have been raised in the realm of coastal resources management (CRM): overfishing, destructive methods of fishing, overpopulation, poor ecosystem management, weak enforcement, and low institutional capacities to name a few. With the recent event of climate change, the need to speed up and invest in CRM activities, both for mitigation and adaptation purposes has become more pronounced than ever.

Coral reefs have always been subject to stresses borne from human activities. Increasing demand for marine-based products due to increasing population and economic development has led to environmental degradation that usually takes the form of loss of live coral, mangrove areas and seagrass beds as well as continuing decline in fish stocks. On the positive side, coral reefs are said to have a "*remarkable long-term resilience to such stresses, and can and do recover from even the most devastating impacts"*[1]. The issue though is not so much whether the ecosystems will recover, rather what is the time scale involved for them to recover, and what opportunity costs do they impose on populations dependent on the coral reefs. For instance, MPAs which are enforced to enable coral reefs to recover will have short-term opportunity costs on subsistence and commercial fisheries, and can quickly undermine economic stability.[2] On the other hand, long-term benefits from MPAs have been recorded and acknowledged in the scientific literature, and should therefore be taken into account when making decisions on whether to pursue CRM or not.

Ubay, Bohol is one of the few municipalities in the Philippines where CRM has reached a relatively advanced stage. The municipal government has made significant strides in enforcing its very own Fishery Ordinance, which in turn draws heavily from RA 8550 otherwise known as the Fisheries Code of the Philippines. Aside from the creation of a coastal law enforcement team and having a separate building and office purely for CRM operations, the LGU has ensured annual budgets are dedicated to running its CRM office and pursuing its CRM Plan. Bantay Dagat operations are all internalized in LGU expenditures. The provincial government of Bohol is equally serious in investing in environmental management, and has funded some of the CRM expenditures of Ubay. The USAID-funded FISH project has provided the municipal government workers with numerous training opportunities, all of which have been put to good use with improved enforcement

[1] Ruitenbeek, J. 1999. Blue pricing of undersea treasures – needs and opportunities for environmental economics research on coral reef management in South East Asia. Paper presented to the 12th Biannual Workshop of the Environmental Economics Program for South East Asia, Singapore, 11-14 May. IDRC, Singapore.
[2] Ruitenbeek, J. 1999.

operations. MPAs have been established, some by the foreign-funded projects FISH and Seahorse, some by the LGUs themselves. Against this backdrop, the LGU now wants to take a step back and see whether there have been any tangible and measurable benefits that have redounded back to the municipality attributable to the expenses they have incurred in pursuit of CRM.

This report has seven parts. The next part outlines the objectives of the study, followed by a brief description of the situation in Ubay, Bohol. The fourth part discusses the proposed framework for assessing CRM investments of the LGU. It proposes two types of analyses: economic and financial, and provides caveats to the use of the framework. The fifth part provides results of using the framework with the available data collected from the municipal LGU and from the FISH database. The sixth part enumerates the data gaps that may be addressed to allow for a full-blown economic analysis to be conducted later on. Finally, the study concludes with recommendations on how to take the study forward.

OBJECTIVES

The study aims to develop a framework for economic analysis that will show the costs and benefits of CRM interventions in the municipality of Ubay, Bohol. Where data is available, actual costs and benefits will be estimated. If there are components of the framework that do not have data existing at the municipality, these will be taken note of. How to address the gaps will form part of the recommendations of the study.

UBAY CRM PLAN AND IMPLEMENTATION

Ubay is a first class municipality located in the province of Bohol. It lies on the north-eastern part of the mainland and has a total land area of almost 30 thousand hectares and 59.47-kilometer coastline. Municipal waters cover 20,296 hectares. Population in 2000 reached almost 60 thousand, with an annual average growth rate of 3.35%. Twenty of its 36 barangays have coastlines and are occupied by 51% of the population[3]. Results of a rapid survey conducted earlier reveal that majority of the population had very few years spent for education. As a consequence, only a small percentage had limited income opportunities outside fishing. 68% relied solely on fishing for livelihood, while 14% engaged in both fishing and farming. Income was expectedly low, with 85% of the survey respondents earning below PhP 5,000 a month[4]. Addressing short and long term considerations of municipal fishing becomes a great challenge for the LGU of Ubay.

Ubay is considered as one of the more progressive municipalities in the country in the realm of CRM. It has established a separate office that addresses CRM issues, complete with a separate building and staff fully funded by the municipal Mayor's Office. A CRM Plan was formulated and completed in 2006, with assistance from the FISH Project. It incorporates the elements of Integrated Coastal Management, wherein land-based strategies are interlinked with sea-based strategies, falling under the following general management programs:

1. Fisheries Management
2. Coastal Law Enforcement Program
3. Habitat Management
4. Shoreline Management

[3] Ubay, Bohol CRM Plan 2006
[4] Ubay, Bohol CRM Plan 2006

5. Coastal Tourism Management
6. Watershed Management
7. Solid Waste Management
8. Legal Arrangements and Institutional Development
9. Reproductive Health Program
10. Livelihood Development

Habitat management forms a major part of the CRM Plan of the municipality. Mangrove rehabilitation is recognized as an important activity, with only a total of 1,824.53 hectares of forest cover left. Mangrove conversion for fishponds has been recorded at 1,141 hectares[5]. According to expert opinion, there should be a 4:1 ratio between mangrove forest cover and fishponds (Primavera, J. 2008). A rehabilitation project in Barangay Tipolo was undertaken through a Community-Based Forest Management Agreement. Project Seahorse, a foreign-funded project, has likewise extended their assistance in mangrove reforestation in other barangays. Expansion of larger rehabilitation areas is a target of the CRM Plan by 2010. A MOA was recently signed by the LGU with DENR on co-management of mangrove areas, which hopefully translates to sharing of expenditures as well.

Shoreline and seagrass bed management are mentioned as major strategies in the CRM Plan, although there are no concrete programs lined up for meeting the targets. Seagrass beds were assessed to contain 64% cover, and the substrates where these are found were generally in muddy, sandy or rocky surfaces[6]. Similarly, strategies for coastal tourism, watershed and solid waste management have yet to be translated into concrete projects and action plans.

As far as coral reefs are concerned, the LGU has focused its CRM expenditures for their rehabilitation and management. Live hard and soft coral covers registered low averages at 23.2 and 11.2%, respectively due to destructive fishing methods practiced over the years. Fish catch is said to have declined by 80 to 90% starting in the early 90s to early 2004[7]. During the decade of the 90s, efforts to control illegal fishing were initiated, but national enforcement agencies were allegedly not cooperating then. There was a strong clamour for government to intervene as the local population started feeling the negative impacts of marine environmental degradation. CRM was then initiated in the late 90s under the auspices of both the municipal and provincial LGUs, strengthening their efforts in 2004 by institutionalizing CRM through a separate office and the creation of a municipal law enforcement team.

Save for the coastal clean-up and mangrove rehabilitation project in Barangay Tipolo, all LGU expenses have been geared towards coral reef and fisheries management. Enforcement of fishing rules and regulations takes the largest share of the budget. Most of the equipment required for patrolling and surveillance have been purchased and provided by the LGU. Boats, communication equipment, safety devices, direct operational needs (e.g. gasoline and boat maintenance) and food for patrolling are regularly supplied to Bantay Dagat volunteers. Trainings for enforcement teams have been provided mostly by the USAID-funded FISH Project. On the other hand, MPAs have been established through joint efforts of FISH, Project Seahorse and the local governments of Bohol. As far as manpower is concerned, there is an adequate number of fishers who volunteer their time and effort together with permanent PNP personnel detailed in the area. Although not explicitly stated, the allowances provided do not appear adequate to fully compensate for the opportunity costs of the fishers who dedicate their time to patrolling. But then again, they may be valuing the benefits on a more non-monetary and longer-term period than a direct compensation in the form of a larger allowance or salary.

The LGU has provided livelihood assistance to a number of its constituents through the establishment of fish cages and fish corals. To date, there are three fish cages that have been set up for three POs (with an

[5] Ubay, Bohol CRM Plan 2006
[6] Ubay, Bohol CRM Plan 2006
[7] Mayor Eutiquio Bernales, August 4, 2008, personal interview.

estimated average of 25 members each) in separate barangays in Ubay. DA-BFAR, through its Ubay Brackish Water Fish Farm Station has provided the technology and fingerlings for establishing the cages. Capital outlay amounting to PhP 100,000 for each cage came from the provincial LGU, the municipal LGU and from BFAR. What is interesting about the financial assistance provided is that the PO is expected to repay the capital cost after two cropping periods, which in turn will be used to lend assistance to another PO.

Institutional development has been clearly demonstrated through the creation of the CRM office and the inclusion of enforcement operations in the regular budget of the LGU. Sustainable financing sources are being pursued through the creation of the CRM Office Trust Fund through Ubay Executive Order No. 06-08. The EO mandates that 30% of all revenues sourced from the use of municipal waters and its resources, including fines and penalties, be dedicated to the use of the CRM Office. Ideally, this should have been larger, since it would be justifiable to allocate most, if not all revenues of that nature for the implementation of the CRM Plan. Nevertheless, it is a progressive step in principle, and should be replicated in other coastal municipalities throughout the country.

Finally, reproductive health is actively being implemented in Ubay. The population-environment link is acknowledged in the Plan, and there are clear strategies on how to pursue objectives of reducing population growth rates, safe sex and responsible parenthood. PATH Philippines has been active in assisting the LGU in this domain, and there is anecdotal evidence that their efforts are being replicated in neighboring barangays which PATH did not initially target as pilot sites. Local residents allegedly blame overpopulation for the unsustainable increase in demand for fish, which consequently led to overfishing and the use of destructive fishing methods. There is thus an incentive to reduce population growth rates to reduce the pressure on coastal resources in their municipality. The same linkage is being propagated by the CRM Office as part of their IEC campaign.

FRAMEWORK FOR ANALYSIS

Two types of analysis will be used to assess the impacts of CRM investments in Ubay, Bohol. Although they are related, they show two distinct sets of benefits. The framework for economic analysis can be used for measuring benefits that accrue to society as a whole. It goes beyond financial revenues and takes account of non-market goods or non-monetary benefits that accrue to humans, many of which contribute to improving human well-being. However, it abstracts from government revenues. In classical economic analysis, government revenues are treated as transfers, thus are not considered as adding economic value for goods and services in principle.

On the other hand, the framework for financial analysis is useful if one wishes to focus on financial revenues and costs that accrue to the local government alone. It provides a rough balance sheet for local government finances in the context of CRM on a short-term basis. In the long run though, the essence of government spending should be seen in terms of economic benefits that accrue towards society. Their mandate is to manage public goods and ensure the equitable distribution of benefits that ensue from their use. CRM expenditures should not be viewed as a source of LGU revenue that progresses or is sustainable through time. The investments should be viewed as providing benefits that may or may not be monetary, and should be spread as equitably as possible to the LGU's constituents over the long run.

ECONOMIC ANALYSIS

BENEFITS FROM MARINE RESOURCES

There are many ways in which humans utilize coastal resources. Some people primarily rely on the marine environment for their main source of livelihood. Among these people, some use traditional methods of extraction, while others have ventured into the use of more aggressive methods and gears. Coral reefs, mangroves and seagrass beds provide nurseries and habitats for many of these aquatic resources we extract. Still, there are some people who utilize coastal resources for recreational purposes, while some are interested in conducting research for scientific and information purposes. Local residents who live in coastal areas and lowlands are dependent on the capacity of marine ecosystems to protect their houses from potential floods that storms bring, as well as on the capacity of watersheds to regulate the amount of soil eroding from the uplands due to natural occurrences and man-made activities. Our coastal waters have long been the recipient of human waste, and we constantly rely on its capacity to absorb and treat waste without sacrificing water quality in the long-term. Some industries use coastal resources and its waters as direct inputs to production, thus contributing significantly to the total value of the final product. With the advent of climate change, scientists are trying to estimate how much carbon is actually being sequestered by coral reefs and other marine organisms, in order to determine how much these resources are contributing to climate regulation. Finally, there are still potentially yet undiscovered medicinal uses of marine resources which may be used later on for drug development against diseases that afflict humans. Recently, certain discoveries have been made with a particular marine organism that are said to be able to combat diabetes and cancer. The impacts of these discoveries on disease control can thus be tremendous.

There are benefits associated with each type of use. The most obvious of these would be production of fish and related resources which are directly used for consumption and livelihoods. Measurement of such benefits is pretty much straightforward due to the presence of market prices for each of these goods. The value of such benefits is equal to the price of the good multiplied by the quantity consumed. Complications arise when some benefits and costs cannot be expressed in the same straightforward manner. These occur when the goods (and services) in question are what are termed as non-market goods, i.e. there are no market prices existing to reflect their economic value to society. Because they do not have market prices, they are treated as free goods with no accompanying costs in using them. Yet the very presence of conflicts and scarcity produces a positive value for such goods and services. On the other hand, there are costs involved when the use of one group precludes the use of others. In the latter case, opportunity costs are said to be incurred. And because many of these resources are located in public domain, the costs are borne by the public in general.

COSTS OF PROTECTION

The growing number of MPAs has attested to the increasing scarcity of natural resources in the marine sector due to the increasing number and intensity of resource use conflicts. The management of these marine protected areas itself is a direct cost which society bears. Government resources are allocated for MPA management which in turn decreases the amount of resources that could be used for other government priorities. Despite that, government recognizes the need to establish and manage MPAs because of the welfare gains that society gets from doing so. In other words, there are benefits that are perceived to outweigh the maintenance and operating costs of environmental protection.

The establishment of MPAs also imposes opportunity costs to groups of users who have traditionally used the resources without any restrictions in the past. Many of these affected groups are those that reside within or near MPAs and most of the benefits they have enjoyed make up a significant proportion of their livelihoods. The imposition of regulations and limitations in resource use most probably would have caused negative impacts on their well-being thus offsetting a proportion of society's welfare gains. In assessing the

total impact of MPAs, it will be vital to identify what the benefits and costs are, and to whom will each of them accrue.

TOTAL ECONOMIC VALUE

In conducting an economic analysis of CRM investments in Ubay, the total economic valuation (TEV) framework is proposed as the main tool of analysis. TEV is defined as the sum of all direct, indirect and non-use values of the study site, including all natural goods and environmental services that benefit humans.

Direct uses are made up of environmental goods and services that directly benefit humans, such as:

- harvesting of seafood for food, decor, curios, aquariums, and other goods for direct consumption
- mariculture
- sand mining and quarrying
- tourism or recreational services, such as snorkelling and scuba diving
- education and scientific research

Indirect uses are made up of ecological functions of marine ecosystems which are essential for human survival, such as:

- Provision of nurseries and habitat for breeding, spawning and foraging of marine organisms
- Gas and climate regulation, e.g. carbon sequestration functions of corals and phytoplanktons
- Disturbance prevention and alleviation, e.g. coral reefs and breakwaters that provide coastal protection
- Bioremediation of waste, e.g. using marine waters are receptacles of human waste
- Nutrient cycling for primary production
- Resilience and resistance, e.g. sandy beaches and dunes that support complex ecosystems

Non-use values are made up of option values, existence values and bequest values. Even if there is no immediate or planned use of such resources, positive values are still attached to them. Option values are derived from the potential to provide direct and indirect uses for humans later on. For instance, marine resources have become vast sources of information for medical, agricultural and industrial uses. Keeping them intact provides humans the option to make such discoveries in the future. Existence values emanate from the desire of humans to keep the resource in existence for humanity as a whole, and bequest values refer to the desire to protect resources for future generations.

In all valuation techniques that have been used, the concept of "willingness to pay" (WTP) is present. WTP represents the costs to the user of the natural good or service, in order to derive the benefits from such use. It is measured either by actual monetary payments, or sometimes by implicit payments through other costs incurred in the use of the natural resource in question. They can be payments that do not involve money directly, nevertheless are costs on the part of the user, such as time or own labor. In measuring WTP, complications arise when what is being valued is a non-market good or service, i.e. no market price exists. This is particularly true for indirect and non-use values in the equation. Various techniques in environmental economics have been used to come up with estimates of WTP for such non-market goods and services.

The TEV framework will be applied mostly to the coral reef ecosystem. To date, most expenditures of the LGU have been geared towards management of coral reefs and fishing practices. It will be difficult to attribute indirect and non-use benefits from mangroves and seagrass beds emanating from such investments. Estimation of most benefits will in effect be focused on coral reefs only.

BENEFIT-COST ANALYSIS

Ideally, to estimate the marginal effects of CRM investments, a "with and without" or "before and after" analysis should be conducted. In other words, the value of resources with and without CRM investments, or before and after investments were poured in, should be estimated. Following is a description of the marginal benefits to be valued and a general description of the data sources.

A. INCREASED FISH CATCH FROM LEGAL METHODS

Increases in fish catch would constitute direct use values or direct benefits that accrue to the fishing population of Ubay in general. For increases in fish catch, the current data available at the Ubay CRM office is not very clear cut as to determine exactly when there was an increase in benefits due to CRM investments. There is no baseline data existing for periods when CRM expenditures were not yet part of local government budgets. In the absence of a clear baseline scenario, 2004 data from the fish catch monitoring survey will be used as the base figures. It is assumed that investments may have been made prior to 2004, but actual impacts were only realized after a year or two of fully enforcing fishing rules starting in 2004.

To validate the data from fish landings, annual purchases of a fish broker in Bgy. Humay-humay for three years will be collated. The hypothesis is that there would be an increase in the volume of fish catch being sold to brokers, and there will be a shift from lower valued fish species to higher valued species being caught in some parts of Ubay. These values will then be compared to the estimates from fish landing data. They should however not be added up to avoid double-counting errors.

Note that the figures used are gross values hence do not represent resource rent estimates. If a survey can be undertaken later on to determine excess profit, the figures can be adjusted to better reflect rent estimates. Nevertheless, the gross values can initially be used to demonstrate the increase in benefits brought about by enforcement investments.

B. DAMAGES AVOIDED FROM DESTRUCTIVE FISHING METHODS

The previous section on TEV described the various ecological services and non-use values that humans derive from marine ecosystems. Although it would have been ideal to estimate values for each TEV component, there is no data existing to perform such a task. In lieu of this, other indicators will be used to measure the increase in ecological services brought about by a decrease in damages arising from destructive methods of fishing and the increase in coral cover due to the establishment of MPAs.

A "with and without" scenario will be inferred for estimating damages from illegal and destructive fishing methods, but a lot of assumptions will be made to capture the baseline and current scenarios. Without enforcement, blast fishing would have continued unabated, causing damages to coral reefs and losses of environmental services that they provide. With blast fishers being caught and discouraged to continue with their destructive operations due to effective enforcement, there will be environmental damages that will be avoided. Those avoided environmental damages will be estimated and will form part of the benefits from enforcement.

C. DECREASED FISH CATCH FROM ILLEGAL METHODS

Aside from increase in coral cover due to less blast fishing, there is also the case of decreased fish catch from all other illegal methods, assuming there are less of them because of increased enforcement. The decrease in their catch can represent an increase in total fish biomass in the area, using the assumption that illegal gears

are responsible for overfishing and catching of juveniles. Although there is the danger that the decrease from these methods may intersect with the increase in fish catch from legal methods, the current data set does not allow for separating these variables from each other. In any case, this indicator will be used to represent a decrease in overfishing and catching of juveniles.

D. Increased Healthy Coral Cover in MPAs

The establishment of MPAs in Ubay is done primarily to increase healthy coral cover to serve as breeding and nursery grounds for fish. Such an increase will necessarily result in increases in the provision of environmental and ecological services that humans benefit from, such as climate regulation, coastal protection, waste bioremediation, nutrient cycling and resilience of marine ecosystems. Valuing coral reefs will be undertaken through the use of the replacement cost method, wherein the costs of replacing coral reefs through technological applications are computed to value the resource itself.

E. Decreased Encroachment of Commercial Fishers

Observations have been made on the success of enforcement activities in minimizing commercial fishers from encroaching in municipal waters in Ubay. The CPUE of commercial fishers has not been monitored and is not included in the fish catch monitoring database of Ubay. Assumptions will be thus be made that commercial fishers who used to fish in Ubay waters are similar in operations and fish catch volumes with fishers in other parts of the country, for which data on CPUE exists. If there is an estimated number of encroachers who used to fish in the area, the total damages avoided from encroachment can represent additional benefits from enforcement and implementation of the CRM Plan.

Total Benefits

The resulting sum of all these benefits will thus represent the total value added with investments in place. It can then be compared to the amount of LGU expenditures being poured for CRM to determine whether there is a net benefit that occurs, which in turn can represent a crude measure of efficiency of local government investments in CRM.

Financial Analysis

Financial analysis of CRM investments in the study site consists of looking at actual management costs versus the revenues generated from enforcing CRM rules and regulations in the area. It will attempt to segregate local government accounts in the field of coastal resources management, thus showing if local government investments are also providing a source of revenue for the municipal LGU, aside from the benefits that may be accruing to the municipal population as a whole.

Weaknesses of the Framework

Admittedly, the framework proposed for analyzing CRM investments in Ubay has a number of inherent weaknesses and flaws. The values used to estimate direct benefits from fish catch are **gross values**, i.e. do not consider the costs of harvesting. Ideally, rent estimates (which are derived from net values) should be used to demonstrate this benefit. Unfortunately, there is no available data existing on fish harvesting costs, and the

study does not allow for a survey to be conducted in filling out this gap. The danger this poses is that the values for these benefits may be overestimated. Be that as it may, there will be some benefits that will be undervalued, particularly the ecological services that coral reefs, mangroves and seagrass beds provide. There are hardly any studies that exist on this subject, and even those that have been published have been questioned and criticized for possible measurement errors. It might therefore be more prudent to just qualitatively acknowledge the presence of some of these benefits, without necessarily providing any estimates for numerical values.

Second, in economic valuation, marginal values are what are more relevant in estimation, rather than **average values**. Unfortunately, the data available does not allow for marginal values to be estimated. The use of average values necessarily implies that the value of one unit of coral reef, e.g. one hectare, is the same as the next unit. This is, however, far from the truth given the complexity of ecological relationships of marine resources and ecosystems. There are hardly any existing economic research studies that have attempted to measure prices or economic values of these relationships.

PILOT-TESTING RESULTS FOR UBAY

The framework was tested using data from the municipality of Ubay, Bohol. As shown earlier, the LGU has spent a considerable amount of funds and effort in protecting its coastal habitats throughout the past few years. As interventions were focused mainly on protecting and rehabilitating coral reefs, benefits measured pertain to the improvement of resources found within the coral reef ecosystem, i.e. increase in fish catch and stock and improvement of coral cover. Following are the results of the pilot-testing exercise for the economic analysis portion of the framework.

ECONOMIC ANALYSIS

ESTIMATION OF BENEFITS

A. INCREASED FISH CATCH FOR MUNICIPAL FISHERS

In measuring the increase in municipal fish catch, two sets of data were used for comparison and validation. The first set utilized the estimated annual fish landings from the monitoring data of the FISH Project housed in Cebu. Data in Table 1 shows that annual landings from legal gear more than doubled between 2004 and 2006, but decreased from 2006 to 2008. Nevertheless, fish catch for the whole four-year period was still doubled. The decrease in catch from illegal gear was significant from 2004 to 2006, registering a drop by more than 90%. Illegal catch increased in 2008, though, but again, total fish catch for the four-year period significantly decreased. Legal gears pertain to almost all types of gear, while illegal gears were composed of all seines and dragnets, and dynamite fishing. Compressor fishing/diving is still considered legal in Ubay, although there are plans of regulating this activity in the future.

In estimating the value of the increase in fish catch from legal means, 2008 farmgate prices from Ubay were used. On the average, fish was sold by fishers at PhP 60 per kilo, based on 56 species bought by fish brokers in 2007 and 2008[8]. Table 2 contains the estimated annual value of the increase in municipal fish catch from the period 2004 to 2008, totalling more than PhP 10 million per annum.

Table 2. Increase in Municipal Fish Catch from Legal Gears, Based on Annual Landings, Ubay, Bohol, 2004-2008

	2004	2006	2008
Fish catch, in kg.	733,472	1,704,653	1,417,549
Increase from previous reporting period, in kg.		971,181	(287,104)
Value of increase, in PhP		58,270,843	(17,226,217)
Annual Value of Increase in Fish Catch, in PhP		**10,261,156**	

Source of basic data:
1. Fish Catch Monitoring Data, FISH Project, Cebu, August 2008
2. Mr. Romeo Galvez, Fish Broker, Humayhumay, Ubay, Bohol, August 2008

[8] Source of basic data: Personal interview with Mr. Romeo Galvez, one of 3 major fish brokers in Humayhumay, Ubay, Bohol, in August 2008.

Table 1. Estimated Annual Landings of Fish Catch in Ubay, 2004 to 2008

GEAR MAJOR CATEGORY	GEAR VARIATION	CPUE			Inventory			No. Days / Year	Est. Annual Landings (kg)		
		2004	*2006*	*2008*	*2004*	*2006*	*2008*		*2004*	*2006*	*2008*
GILLNETS	Bottom-set gillnet	6.93	6.89	5.78	5	82	90	227	7,880.4	128,480.2	118,345.3
	Crab gillnet	2.59	2.26	1.56	117	100	317	262	79,332.7	59,258.8	129,522.9
	Drift gillnet	17.00	14.89	15.71	64	67	79	170	184,839.1	169,492.1	210,819.1
	Drive-in gillnet	5.47	12.08	5.52	3	5	6	218	3,572.1	13,140.2	7,204.8
	Encircling gillnet	8.90	--	--	2	--	2	226	4,022.8		
	Set gillnet w/ plunger	10.72	14.33	11.25	24	60	50	260	66,883.7	223,539.7	146,242.4
	Squid gillnet	--	3.72	--		1	2	80		297.7	
	Trammel net	5.16	3.66	3.69	6	10	13	220	6,815.3	8,061.4	10,544.3
IMPOUNDING NETS	Barrier net	4.70	10.26	11.71		5	3	96	0.0	4,922.7	3,373.7
	Fish corral	4.59	3.32	8.54	17	16	47	165	12,861.3	8,763.9	66,198.3
	Stationary liftnet	10.31	17.38	62.10	4	16	21	186	7,672.5	51,732.8	242,573.8
JIGS	Squid jig (troll)	1.53	1.73	--	5	340	10	125	959.7	73,840.9	
LINES	Bottom-set longline	*4.59*	5.98	3.20	55	117	87	229	57,826.4	160,123.4	63,753.6
	Hook and Line (Simple)	2.04	1.86	2.12	266	567	308	217	117,790.8	228,463.0	141,973.7
	Multiple handline	2.33	6.58	3.56	26	170	203	214	13,010.8	239,717.5	154,938.8
OTHERS	Handspear, spear gun, harpoon	0.90	4.43	--	37	53		195	6,503.5	45,802.7	
	Dynamite	187.26	32.48	--	15	8		84	235,952.5	21,824.3	
	Compressor fishing/diving	29.05	23.22	--	2	32	26	181	10,503.0	134,304.5	

POTS & TRAPS	Crab liftnet	2.98	2.67	3.28	84	66	115	218	54,498.6	38,284.3	82,004.4
	Crab pot	6.86	4.21	3.83	57	23	49	213	83,440.9	20,669.2	40,053.7
	Fish pot	14.50	21.57	--	3	33	13	117	5,088.2	83,274.8	
	Shrimp pot	--		--	13	11	25	300		0.0	
	Squid pot	3.74	3.40	--	16	22	5	167	9,970.4	12,482.7	
SEINES & DRAGNETS	Beach seine	7.25	4.50	7.89	21	4	3	158	23,971.1	2,835.0	3,727.5
	Danish seine	17.73	16.50	20.59	27		2	***15***	7,178.6	0.0	617.7
	Mid-water trawl	--	--	--	5						
	Otter trawl	13.45	6.38	13.01	12	3	4	***10***	1,614.3	191.3	520.5
	Seine net	--	--	26.12			4	286			29,881.3
TOTAL ANNUAL LANDINGS									**1,002,188**	**1,729,503**	**1,452,296**
ANNUAL LANDINGS, LEGAL GEAR									**733,472**	**1,704,653**	**1,417,549**
ANNUAL LANDINGS, ILLEGAL GEAR									**268,717**	**24,851**	**34,747**

Source: Fish Catch Monitoring Data, FISH Project, Cebu, August 2008

The other set of data used to estimate increase in fish catch was based on the amount of fish bought by Mr. Romeo Galvez, a medium-sized fish broker in Barangay Humayhumay in Ubay. A detailed daily record of amount and type of fish bought was obtained for the whole year of 2007 and for the months of January to July of 2008. Mr. Galvez is one of three brokers who operate in the village of Humayhumay. Brokers his size are the main buyers of fish that deal directly with municipal fishers. In turn, most of them sell their fish to six big brokers in the whole of Ubay who in turn distribute the fish either to the local Ubay market or export the fish out of the municipality. Brokers like Mr. Galvez are thus the direct buyers from the fishermen and their buying prices are reflective of the farmgate prices of fish.

One problem with this data set is that fish caught using legal and illegal methods are not distinguished from each other. If we use this data set to measure benefits from increased fish catch, there is the implicit assumption that most, if not all, of fish bought by brokers are from legal means. While this assumption may not hold true in all cases, the main purpose of this exercise is just to validate the results drawn from the fish catch monitoring survey.

Table 3 shows the increase in fish bought by fish brokers during the period January to July of 2007 and 2008. For one broker, there was almost a 3,500 kg. Increase for the first seven months. Using the same average price per kilo of fish at PhP60 reflects an increase in fishing income by almost PhP 210,000. Translating the figures into annual values shows an increase of almost PhP 360,000, or an average of PhP 30,000 per month. Unfortunately, the total number of brokers for Ubay was not established. A very conservative estimate would be to assume one broker per fishing Barangay, or a total of 19 brokers, which sums up to an average annual value of increase in fish catch close to PhP 6.9 million per annum. According to Ubay CRM personnel, this assumption can be considered a minimum. If one were to assume two brokers per fishing Barangay, the figure would double to almost PhP 14 million per annum.

Looking at both results in Tables 2 and 3, it can be safely concluded that during the four-year period since enforcement was vigorously pursued in Ubay, there has been a noticeable increase in fish catch by municipal fishers in the area.

Table 3. Fish Bought by Fish Broker in Humayhumay, Ubay, Bohol, 2007 to 2008

	2007	2008
Total fish bought, Jan to Jul, in kg.	8,546	12,045
Total fish bought, Aug to Dec, in kg.	7,997	
Increase in fish bought, Jan to Jul, in kg.		3,499
Value of increase, in PhP		209,942
Annual value of increase in fish bought per broker, in PhP		359,900
Annual value of increase in fish bought, 19 brokers, in PhP		**6,838,104**

Source: Mr. Romeo Galvez, Fish Broker, Humayhumay, Ubay, Bohol, August 2008

B. DAMAGES AVOIDED FROM DESTRUCTIVE FISHING METHODS

Among the destructive methods of fishing, dynamite or blast fishing was identified as a common practice in Ubay. In fact, it was one of the types of gears/methods included in the monitoring survey of the FISH Project. With the increase in enforcement activities of the LGU, there was a noted decrease in the number of dynamite fishers observed in the area. The baseline survey indicated 15 blast fishers operating in Ubay in 2004, each one operating at 84 days in a year (Table 1). The number decreased to 8 in 2006, and the latest survey in 2008 shows that there were no blast fishers observed during the survey period. Some marine scientists estimate that the damage brought about by 1 blast averages at 10 square meters of coral reef, although this figure is highly variable depending on the dynamite used and the depth where the blast fisher

operates. For lack of any other basis for coming up with estimates of damages from blast fishing, it is assumed that the damage caused by one blast is equivalent to 5 sq. meters, which hopefully veers towards the conservative side of estimation.

Previous environmental economics studies estimate the range of values of one square meter of coral reef, depending on the site where the reefs are located. The valuation technique used is what is called the replacement cost method, or the coral reef restoration method. An increasingly popular way of dealing with damaged coral reefs is coral reef restoration. Numerous attempts at restoring coral reefs are currently being undertaken with a wide range of objectives and techniques[9]. Such mechanisms involve a number of cost components such as capital, operational and labor costs. Capital costs include both pre-construction and construction costs. Operational costs include materials, equipment, staff wages, expenses and general administration costs. Finally, labor costs involve all costs for supervision, training and labor in actual restoration activities. Estimating the cost of restoring is a valuation technique used to value coral reefs. If blast fishing occurs, the damage can be said to be equivalent to the cost of having the coral reef restored.[10] Values in the Philippines have ranged from PhP 13,148 per square meter per year in Apo Reef National Marine Park[11], to PhP 14,964 for Tubbataha Reef National Marine Park[12]. Using the lower end to approximate the value of coral reefs in Ubay results in an estimate of total damages avoided from blast fishing to be equal to PhP 20.5 million a year (Table 4 below). The assumptions are conservative such that the restoration costs were not adjusted to reflect inflation and additional transportation costs to get to Ubay. The figure can thus represent a minimum value of damages avoided through increased enforcement.

Table 4. Damages Avoided from Blast Fishing, Ubay, 2004-2008

Indicator	Value
Decrease in no. of dynamite fishers, 04-08	15
Total blasts, per fisher per year	84
Damage per blast, in sq. m.	5
Economic value of 1 sq. m. of corals, in PhP	13,000
Total damages avoided from blast fishing, in PhP	81,900,000
Annual damages avoided from blast fishing, in PhP	**20,475,000**

C. DAMAGES AVOIDED FROM ILLEGAL FISHING METHODS

Aside from the increase in fish catch from legal methods, there is also the observed decrease in fish catch from illegal methods. As pointed out earlier, the value for this indicator might overlap with the value of increased fish catch through legal means. Still, it is included here to represent the benefits derived from avoiding damages brought about by illegal gears, such as overfishing and catching of juveniles.

Table 5 contains the estimated annual landings from illegal gears, represented by all types of seine nets, dragnets and dynamite fishing. Using the same farmgate price for one kilo of fish, and adding the value of confiscated gear during 2008[13], the annual value of the decrease in damages from illegal gears is estimated to be PhP 4 million.

[9] NCRI 1999. In Spurgeon, J. 2000. Economics of Coral Reef Restoration. Collected Essays on the Economics of Coral Reefs. CORDIO, Kalmar University, Kalmar, Sweden.
[10] Rosales, RMP. 2006. Estimating Appropriate Fines for Ship Grounding Violations in Tubbataha Reef National Marine Park. Conservation International Philippines, Quezon City.
[11] Bautista, G. 2004. M/Y Island Explorer Grounding Site Restoration. Haribon Policy Paper No. 1. UP Village, Quezon City, Philippines.
[12] Rosales, RMP 2006. Estimating Appropriate Fines for Ship Grounding Violations in Tubbataha Reef National Marine Park. Conservation International Philippines, Quezon City.
[13] Estimates were provided only for January to July 2008. They include the value of confiscated gear and boats. Earlier confiscations were not recorded and valued.

Table 5. Damages Avoided From Illegal Fishing Methods, Ubay, Bohol, 2004 – 2008

	2004	2006	2008
Total catch from illegal methods, in kg.	268,717	24,851	34,747
Decrease in catch, in kg.		243,866	(9,896)
Value of decrease in catch, in PhP		14,631,957	(593,785)
Value of confiscated gear, in PhP			499,100
Annual damages avoided from illegal fishing methods, in PHP			**4,008,643**

D. Increased Coral Cover from Marine Protected Areas (MPAs)

Establishment of Marine Protected Areas (MPAs) is a major program in the CRM Plan of Ubay. To date, there have been three sanctuaries that have been set up: Humayhumay MPA (71 has.), Sinandigan MPA (51 has.) and Tipolo MPA (31.4 has.). One of the objectives of these MPAs is to increase healthy coral cover, which in turn will lead to an increase in fish stock. MPA benefits can thus be measured by the increase in healthy coral cover.

The FISH Project's database established monitoring sites in MPAs found within the vicinity of Danajon Bank, although Ubay MPAs were not part of the sample. According to natural scientists working with the FISH Project, it is safe to assume that the coral reefs found in the municipalities covering Danajon Bank are similar in type and composition. An assumption is thus made that the results of the monitoring sites within Danajon Bank can be applied to Ubay MPAs.

Monitoring data from 2004 to 2006 reveal that there was a total increase in live hard coral by 4.8 has., or an average increase of 6% across all monitoring sites (Table 6). This roughly translates to a 3% increase in live hard coral every year. To be conservative in estimation, this increase is applied only to the total dead coral area in Ubay MPAs. To get dead coral area in Ubay MPAs, the coral reef status in the whole of Ubay was used, which registered at 10%[14]. Applying the value of coral reefs using the replacement cost method translates into MPA benefits with an annual value of PhP 56.7 million (Table 7).

Table 6. Increased Coral Cover, Danajon Bank, 2004-2006

	Bilangbilangan, East	Hingutanan East	Bantigue	All Sites
Live Hard Coral (LHC), 2004, in has.	18.7	22.7	33.9	
LHC, 2006, in has.	25.86	23.37	41.35	
Increase in LHC, 04-06	3.21	0.15	1.41	4.76
Total MPA Area, in has.	44.8	21.7	18.9	85.4
% Increase in LHC, 04-06	7%	1%	7%	6%
Annual Increase in LHC				3%

Source of basic data: MPA Monitoring Report 2004-2006, FISH Project

[14] Ubay CRM Plan, 2006.

Table 7. Value of MPA Benefits, Ubay, Bohol, 2004 to 2008

	Total Area, in has.	Annual Increase in LHC, in has.	Value of Annual Increase in LHC, in PhP
Sinandigan MPA	51	0.15	18,851,024.66
Tipolo MPA	31.4	0.09	11,606,317.14
Humayhumay MPA	71	0.20	26,243,583.34
All MPAs	153.4	0.44	**56,700,925**

E. Damages Avoided from Decreased Encroachment of Commercial Fishers

Commercial fishing encroachment is said to have been completely eliminated in Ubay ever since enforcement efforts were beefed up. Informal talks with former commercial fishers reveal that there were roughly 15 or so of them operating in the 1990s up until the middle of this decade. In the meantime, previous surveys of commercial and municipal fishing operations estimate commercial fish catch to be four or five times higher than municipal fish catch, on the average. Applying the lower estimate (i.e. 4) to the average CPUE of Danish Seine fishers in Ubay (Table 1) produces a total volume of 222,000 kilos of fish that could have been caught by commercial fishers, with a value of PhP 13.3 million (Table 8). If the elimination of commercial fishing encroachment is assumed to have taken place over the 4-year period of this study, the annual value of damages avoided from commercial fishing encroachment is PhP 6.7 million. The figure is an underestimation of this benefit, since estimated annual catches were averaged over a four-year period of enforcement. There was no basis to assume a number representing the actual decrease in commercial fishing encroachment on a yearly basis.

Table 8. Damages Avoided from Decreased Commercial Fishing Encroachment, Ubay, Bohol, 2004-2008

Indicator	Value
Total commercial fishers, Ubay	15
Average annual fish catch per commercial fisher, in kg.	14,824
Total annual fish catch, all commercial fishers, in kg.	222,360
Value of total fish catch, all commercial fishers, in PhP	13,341,600
Annual value of damages avoided from decreased commercial fishing encroachment	**6,670,800**

Total Economic Benefits

Summing up the estimated values reveals that the municipality of Ubay is enjoying annual benefits in the amount of PhP 98 million per year. Table 9 below provides a summary of the estimated values of benefits brought about by enforcement efforts of the LGU. Using the estimated increase in fish catch from data of fish brokers will lower the total by a few million pesos (PhP 95 million), but will not affect the conclusions significantly. In fact, if the number of brokers proves to be more than 19 for the whole of Ubay, the figures could be higher. Note that the process of estimating benefits tried to be as conservative as possible, although admittedly there could be some overlaps in the values attributed to some of the categories. Be that as it may, the exercise still proves useful in demonstrating that the total value of benefits can be substantial if all types of economic benefits are valued and accounted for.

Table 9. Summary of Annual Economic Benefits from Enforcement, Ubay, Bohol, 2004-2008

Economic Benefit	Value
Increased municipal fish catch, legal methods	10,261,156
Damages avoided from blast fishing	20,475,000
Damages avoided from illegal fishing methods	4,008,643
Increased coral cover from MPAs	56,700,925
Damages avoided from commercial fishing encroachment	6,670,800
TOTAL	**98,116,524**

COSTS OF ENFORCEMENT

Over the past four years, costs incurred for enforcement activities may be classified according to whether they were incurred by the LGU or by some other entity. Furthermore, some cost items could be termed as one-time investments, while others recur every year. One-time costs include MPA establishment, assessment and training workshops, procurement of boats, and livelihood projects. Recurring costs pertain to direct expenses for patrol operations, periodic meetings, regular coastal clean-up activities and IEC. In general, all types of costs should be reflected and compared with benefits accruing from enforcement for a full-blown economic analysis. It is however useful to disaggregate cost items to assess how much exactly the LGU is investing.

During the period 2002 to 2007, the LGU has been incurring a total cost of PhP 820,000 in recurring costs, and it has invested PhP 1.2 million in one-time costs (Table 10). Unpaid costs are borne by varying entities. Outside interventions, such as the FISH Project and Project Seahorse have contributed funds (costs highlighted in gray are direct contributions of the FISH Project). Other government agencies such as BFAR, DENR and the Provincial LGU of Bohol have likewise given funds for CRM activities in Ubay. Finally, a substantial amount of unpaid labor and voluntary contributions from community members have been included as unpaid costs. For one-time costs, the LGU has spent for a little over half of total costs, while it has spent 60% for recurring costs. This shows that a big portion of total enforcement costs is being borne by other stakeholders. In sum, a total of more than PhP 2.2 million has been invested, and more than PhP 2 million is being spent annually for enforcing CRM rules in Ubay. The figure represents 3.2% of the total annual budget of the LGU in 2007.

Table 10. Costs in Enforcing CRM Rules and Regulations in Ubay, Bohol, 2002 - 2007

ACTIVITY	ONE-TIME COSTS			ANNUAL COSTS, 2002 to 2007		
	ACTUAL	UNPAID	TOTAL	ACTUAL	UNPAID	TOTAL
Seaborne Patrol				1,152,476	749,261	1,901,737
Coastal Clean-up				2,700	12,500	15,200
PCRA				3,000	5,580	8,580
CLEC Meetings				39,584	38,400	77,984
MFARMC Meetings					11,480	11,480
IEC				13,600	2,680	16,280
CLEC Wide		319,200	319,200			

Assessment						
CLE Assessment Workshop		12,600	12,600			
Fish Examiners' Training	6,300	12,000	18,300			
Parelegal Training	3,200	55,000	58,200			
CLE Training	41,600	300,000	341,600			
Deputation of Fish Wardens	12,000		12,000			
Fish Cage Establishment	50,000	54,600	104,600			
Mud Crab Culture	50,000	254,600	304,600			
MPA Establishment:						
a. Tipolo	150,000	15,400	165,400			
b. Sinandigan	150,000	15,400	165,400			
c. Humay Humay	50,000	15,400	65,400			
CBFMA Mangroves Rehab	10,140	15,400	25,540			
Procurement of Boats						
a. 1st	150,000		150,000			
b. 2nd	250,000		250,000			
c. 3rd	250,000		250,000			
TOTAL	**1,173,240**	**1,069,600**	**2,242,840**	**1,211,360**	**819,901**	**2,031,261**
% to Total	***52%***	***48%***		***60%***	***40%***	

Source: FISH Project, July 2008

In computing for annual costs from 2008 onwards, the same activities were accounted for. This time, one-time costs were depreciated so they could be reflected in total annual costs. Some activities were likewise added, particularly training workshops that will need to be held periodically. In sum, total CRM costs should amount to almost PhP 2.4 million every year to continue enforcement activities in Ubay (Table 11).

Table 11. CRM Enforcement Costs, Ubay, Bohol, 2008

ACTIVITY	ANNUAL COSTS, 2008 onwards		
	ACTUAL	**UNPAID**	**TOTAL**
Seaborne Patrol	1,152,476	749,261	1,901,737
Coastal Clean-up	2,700	12,500	15,200
PCRA	3,000	5,580	8,580
CLEC Meetings	39,584	38,400	77,984
MFARMC Meetings	-	11,480	11,480
IEC	13,600	2,680	16,280

CLEC Wide Assessment	12,768		12,768
CLE Assessment Workshop	12,600		12,600
Fish Examiners' Training	9,150		9,150
Parelegal Training	29,100		29,100
CLE Training	113,867		113,867
Deputation of Fish Wardens	6,000		6,000
Fish Cage Establishment	52,300		52,300
Mud Crab Culture	52,300		52,300
MPA Establishment			
a. Tipolo	6,616		6,616
b. Sinandigan	6,616		6,616
c. Humay Humay	2,616		2,616
CBFMA Mangroves Rehab	1,022		1,022
Procurement of Boats			
a. 1st	6,000		6,000
b. 2nd	10,000		10,000
c. 3rd	10,000		10,000
TOTAL	**1,542,314**	**819,901**	**2,362,215**
% to Total	*65%*	*35%*	

NET BENEFITS

Combining benefits and costs reveal a huge net benefit for the municipality of Ubay, in the amount of PhP 95.7 million (Table 12). Large economic benefits are realized from improved coral cover because of its large unit value. Some critics warn against the use of the replacement cost method because engineering solutions (such as coral transplantation, in this case) do not always reflect willingness to pay (which is the crux of economic valuation), and they usually tend to be large. On the other hand, there is not enough basic data to allow estimation of the various indirect and non-use values derived from coral reefs. Admittedly, this study does not intend to produce an absolute or exact estimate of benefits and costs. Rather it attempts to show their relative values or magnitude, which in this case demonstrates the soundness of investing in CRM. Costs approximately represent a mere 2% of annual benefits derived from CRM investments.

Table 12. Net Annual Benefits from CRM Investments, Ubay, Bohol, in PhP, 2004 – 2008

Total Annual Economic Benefits	**98,116,524**
Total Annual Costs	**2,362,215**
Net Annual Benefits	**95,754,309**

FINANCIAL ANALYSIS

CURRENT REVENUES

The main source of income of any LGU in the Philippines would be from taxes. In Ubay, certain business taxes have been charged against marine-related businesses such as crab processing plants and fish vendors. At the start of 2008, the LGU has decided to expand its revenue-generating schemes that draw from natural resources in the marine sector. Fish corrals are now being promoted, and there have been a number of them who have registered and paid taxes to the Municipal Treasurer. Special fishing permits are now sold to non-Ubay fishers who fish in their municipal waters. A registration and licensing scheme has been set up for fishing gears and boats. Finally, the LGU has started issuing auxiliary invoices with concomitant fees for marine products that are brought out of Ubay. Fines and charges against violators of CRM rules have been collected since 2004. However, as pointed out earlier, these should not be seen as revenue-generating schemes, rather should be viewed as regulating mechanisms and disincentives. In the long run, the main objective should have these fines and charges decrease, which would translate to a lower rate of violations among community members. Ubay's experience has proven this, with fines and charges drastically being reduced in four years. The trend is consistent with the decreasing number of violators recorded by the monitoring survey of the FISH Project.

Table 13 contains a summary of current revenues that have been collected by the LGU. Revenues have been increasing throughout 2004 to 2008. To date, collections have totalled almost PhP 548 thousand for 2008.

Table 13. Current Revenues from CRM-Related Activities, Ubay, Bohol, in PhP, 2004 - 2008

Source	*2004*	*2005*	*2006*	*2007*	*2008*
1. Registration and Licensing					158,512
2. CRM-related Business Permits and Taxes					
a. Crab processing plant 1			17,635	16,635	17,030
b. Crab processing plant 2				2,495	6,980
c. Fish vendors			178,468	130,592	203,205
d. Fish corrals					23,010
e. Special fishing permits					11,000
3. Fines and charges	99,550	62,280	53,100	33,000	5,000
4. Auxiliary Invoices				113,286	123,068
TOTAL REVENUES	**99,550**	**62,280**	**249,203**	**296,007**	**547,804**

When compared with costs incurred in enforcement, the LGU is still experiencing negative net income, as shown in Table 14 below:

Table 14. Current Net Income from CRM-Related Activities, Ubay, Bohol, in PhP, 2008

Annual Revenues	**547,804**
Annual Costs	**2,362,215**
Annual Net Income from CRM	**(1,814,411)**

POTENTIAL REVENUES

There are several potential sources of revenues that the LGU can tap into which will allow for a positive net income from CRM.

First, the current registration and licensing scheme has only been able to tap around 10% of the total number of fishers and gears operating in Ubay waters. If all fishers and gears are registered, there can be a substantial increase in LGU revenues. Using the fees prescribed in Ubay's Fishery Ordinance, the estimated number of gears from the fishcatch monitoring survey, and the total number of fishers operating in Ubay, total revenues from gear registration can amount to PhP 426,900, while revenues from boat registration can reach PhP 420,400. The assumption used is that out of the total 2068 fishers[15], 1000 vessels are classified as less than 9 HP, and 1068 are within the range of 9 to 16 HP. Potential revenues from gear registration is a conservative estimate considering that the survey recorded only 1480 gears in operation, some of which were classified as illegal hence could not be registered.

Second, income from issuing auxiliary invoices can increase substantially once the system is fully set up. There are two possible sources of income from auxiliary invoices: capture fisheries and aquaculture. According to Ubay CRM officials, total exports of capture fisheries can safely be placed at 30% of total production. Using the estimated annual landings from Table 1, potential income from this source can reach PhP 212,632.

With respect to aquaculture, there is still no available data on current production from fish farms in Ubay. What is known is the total area that has been allowed for aquaculture production, i.e. 1,141 has. To get production data, BFAR's provincial average yields are applied. Five aquaculture species are being grown in Bohol: tiger prawns, milkfish, tilapia, mudcrabs and kingcrabs. Among these, milkfish produces the lowest value of yield per ha. If the total area is assumed to be dedicated to just milkfish, total production value can reach PhP 65.7 million. To get a minimum value of potential revenues, we assume only 10% of this total production is exported out of Ubay. The Fishery Ordinance states that 2% tax is applied to the value of aquaculture production brought out of the municipality. This translates to potential revenues of PhP 131,405 from milkfish production. Using the same assumptions for kingcrabs generates a maximum amount of potential revenues at over PhP 1 million.

A third source of potential revenues is from fees from the use of land for aquaculture purposes. The Ordinance allows the LGU to charge PhP 2,000 per hectare per year dedicated to aquaculture. Assuming only 90% of total area is subjected to fees, the LGU can earn an additional PhP 2 million per year.

Finally, the Ordinance mandates the charge of production fees from aquaculture, at PhP 1 per kilo per cropping for tiger prawns and crabs, and PhP 0.50 per kilo per cropping for milkfish and tilapia. This time, crabs have the lowest volume in terms of yield per hectare. To get the minimum value of production fees, we assume total area is dedicated to mud crabs, which translates to a total production of 353,710 kilos per cropping. Assuming two croppings per year can yield PhP 707,420 in annual revenues for the LGU. If king crabs were produced in all fish farms in Ubay, maximum revenues can reach as high as PhP 5.9 million per year. If we abstract from the aquaculture species and assume an average figure of 800 kilos per cropping, a 50 centavo production fee can yield an average of PhP 912,800 in revenues per year.

In sum, additional LGU revenues from CRM-related activities can reach PhP 3.7 million using minimum values for assumptions, and PhP 9.8 million using maximum figures for assumptions in aquaculture production (Table 15).

[15] Source: Ubay CRM Office

Table 15. Potential Additional LGU Revenues from CRM Activities, Ubay, Bohol, in PhP

SOURCE	AMOUNT
1. Registration and Licensing	
a. Gear	426,900
b. Boats/ fishers	420,400
2. Auxiliary Invoices	
a. Capture Fisheries	212,632
b. Aquaculture	
b.1 Minimum	131,405
b.2 Maximum	1,017,253
3. Permits, Aquaculture	
a. Land Use	2,000,000
b. Production	
b.1 Minimum	707,420
b.2 Maximum	5,887,560
b.3 Average	912,800
TOTAL MINIMUM	**3,740,245**
TOTAL MAXIMUM	**9,806,233**

NET REVENUES

Combining revenues and costs shows that at the current level of revenues, the LGU is still experiencing negative investments. But if they are able to realize all types of fees prescribed in their Fishery Ordinance, they can increase revenues by almost 700% and come out with positive net income levels every year (Table 16). Similar with the caveats on doing economic analysis, these figures are only meant to demonstrate the relative magnitude of benefits that can be obtained from CRM investments. They are not meant to be exact estimates of what the LGU can earn from taxes, especially since there are a lot of assumptions used in most of the revenue scenarios. Instead, they attempt to show that the LGU can actually earn positive revenues if CRM activities are pursued effectively. If more CRM friendly businesses can be set up, such as seaweed and king crab production, the LGU increases its potential to earn more revenues.

Table 16. Current and Potential Net Income from CRM Activities, Ubay, Bohol, in PhP

Current Annual Revenues	**547,804**
Annual Costs	**2,362,215**
Annual Net Income from CRM	**(1,814,411)**
Potential Annual Revenues (Minimum)	**4,288,050**
Annual Costs	**2,362,215**
Potential Annual Net Income from CRM	**1,925,835**

DATA REQUIREMENTS AND GAPS

The monitoring survey introduced and maintained by the FISH Project has proven highly useful in providing a number of important indicators in estimating economic benefits from CRM investments, such as:

1. Types of legal and illegal gear used in Ubay
2. Total number of gear operating in Ubay, by gear type
3. Total no. of operating days in a year, by gear type
4. Annual fish catch by type of gear, in kg.
5. Live hard coral cover in MPAs

Other types of data gathered that should be monitored periodically include the following:

1. No. of commercial fishers operating in the area
2. No. of dynamite fishers operating in the area
3. Total fish catch bought by fish brokers from municipal fishers
4. Farmgate prices of fish commercially traded
5. Actual costs incurred in CRM activities, by type of activity

These indicators should continuously be monitored to keep track of the economic benefits that the LGU provides through the implementation of its CRM Program for coral reefs. Meanwhile, the following indicators could further enrich and refine the benefit estimates for Ubay:

1. Actual size of area damaged by dynamite fishing
2. Actual increase in hard coral cover in MPAs of Ubay
3. Actual number of fish brokers in Ubay
4. Actual aquaculture production in Ubay
5. Actual volume of fish exported out of Ubay, both for capture and aquaculture fisheries
6. Actual number of fish corrals operating in Ubay waters

Admittedly, there are other potential social benefits that were not accounted for due to lack of existing data. In theory, the increase in fish catch could mean that there are more sources of protein for community members, thereby improving their daily diets and health status. Increases in income from fishing could also mean higher savings for local households, which could in turn translate to better opportunities for children's education or higher quality of living for them in general. If socio-economic surveys can be conducted later on, estimates for income and social impacts could be established and added to the benefits from CRM interventions.

Potential revenues for the LGU are large provided that there is an adequate monitoring and collection mechanism in place. The actual area and production from aquaculture should be monitored, along and all municipal fishing boats and gear operating in Ubay waters. Ideally, registration and licensing should not only be treated as revenue generating measures, but should be used primarily as management tools to regulate fisheries. If overfishing is already a problem, then limits to fishing should be implemented. Otherwise, if the regenerating capacity of the resource itself cannot cope with the demand, no amount of enforcement will be able to save it from extinction or collapse.

In this connection, the program on reproductive health care should be continued and monitored as well. Controls should be instituted for all aspects affecting fisheries (i.e. fisheries management along with human population management). Further studies can focus on the impacts of a controlled population on both the

state of the natural resource and on the well-being of the community members themselves. The integration of health care and fishery programs in the overall CRM Program of Ubay is an ideal set-up that should be replicated in other parts of the country. Not only does it bode well for fisheries, but it also allows for a better quality of life of the local population, which should be the ultimate goal of public service.

Note that only the coral reef ecosystem was covered by this study due to the lack of data for mangroves, seagrass beds and foreshore areas. A full blown implementation of the CRM Plan even includes programs that cover watersheds in the area in recognition of the impact of upland activities on the marine sector. Before the other components of the Plan are implemented, it would be ideal if the CRM Office and/or FISH Project can establish baseline data with the same level of detail done for coral reefs.

CONCLUSIONS AND FURTHER STEPS

The journey towards effective CRM should be viewed from the point of view of providing adequate opportunities of sustainable exploitation for the current and future generations. It is thus important for the LGU to know whether its investments are still providing net economic benefits to its constituents now and in the future. Aside from filling in the data gaps identified above, the analysis can be extended further to go into the details of whether fish catch size is growing, and if there are positive trends in harvesting species that go up the food chain. Offhand, the database can allow for this analysis if monitoring is ensured. Even the data collected from fish brokers can serve as a powerful source of such types of analyses if it extends beyond the current time frame.

Socio-economic monitoring can also benefit the LGU in this arena. If benefits from CRM investments can be linked with household income increases, thereby promoting positive social and economic impacts including poverty alleviation, it would be worth the LGU's while to invest in such surveys. Lower income municipalities in particular whose main goal is to alleviate poverty would probably be interested in such conclusions.

The increase in financial revenues can lead to further investments in the other components of the CRM Plan. It was rightfully recognized that upland activities directly impact on the marine sector. Investing in programs that deal with proper watershed management and waste/water pollution management would increase benefits in improving the status of the various marine ecosystems as well as to quality of living of the population. What the LGU should look out for is the potential impacts of increased mariculture and aquaculture activities. Such programs may bring about income increases but they come with their own set of environmental and pollution problems when left unabated. To address these at the onset, the LGU may choose to dedicate its funds earned from mariculture and aquaculture towards mangrove and foreshore habitat management. Increasing revenues therefrom may be tempered by the need to conduct more management activities and regulatory measures if economic activities increase.

Finally, the LGU may opt to consider the use of economic instruments in furthering its enforcement activities. If the fishing population reaches a point whereby they are able to police themselves and patrolling is conducted efficiently on a bay-wide basis, individual transferable quotas or similar instruments may be implemented later on. Not only can they become regular sources of revenue for the LGU, they have likewise been proven to be one of the more effective tools in other countries that have had longer and richer experiences in managing their fishing sector.

REFERENCES

Bautista, G. 2004. M/Y Island Explorer Grounding Site Restoration. Haribon Policy Paper No. 1. UP Village, Quezon City, Philippines.

FISH Project, August 2008. Fish Catch Monitoring Data. Cebu City, Philippines

FISH Project. MPA Monitoring Report 2004-2006. Cebu City, Philippines.

Galvez, Romeo. August 2008. Personal Interview, Humayhumay, Ubay, Bohol.

NCRI 1999. In Spurgeon, J. 2000. Economics of Coral Reef Restoration. Collected Essays on the Economics of Coral Reefs. CORDIO, Kalmar University, Kalmar, Sweden.

Rosales, RMP. 2006. Estimating Appropriate Fines for Ship Grounding Violations in Tubbataha Reef National Marine Park. Conservation International Philippines, Quezon City.

Ruitenbeek, J. 1999. Blue pricing of undersea treasures – needs and opportunities for environmental economics research on coral reef management in South East Asia. Paper presented to the 12th Biannual Workshop of the Environmental Economics Program for South East Asia, Singapore, 11-14 May. IDRC, Singapore.

Ubay, Bohol CRM Plan 2006.

LIST OF PERSONS MET

1. Abad, Allan. Senior Administrative Officer, Ubay, Bohol.
2. Alingig, Helen. CRM Office, Ubay, Bohol.
3. Avenido, Maymay. Fish Project Site Coordinator, Ubay, Bohol.
4. Avenido, Nazario. Barangay Official, Humayhumay, Ubay, Bohol.
5. Bernales, Eutiquio. Municipal Mayor, Ubay, Bohol.
6. Boniel, Elenita. CRM Office, Ubay, Bohol.
7. Butawan, Diosecito. Municipal Treasurer, Ubay, Bohol.
8. De Lima, Jojo. CRM Coordinator, Ubay, Bohol.
9. Galvez, Romeo. PO President, Humayhumay, Ubay, Bohol.
10. Gulayan, Aning. Provincial Coordinator, FISH Project, Bohol.
11. Hilot, Roselle. Ubay Brackish Water Fish Farm, BFAR.
12. Lagura, Ralph. Fishery Technician, Ubay, Bohol.