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Economic Evaluation of Fishery Policies in Lamon Bay, Quezon, Philippines

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This report assesses the sustainability of fisheries of Lamon Bay in the Philippines and investigates the effectiveness of fishery conservation policies. It finds that current policies are failing and that a substantial investment would be required to ensure full compliance with current regulations. It also finds that the benefits of achieving high levels of compliance would exceed costs by only a tiny margin. It concludes that current regulations to deal with overfishing are neither cost-effective nor address the underlying problems of overexploitation of fish stocks and open access to fishing areas. The report suggests that a tradable quota system may provide one answer to the problem and outlines government policies that would back up such an approach.

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EXECUTIVE SUMMARY

Lamon Bay is one of the most important fishing grounds in the Philippines. In spite of this, most fishermen in the area live in poverty and their plight is getting worse. Fish catch is declining by 13.5% a year, more than double the reduction experienced elsewhere in the country. Current fishery policies for the area have failed to improve the situation but no research has been done to find out why. Are the policies poorly designed? Or are they not adequately enforced?

This report attempts to fill this information gap about the reasons for the policy failure. Drawing on data from secondary sources and an original survey, it uses a bioeconomic model to simulate the effects of changes in the enforcement levels of three current policies - ban on electric shiners, regulation on fish cage, as well as both electric shiners and fish cages. Government investments on different levels of enforcement were assessed using benefit cost analysis (BCA).

The report assesses the effects of enforcing current fishery policies more stringently. It finds that a substantial investment [PHP 614,000 (USD 11,500) per year] would be required to ensure compliance with regulations and that the benefits of achieving high levels of compliance would exceed costs by only a tiny margin. The situation would be transformed into one in which increasing number of people would continue to fish, expending larger amounts of effort to comply with various gear restrictions but, in all likelihood, harvesting fewer fish. Catch per unit effort (CPUE) and marginal productivity would decrease because the bay is already overfished. Any additional fishing effort in the bay will result in a decrease in the average catch of all fishermen. Enforcement of current policies will not address the underlying problems of open access and overfishing.

One policy to deal with the problems of open access and overfishing is to set a limit on the total number of fish that can be caught and divide this quota among Lamon Bay's fishermen. Over time, the total allowable catch might be reduced. The easiest way to make the initial reductions would be to revoke the permits of fishermen who contravene fishing regulations, for example, with regards to the permissible catch size or seasons. To allow flexibility, the quotas allocated to individual fishermen may be tradable. This system of individual tradable quotas or permits has been very successful in New Zealand.

The typical Lamon Bay fisherman lies below the poverty level. He has almost no secondary source of income and finds his household members willing but unable to

obtain work. Efforts to reduce overfishing in the bay should therefore be complemented with measures to promote alternative sustainable livelihoods.

1.0 INTRODUCTION

The contribution of fisheries to the Philippine economy is significant. The Philippines was the twelfth largest fish producer in the world until the early eighties. In 1998, the total fish production from commercial fisheries was 941,000 metric tonnes (mt), comprising 35% of the total national commercial fish catch. Municipal fisheries[1] was 34% of the total national municipal fish catch. The rest was attributed to aquaculture production (31%). Fisheries provide more than 60% of the edible protein in the country.

Threatened by overfishing and habitat destruction, municipal fisheries production has been declining by 5.4% annually since 1991 (BAS 1993). In 1998, this decreased slightly to 4.8%. The rapidly growing population, increased fishing efforts, expansion of fishing areas and illegal fishing have caused harvesting to be uneconomical for fishermen. Many nearshore and traditional fishing areas of the country are already fully exploited with most of the enclosed bays and gulfs overexploited. To address this problem, the Bureau of Fisheries and Aquatic Resources (BFAR) implemented several administrative orders among which include the establishment of fish sanctuaries in the overexploited areas, replanting of mangroves, regulating the use of fine meshed nets in fishing and seasonal policies on commercial boats.

One of the top ten major fishing grounds in the country is Lamon Bay, located in Quezon province. It ranked as the fifth highest commercial fishing ground in 1995 with a total production of 55,252 mt comprising 6% of the total national harvest. Municipal fisheries production in the same year was 41,862 mt or 5% of the total, thus, making it the ninth major municipal fishing ground in the country. However, since 1985, its fish catch has been declining at the rate of 13.5% per annum which is more than twice the national average of 5.4%. Thus, the need for local policies was realized.

Republic Act No. 8550 or the 1998 Fisheries Code was enacted to provide for the development, management and conservation of fishery and aquatic resources. It specifically considered the protection of the rights of fishermen in the preferential use of municipal waters. It provides a wider area of operation - that is 15 km from the coastline - for municipal and small scale fishermen using fishing boats of three gross tonnes or less, in order to increase their CPUE. The Code follows the implementation of Fisheries Administrative Order No. 156 which extended the area of operation of municipal fishermen to 7 km from the original 3 km stipulated in the Presidential Decree No. 704.

With the empowerment of the local government units (LGUs) through the Local Government Code of 1991, several local/municipal ordinances are concurrently being implemented with the Fisheries Code in Lamon Bay. These include banning of electric shiners or incandescent lights with wattage ranging from 200 to 1,000 per bulb and

[1] The term "municipal fisheries" refers to fish catch from boats of 3 gross tonnes or less, or uses gear not requiring the use of boats. The term "coastal or municipal waters" includes streams, lakes and tidal waters within the municipality as well as marine waters with the seaward boundary running along a line three nautical miles from the shoreline. This was later extended to 15 km from the shoreline by the Local Government Code of 1991, and as also provided for in the Fisheries Code of 1998.

powered by dynamo, and regulating the use of fish cages. Moreover, a resolution on seasonal closure for gathering milkfish fry has been forwarded to the municipality of Infanta, Quezon.

Electric shiners are used by fishermen to attract fish at night. These devices also attract smaller fish including fry that have not grown to harvestable size. On the other hand, the proliferation of fish cages destroy the breeding grounds of milkfish which also serve as sanctuary for milkfish fry in times of bad weather. A moratorium on catching/harvesting of milkfish fry for two years was endorsed by the LGUs. Also known as closed season for milkfish fry harvesting, this was proposed to allow the fry of other fish species to grow since they were also caught with the same gear used by the milkfish fry gatherers but thrown away because there were no buyers. This has affected the catch of other municipal fishermen. The aforementioned policies may be referred to as an "initial policy set".

In spite of these developments in fishery regulations both at the national and local levels, no study has been conducted to determine their effectiveness and efficiency, particularly in Lamon Bay. No study has evaluated the changes that have occurred under the different fishery policies to show that the targets and objectives of the policies have been achieved.

This study was undertaken to evaluate the economic benefits and costs of implementing various fishery policies and the changes in fisheries resource quality. At the same time, it also considered the institutional effectiveness and efficiency of the system in the current situation and future scenarios. This study serves as a tool for recommendations relevant to municipal fishery policies formulation in Lamon Bay and in other coastal sites.

2.0 OBJECTIVES

Research Objectives

The general objective of this research was to use economic evaluation in assessing fishery policies that can be implemented in Lamon Bay.

The specific objectives of this research were to:

- Evaluate some of the existing local fishery policies;
- Assess the changes in benefits and costs of municipal fishermen using different fishery policies;
- Evaluate the changes in fisheries resource quality of the area using different fishery policies;
- Determine the major factors that influence trends in fishery catch under different fishery policies, using a bioeconomic model;
- Identify and assess the capability of the local institutional mechanism used in the different policies; and

- Recommend further enhancements, where necessary, to the fishery policies considered.

3.0 REVIEW OF LITERATURE

Effective March 1998, all fishery ordinances/policies at the local/municipal and national levels are superceded by Republic Act 8550 upon the approval of President Fidel Ramos. It extends municipal waters to 15 km from the coastline to protect municipal and small fishermen from commercial fishermen. The integrated coastal resource management plan under the Fisheries Sector Program of the Department of Agriculture (DA) indicated that the poor condition of local fishermen is aggravated by violations of existing policies like the intrusion of commercial fishing boats into municipal waters (DA 1992). Thus, aside from the new Fisheries Code, local ordinances have been implemented as management intervention for the preferential use of municipal waters.

Lamon Bay is defined as "Polillo Strait and a portion of Lamon Bay refers to that body of marine waters - beginning at Descada Point part of General Nakar, Quezon province; traversing the coastline of Real, Infanta and General Nakar to the point of beginning - totalling 300,000 ha"

However, this study concentrated only on the municipal waters of Infanta, Real and Polillo because of the unstable peace and order condition in the other municipalities.

The following are the existing local fishery ordinances in the said municipalities:

Resolution (Res) No. 1 (1998) of Infanta calls for the seasonal closure of milkfish fry gathering for two years. This was formulated upon the request of municipal fishermen whose catch is affected by milkfish fry gatherers. Milkfish fry is gathered by municipal fishermen and sold to milkfish fishpond owners. The milkfish fry is either sold to breeders or cultured and grown to a harvestable size for human consumption. During the gathering process, fry of other fish species are also caught and eventually thrown away. The complainants claim that this practice has contributed to the increasing mortality of other fish species in the fry stage.

In order to increase their fish catch at night, some fishermen have resorted to using electric shiners to attract fish. Electric shiners are fishing boats equipped with 200 to 1,000 watts incandescent lights powered by a dynamo. This technology is prohibited in municipal waters because the light also attracts smaller fish that are not yet harvestable. Municipal Ordinance (MO) No. 09 (1996) in Infanta states that electric shiners are allowed in municipal waters provided that no more than four bulbs of 200 watts each per fishing boat is used. Coleman/Petromax lamps of more than six units per fishing boat shall not be allowed in municipal waters except for research purposes only.

In 1997, MO No. 001, also known as "Demolition of Fish Cages Ordinance", declared fish cages "*saplad* and *baklad"* (fish coral) as illegal structures affecting small fishermen by reducing their fish catch and income. These structures destroy the breeding grounds of milkfish which also serve as sanctuary for milkfish fry in times of bad weather.

Both municipalities of Real and Polillo had set aside areas for santuary and prohibition of fishing within the established sanctuaries to protect fisheries and aquatic resources.

Infanta had approved MO No. 4 (1999) limiting mesh size to 3 cm to allow fish fry to mature before harvesting.

An economic evaluation of the aforementioned policies was conducted to come up with recommendations for further enhancements, where necessary, of such fishery policies. Economic evaluation is a technique used by decision-makers in the management of scarce resources. The goal of this study is to apply economic evaluation to different policies in order to determine which alternative will reduce or counteract adverse effects of coastal fisheries. To this end, such effects and measures were expressed in specific physical terms using BCA to come up with economic efficiency indicators like benefit cost ratio (BCR), internal rate of return (IRR) and net present value (NPV). Economic evaluation of different resource management options has been used in several studies on coastal resources. Bishop et. al. (1987) used economic evaluation as a decision-making tool in the use of the Great Lakes as a recreation site in the United States of America. Cruz (1986), in using economic evaluation to determine the optimum coastal policies for San Miguel Bay, revealed that out-migration for alternative sources of income to fishing should be sufficient to offset rapid population growth in the coastal communities. Campos (1997) used economic evaluation as an ex-ante evaluation of seasonal policies for Calauag Bay. The results showed that seasonal policies would further increase the income of municipal fishermen, productivity of the bay and improve fisheries resource quality.

In government programs and policies where coordination among LGUs, non-government organizations (NGOs), people's organizations (POs) and different sectors of society are involved, analysis of institutional arrangements is now used as a tool for policy formulation and recommendations with the objective of learning from the past (PNOC 1994). This was done through the policy guidelines for risk management of the Leyte Geothermal Plant. The indicators of institutional capability were based on the components of the guidelines, adaptation of the implementors and stakeholders, hazards encountered, structural measures, non-structural measures, emergency response, breakdown prevention, restoration, damage assessment and rehabilitation. Thus, identification and assessment of the local institutional mechanism with and without the implementation of seasonal policies were covered in this study. Emphasis was on the preparedness of the local institutional mechanism, the number and capability of the manpower complement, physical and financial resources as well as awareness of implementors on seasonal policies. Furthermore, the analysis focused on the mandated (legislated) vis-à-vis the actual functions as well as the issues, gaps and constraints of the institutional mechanisms under consideration.

There are no previous studies done or existing researches being conducted on the impact of Republic Act 8550 on Lamon Bay. Related researches are as follows:

The Rapid Resource Ecological Assessment conducted by Hayuma Foundation in 1995 and 1999 in the Real and Infanta portions of Lamon Bay identified the fish species found in the area. Although the outputs of these studies are statistics on fisheries and resource assessment, no attempt was made to relate the trends with and without fishery policies to fisheries resource quality. Fisheries resource quality is the extent of variation in the number of species in a given ecological area. In this study, the change in fisheries resource quality was measured by comparing the number of fish species with and without the existence of fishery policies. Primary data on fish catch (volume and value) by species and by type of boat which were gathered during the course of this study and

the results of the monitoring done by the Office of the Municipal Agriculturists (OMAs) in Infanta, Real and Polillo were used in the computation and analysis of changes in fisheries resource quality.

In Lamon Bay, the environmental benefits and costs of monitoring and implementing different fishery policies were analyzed using a bioeconomic model. This methodology was used by Campos (1997) for Calauag Bay wherein the technological factors identified were type of fishing gear used (e.g. baby bagnets), fishing policies or management intervention (whether or not to impose seasonal policies). Technological factors are considered as controls since they allow the resource managers to decide on what impact/effect they want on the fishery resource. The biological aspect was conducted by comparing growth (length of the fish during recruitment), natural recruitment weight and natural mortality. However, this study used the number of fish species, recruitment size and fishing effort (or number of fish catch per fishing trip), as primary data taken during the survey. The socioeconomic factors used in the Calauag study include input costs and output prices. These were taken from the said survey. Other socioeconomic factors that were analyzed in this study are change in income and productivity within the bay. Data on income as well as on productivity measure or volume of fish catch were also taken from the same survey.

Both biological and economic units are included in models of fishery economics. The biological unit consists of a growth function relating natural growth (reproduction plus individual growth minus mortality) to the fish population size or fish stock. On the other hand, the economic unit consists of the relationship between output (catch) and inputs (fishing effort) known as the production function.

The advantage of an economic evaluation study over technical studies like resource and ecological assessment is that the layman appreciates it more because it expresses a variety of impacts in a common unit of measurement - a currency value. This allows tradeoffs to be more clearly seen and weighed. It is only when the technical studies have been translated into monetary terms that they can be appreciated by the general public. In short, an economic evaluation can only be conducted after a technical study e.g. an ecological assessment has been done. Furthermore, the results can be used as a tool in policy formulation and recommendations to the Fisheries and Aquatic Resources Management Council (FARMC) and implementors of their proposed policies.

4.0 METHODOLOGY

4.1 Hypotheses

The following are the hypotheses of the study:

- The implementation of fishery policies has improved the fisheries resource quality of the area.

- Fishery policies have increased the productivity and income of fishermen.

- The total number of sustenance fishermen affected by a particular fishery policy, the type of fishing gear employed by the fishermen and the average price by fish species are the factors which determine the fishing effort in Lamon Bay.

- The local institutional mechanism requires further capability building assistance to implement the different fishery policies.

Two existing fishery policies scenarios: (1) banning the use of electric shiners; and (2) regulating the use of fish cages, were covered in this study under Republic Act 8550. Moreover, the resolution on the seasonal closure for gathering milkfish fry was included in the study.

4.2 Research Methodology

This research covers four aspects: economic, fisheries resources quality, institutional assessment and policy analysis.

4.2.1 Policy Aspect

Review of Existing Policies

After identifying and gathering all relevant, existing national and municipal policies, local executives and stakeholders were interviewed to assess the effectiveness and efficiency of these policies.

Policy Analysis

Effectiveness was measured by comparing the objectives and targets of the policies with the outputs. In this case, meeting the objectives of providing municipal and small scale fishermen with a wider area to operate fishing boats of three gross tonnes or less as well as to increase their CPUE. The results of the fisheries resource quality were also used in this component. An increase in CPUE is an indication of improved fisheries resource quality. Aside from this, improved fisheries resource quality occurs hand in hand with an increase in the size of fish catch and in the number of fish species harvested. Acceptability of the policy from the point of view of stakeholders (municipal fishermen, traders, policy implementors) was also analyzed.

Efficiency was analyzed by comparing the costs of implementation (including transfer costs) on the part of the LGUs, the Coast Guard, BFAR and other entities with the benefits of the policy to different stakeholders. This was taken from the BCA of the Economic Aspect of the study. Regulatory provisions were evaluated for functionality and pragmatism. Review of other related policies was done in order to determine the gaps and constraints as well as conflicting provisions.

The output of the Economic Aspect on the socio-economic profile of households of municipal fishermen was utilized as inputs to possible alternative livelihood projects for municipal fishermen (e.g., milkfish fry gatherers) in the area. Key informant interviews were conducted in the Institutional Assessment of this study to evaluate the acceptability of various fishery policies.

4.2.2 Fisheries Resource Quality

Inventory of Fishermen

An inventory of fishermen was conducted since the data from the LGUs was incomplete and needed updating. A survey of fishermen was also conducted by the Infanta Integrated Community Development Assistance, Inc. (ICDAI) and Cope Foundation, both NGOs, in 1995, but this does not tally with the inventory taken by the LGUs. For each coastal barangay (or village) covered, complete enumeration of each type of fishing gear was done. This involved listing down the names of all fishermen in the barangay and the fishing gear/s they own or co-own. Additional information pertaining to seasonality of use(for example, the months the gear is used, number of trips per year) was also gathered. Estimates of the number of units by gear type for Lamon Bay was obtained by summing up the estimates in each barangay. The seasonality of use - number of trips per year - by gear type was obtained by averaging all responses.

Fish Landing Survey

Daily fish landing survey for 10 months from November 2000 to August 2001 was conducted to provide inputs for the Bioeconomic Model (discussion is in the following section). The original plan was to collect data from strategic fish landing stations in each municipality: Infanta, Real, and Polillo. However, during the reconnaissance survey, it was discovered that municipal boats do not go to the fish landing ports where commercial fishing boats go. Instead, they dock near their houses so that there are as many fish landing points as there are municipal fishing boats.

Fish landing data on price and volume of fish catch was collected which is equivalent to the farmgate price (for agricultural products) being the point of first sale. Municipal boats carry only one passenger (the operator) so it is impossible for the researcher to join the fishing trips. Information on monitoring landings by gear type, species composition of the catch, gear design and dimensions, as well as area and time of operations were instead gathered at the fish landing points.

Criteria for the selection of the municipal fishing gears were based on the following: (1) target beneficiary of a particular fisheries policy; (2) frequency of use or popularity among fishermen; (3) relative contribution to fish production; (4) gear efficiency; (5) potential impact on resource sustainability; (6) use in or near a critical habitat of interest; and (7) accessibility to periodic monitoring. The sample size was obtained using the Sample Size Calculator developed by Creative Research Systems (http://www.surfeysystem.com/sscalc.htm).

Bioeconomic Model

A bioeconomic model was used to compute fish catch by fishing gear and by fish species. The catch/ yield was used as input to the BCA of the Economic Aspect of this study.

The model incorporates both biological and economic units which are included in models of fishery economics. The biological unit consists of a growth function that relates natural growth to fish population or stock. Natural growth is computed as reproduction plus individual growth minus mortality.

$$G = G(X);\ G(X) >/< 0 \text{ for } X >/< K,\ \partial G/\partial X >/< 0 \qquad (1)$$

For X >/< maximum sustainable yield, $\partial^2 G/\partial X^2 < 0$ throughout

Where G = natural growth measured in weight of biomass

X = fish stock also measured in weight of biomass

K = natural equilibrium stock or carrying capacity of the environment

The economic unit consists of the relationship between output (catch) and input (fishing effort) known as the production function:

$$Y = j\ (E);\ \partial j/\partial E > 0,\ \partial^2 j/\partial E^2 < 0 \quad \text{for } X = \bar{x} \qquad (2)$$

This equation implies that, for any given X, the larger the effort (E), the greater is the catch (Y). Conversely, for any given E, the larger the fish stock, the greater is the catch:

$$Y = r(X);\ \partial r/\partial X > 0,\ \partial^2 r/\partial X^2 < 0, \quad \text{for } E = \bar{E} \qquad (3)$$

If we combine equations (2) and (3), the fishery production function is:

$$Y = F(E,X);\ \partial F/\partial E > 0,\ \partial^2 F/\partial X^2 > 0,\ \partial F/\partial E < 0,\ \partial^2 F/\partial X^2 < 0, \qquad (4)$$

The fish stock (X) in the fishery production function (5) is assumed to be constant ($X = \bar{X}$) and eliminated from the equation as an explanatory factor of variations in catch, hence,

$$Y = f\ (E,X) \qquad (5)$$

Fishing effort is itself an output of various fishing input or it is a composite input that can be broken down into its component elements such as capital and labor. Capital is represented by number of boats and fishing gear while labor is represented by population and number of fishermen. The fishermen or fishing units produce effort and each fisherman's catch depends not only on his own effort but also on the effort applied on the given fish stock by fellow fishermen.

Similarly, an increase in fish prices - without any change in costs - would induce entry into the fishery until all profits are dissipated. Changes in fish prices occur as a result of shifts in the supply or demand for fish. With a given demand, poor catch would lead to an increase in price and higher catch to a fall in price. With a given supply, increasing demand (due to population growth or increasing income) would lead to increase in fish prices. Catch rises in the short run but falls in the long run if the fishery is biologically overexploited. Daily or seasonal fluctuations or prices may or may not affect the equilibrium level of effort depending on the level of exit and re-entry (including the availability of alternative employment for labor and capital).

Combining the above elements will produce catching power so that

$$E = j(\ POP, FMEN, FTECH, PR) \qquad (6)$$

Where E = the fishing effort which can be in the form of labor and capital input

POP = population in the fishing community

FMEN = total number of sustenance fishermen affected by a particular fisheries policy such as regulation of milkfish fry gatherers, ban of electric shiners, and ban on fish cages

FTECH = level of fishing technology which includes hook and line, multiple hook, and gill net

PR = average price of a fish species in PHP/kg

The aforementioned model was run for the three policy scenarios. Cross section data on E, POP, FMEN, PR and FTECH taken from the daily monitoring survey were in the model.

The hypothesized values of the partials are:

∂E/∂POP > 0	An increase in the population of the Lamon Bay watershed will increase fishing effort since the main livelihood of the people in the coastal areas is fishing. Fishing is an open access livelihood, which makes it the primary source of income in the area. Aside from this, fish is the major source of protein in the coastal villages.
∂E/∂ FMEN >0	An increase in the number of fishermen will increase the rate of resource extraction in terms of manpower.
∂E/∂FTECH > 0	A direct pressure on the fishing effort will be caused by an increase in the rate of resource extraction (number of boats).
∂E/∂PR >0	An increase in the price of fish will increase the rate of resource extraction.

In an overexploited natural resource system, continuous exertion of efforts through increase in population, sustenance fishermen and boats in operation as well as unregulated fishing would likely result in a declining output. Increasing prices, on the other hand, would enable the fishermen to double their effort to catch more fish. However, with an exploited resource, stock would become extinct.

Assessment of Fisheries Resource Quality

Indicators of improved fisheries resource quality are increased fish catch and number of fish species caught, and decreased fishing effort in the regulated area. Decreased fishing effort in the regulated area will give time for the new stock to grow until the next fishing season. The results of the fisheries monitoring conducted by the OMAs of Real, Infanta and Polillo, and by BFAR in 1995 and the daily fish monitoring conducted by this project were used. Increase in fish catch, number of fish species caught and fishing effort during the different scenarios (before and during implementation of the policies) were computed and analyzed. CPUE was computed as the number of fish caught divided by the time it takes to make one fishing trip.

4.2.3 Economic Aspect

Data Collection

A survey of 450 sample municipal fishermen in Infanta, Real and Polillo was conducted. From the list of fishermen in each municipality, 150 samples were randomly chosen. Using a structured questionnaire, information on the cost of operation and income of the fishermen for the year 2000 was generated, including their socio-demographic profile, perceptions and production or level of fish catch, as well as daily fish prices by species from September 2000 to June 2001. The survey period captured the lean months (October-January), peak months (March-August) and spawning period (April-June) in Lamon Bay. Results of the survey were used in the BCA for the implementation of selected fishery policies in Lamon Bay, particularly in the computation of economic efficiency indicators. Due to errors in the list of fishermen in the three municipalities, a validation of respondents with village officials and/or PO leaders was made prior to the conduct of the survey in the sample *barangays*. This procedure was done to ensure that the respondents are residents of their respective villages. With the validation, some respondents had to be replaced right away as many of them have migrated to another area, a few have died while others are not residents of the particular village.

To complement the survey data, information from secondary sources was also taken. These include the list of municipal fishermen which was taken from the respective OMA of the three towns covered. Additional information was gathered in two *barangays* (i.e., Sibulan, Polillo and Ungos, Real) and ICDAI. This information was used primarily for the sampling of respondents.

Method of Analysis

BCA of the different fishery policies in the following scenarios: a) no regulation and b) with regulation (low and high levels of implementation and monitoring) from the point of view of the municipal fishermen was done. Levels of implementation and monitoring are dependent on the budget allotted by LGUs. The results of the survey on fishermen and key informant interviews as well as the results of the bioeconomic model of the Fisheries Resource Quality Aspect of this study were used in the computation of economic efficiency indicators. Economic efficiency indicators are used in comparing alternative investments, in this case, with and without seasonal policies. These indicators include the IRR, NPV and BCR. Comparison of measures of economic efficiency was done after computing the above.

4.2.4 Institutional Aspect

The following procedures and methods were used to gather and analyze data in the conduct of the study:

Data Collection

A reconnaissance survey was conducted to identify the existing institutional mechanisms that are being utilized to implement various fishery policies in the municipalities of Infanta, Real and Polillo. This activity required an ocular inspection of the area, collection of relevant data and information from various offices as well as

interviews with some key informants from the concerned LGUs, NGOs and the fishermen.

Existing records from concerned government offices involved in the implementation of fisheries policies were reviewed. These materials served as relevant background information for the development of the research instruments for the study. Key informant interviews were conducted using interview guides for the different local institutional mechanisms.

Method of Analysis

The 7S McKenzie Framework and the strengths, weaknesses, opportunities and threats (SWOT) analysis were used to assess the capability of the existing local institutional mechanisms to implement fishery policies. The different aspects considered in the 7S McKenzie Framework are as follows:

1. Structure – composition, functions, physical, financial and manpower resources, linkages with other organizations;

2. Systems working within the organization – information system, monitoring and evaluation system, rules and policies on members;

3. Style – leadership within an organization, characteristics of the leadership;

4. Staff - number and qualifications of the staff upon entry, description of work, level of awareness of local policies;

5. Skills – skills of the existing manpower complement, relevant trainings before entry, relevant on-the-job trainings attended, plans for staff development;

6. Strategy – approaches used to meet the vision, mission and goals; and

7. Superordinate Goal – assessment of the collective sum of the six plus the shared values of the staff towards the attainment of Vision, Mission and Goals.

SWOT. The SWOT Analysis was done for following functional institutional mechanisms: the Municipal Fisheries and Aquatic Resources Management Council (MFARMC) and OMA. SWOT analysis was not done for Infanta *Bantay Dagat* and *Bantay Polillo* since these mechanisms were no longer in existence at the time of the study. The SWOT analysis is presented (Table 6) taking into consideration the internal strengths and weaknesses as well as the external opportunities and threats of the MFARMC and OMA in the execution of fishery policies.

5.0 CHARACTERISTICS OF THE STUDY AREA

5.1 The Study Area

Lamon Bay, 160 km south of Manila, is located in Quezon province (Figure 1). The municipalities of Lamon Bay included in this study are: Infanta and Real - situated in the mainland of Quezon province - and Polillo part of the Polillo Islands.

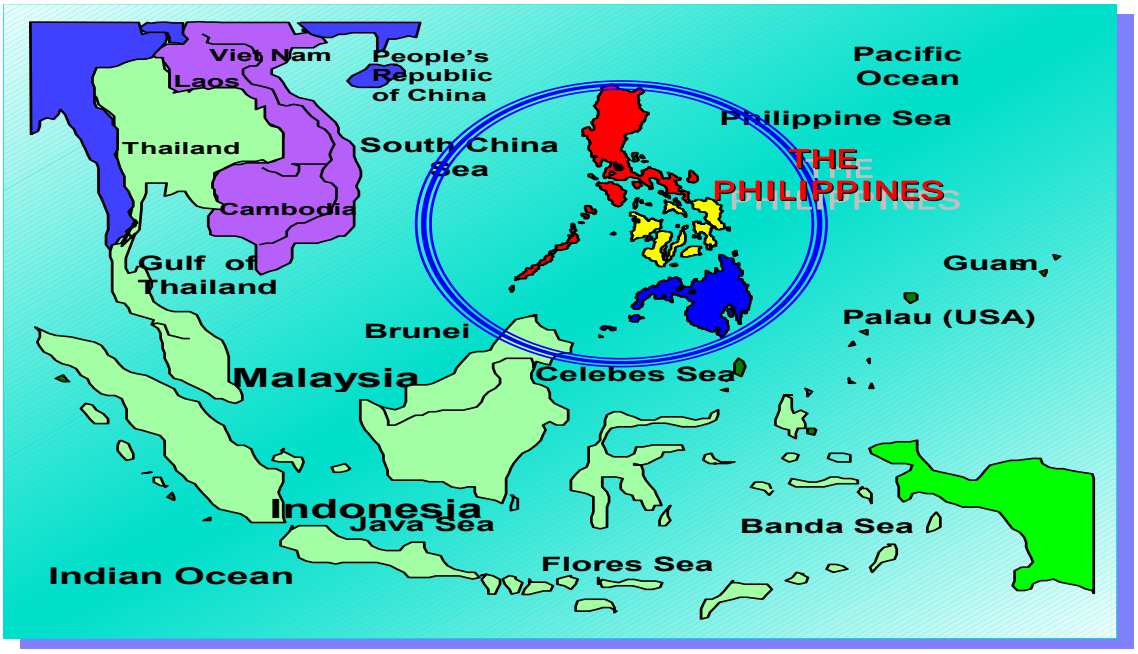

Figure 1 Location of Lamon Bay, Quezon, Philippines.

Infanta

Infanta - one of the oldest towns in Quezon province - is situated in the northern part of the Quezon mainland, lying along the coast of the Pacific Ocean and facing the island municipalities of Polillo. The town has 36 barangays with six located in coastal areas. The total land area is 34,276 ha. It has a coastal area of 490 ha, a tidal flat of 3,548 ha and a relatively huge mangrove area of approximately 3,000 ha.

Real

Real, with a total land area of 56,380 ha, is located in the northern part of Lamon Bay. Majority (10) of its 17 barangays are situated along the coastline stretching up to 22 km.

Polillo

Polillo is the major municipality in the Polillo group of islands. The strong political will of the mayor of Polillo has made fishing along municipal waters strictly for municipal fishermen only unlike in Infanta and Real. However, no study has been conducted on the fish production and policy implementation in the area.

5.2 Fisheries Resource Quality

5.2.1 Fishery Productivity

Lamon Bay, one of the traditional fishing grounds in the Philippines, has a total of 108 fish species. The most prevalent fish in the bay are *Nemyptherus bathybus* and *Sardinella spp.* which are commonly called "bisugo" and "tamban", respectively. They

comprise 33% of the total municipal fish catch in the bay. Of these, 22% or 89 mt per hectare are caught annually by hook and line (Table 1).

Table 1 Most Common Fish Species Caught in Lamon Bay, 2001.

Scientific Name	*Common Name*	*Local Name*
Ablennes hians	Flat needlefish	Salasa
Anampses caeruleopunctatus	Wrasse	Maming
Arule mate	Yellow tail scad	Kalapato
Auxis thazard	Frigate tuna	Tulingan
Caranx ignobilis	Giant trevally	Banlog
Caranx sexfaciatus	Bigeye trevally	Pipikat / Talakitok / Sibo
Caranx spp.	Trevally	Talakitok
Cephalophosis spp.	Rockcod	Sibungin / Lapu-lapu
Decapterus maruadsi	Round scad	Galungggong
Elagatis bipinnulatus	Rainbow runner	Salmon
Epheniphelus spp.	Grouper	Lapu-lapu
Leiognathus equulus	Common ponyfish	Sapsap
Lethrinus harak	Thumbprint emperor	Bukawin
Loligo spp.	Squid	Pusit / Nucos
Lutjanus fulvus	Flame colored snapper	Maya-maya / Pula / Dapak
Mugil cephalus	Flat gray mullet	Banak
Nemyptherus bathybus	Yellowbelly thread fin bream	Bisugo / Saray / Gunggong
Parupeneus spp.	Goat fish	Salmonite
Priacanthus spp.	Bigeye	Pahak
Rastrelliger kanagurta	Indian mackerel	Burao / Alumahan
Sardinella spp.	Sardine	Tamban
Scarus spp.	Parrotfish	Bunhak / Loro
Selar spp.	Oxeye / Big eye scad	Matambaka
Siganus canaliculatus	Rabbitfish / Spinefoot	Balawis / Samaral
Spyraena spp.	Barracuda	Batig
Stolephorus spp.	Anchovies	Bolinao / Dilis
Terapon jarbua	Therapon	Bugaong
Thunnus albacares	Yellow fin tuna	Tambakol
Trichiurius lepturis	Largehead hairtail	Espada

A comparison of the length and exploitation rate of common fish species caught in Lamon Bay and other coastal areas in the Philippines is shown in Table 2. The asymptotic length of the fish is measured from the snout to the tail during recruitment. Exploitation rate is the ratio of fishing mortality during recruitment to the total mortality which is the sum of recruitment and natural mortality. Exploitation rate ranging from 0.3 to 0.5 suggests that the stocks are exploited optimally (Gulland 1971 and Pauly 1984). The results showed that the stock for *Sardinella spp* is optimally exploited (0.42). This means that there is overexploitation of the fish in the area with the exception of *Sardinella spp* because it is reduced to a point that they may no longer reproduce fast enough to maintain current population. The length analysis shows that those caught in Lamon Bay have the shortest recruitment size among the localities surveyed by the University of the Philippines-Marine Science Institute (UP-MSI).

Table 2 Comparison of Growth and Exploitation Rate Parameters for Several Species Occurring in Lamon Bay with Other Philippine Stocks, 2001.

Species/Locality	*Length (Cm)*	*Exploitation Rate (Per Year)*
Nemyptherus bathybus		
Camotes Sea	25.6	0.54
Moro Gulf	30.0	0.59
Tayabas Bay	35.0	0.76
Guimaras Strait	31.0	0.60
Manila Bay	29.9	0.54
Lamon Bay	24.4	0.71
Sardinella spp.		
Visayan Sea	13.9	0.69
Tayabas Bay	13.5	0.64
Samar Sea	13.6	0.66
Ragay Gulf	8.2	0.33
Lamon Bay	7.9	0.42
Selar crumenopthalmus		
Camotes Sea	12.9	0.61
Visayan Sea	10.2	0.31
Moro Gulf	11.8	0.46
Samar Sea	11.5	0.36
Ragay Gulf	12.1	0.74
Lamon Bay	10.1	0.78
Caranx sexfaciatus		
Samar Sea	30.2	0.38
Burias Pass	28.0	0.55
Ragay Gulf	27.0	0.45
Manila Bay	25.7	0.53
Lamon Bay	25.6	0.58

Source: Fisheries Sector Program - REA

There is cause for concern that fishing in Lamon Bay is over its sustainable limits. *Nemyptherus bathybus*, *Selar crumenopthalmus* and *Caranx sexfaciatus* in Lamon Bay all have small length and high exploitation rates compared to those existing in other localities which are indications of overfishing in the bay.

About nine species in Lamon Bay were analyzed for growth and exploitation rates (Table 3). Municipal fisheries catch shows over 398 mt were extracted from the bay for a period of ten months - November 2000 to August 2001. This provides an estimated yield of around 478 mt per year.

Table 3 Length and Exploitation Rates of Common Fish Species in Lamon Bay, Quezon, 2001.

Species	*Length (Cm)*	*Exploitation Rate (Per Year)*
Nemyptherus bathybus	24.4	0.71
Sardinella spp.	7.9	0.42
Selar crumenopthalmus	10.1	0.78
Caranx sexfaciatus	25.6	0.58
Spyraena spp.	13.2	0.65
Rastrelliger kanagurta	24.5	0.70
Parupeneus spp.	10.2	0.61
Ephinephilus pp.	31.2	0.75
Lethrinus spp.	24.7	0.72

The increasing population in the municipalities surrounding Lamon Bay has added to the fish pressure in the bay. Together with these developments, municipal fishing gears have proliferated.

Polillo has at least 17 coastal barangays which are actively engaged in the municipal fishing industry while Infanta and Real have five and ten, respectively. Of these clusters of communities, there are at least 948 fishing vessels known to operate in Lamon Bay. Notably 63% (or 596) of the total fishing vessels are hook and line, 15% (or 145) are multiple hooks, 14% (or 135) are gill net, while the rest (8% or 72) are a combination of the aforementioned. Most of the fishing gears are from Real (414), followed by Polillo (350) and Infanta (175). Most of the municipal fishermen use only the simplest traditional way of fishing which are hook and line, multiple hooks and gill nets.

5.2.2 Productivity of Capture Fishery

Several parameters were used to measure the productivity of the bay by fishing gear and species caught. They are volume of fish catch, relative abundance and CPUE. Relative abundance is a rough estimate of the population density of a given species. It is calculated from the number of individuals of a certain species caught over a certain period of time in a particular place, divided by the total of all species in a community. The relative abundance of each fish species caught by different gears was obtained by getting its proportion (in percentage) relative to the total harvested fish. CPUE is the volume of fish caught per unit time in a fishing trip, expressed as kg per hour (Table 4).

Table 4 Volume of Fish Catch, Relative Abundance and CPUE by Municipal Fishing Gear and by Species, Lamon Bay, 2001.

Fishing Gear	*Species*	*Volume Of Catch (Kg)*	*Relative Abundance*	*CPUE (Kg/Hr)*
Hook and Line	*Sardinella spp.*	58,296.25	21.74	
	Selar crumenopthalmus	38,233.40	14.26	
	Nemyptherus bathybus	31,066.50	11.59	
	Caranx sexfaciatus	24,547.75	9.15	
	Spyraena spp.	16,740.15	6.24	
	Rastrelliger kanagurta	11,085.60	4.13	
	Parupeneus spp.	10,720.55	4.00	
	Ephinephilus spp.	8,008.75	2.99	
	Lethrinus harak	7,368.05	2.75	
	Anampses caeruleopunctatus	6,362.30	2.37	
	Lutjanus fulvus	5,565.15	2.08	
	Priacanthus spp.	4,350.80	1.62	
	Others	45,810.05	17.08	
	Total	**215,685.30**	**100.00**	**2.27**
Multiple hooks	*Nemyptherus bathybus*	40,888.19	43.47	
	Auxis thazard	9,568.19	10.17	
	Priacanthus spp.	8,297.63	8.82	
	Lutjanus fulvus	6,700.81	7.12	
	Caranx sexfaciatus	6,361.88	6.76	
	Lethrinus harak	4,433.38	4.71	
	Thunnus albacares	3,655.81	3.89	
	Ephinephilus spp.	2,818.44	3.00	
	Parupeneus spp.	2,561.06	2.72	
	Decaptherus spp.	1,205.31	1.28	
	Others	7,576.25	8.05	
	Total	**94,066.95**	**100.00**	**0.96**
Gill net	*Sardinella spp.*	10,828.69	18.14	
	Stolephorus spp.	7,846.88	13.15	
	Parupeneus spp.	4,924.13	8.25	
	Spyraena spp.	4,770.56	7.99	
	Caranx sexfaciatus	3,673.69	6.16	
	Leionathus equulus	3,594.38	6.02	
	Loligo spp.	2,975.06	4.98	
	Siganus caniculatus	2,404.69	4.03	
	Megalaspis cordyla	2,387.81	4.00	
	Ablennes hians	2,342.25	3.92	
	Rastrelliger kanagurta	2,276.44	3.81	
	Scarus spp.	1,336.50	2.24	
	Others	10,324.13	17.30	
	Total	**59,685.21**	**100.00**	**9.52**
	All	**369,437.46**		

Three types of municipal fishing gears were recorded in the bay: hook and line (or "*kawil*"); multiple hooks (or "*kitang*") and gill net (or "*lambat*").

Hook and line is the most widely used fishing gear in the locality. One person on board a non-motorized boat casts a single hook and line with bait to catch fish. This boat usually plies shallow waters compared to those using other fishing gears. The average CPUE is 2 kg per hour. The dominant species caught by the hook and line are *Sardinella spp.* (22% relative abundance or 58 mt during the 10-month period of monitoring) and *Selar crumenopthalmus* (14% relative abundance or 38 mt). More than half of the catch from hook and line in Lamon Bay consists of sardines, big eye scad, yellow belly threadfin bream, trevally and barracuda. Sardines, which is the most prevalent species, peaks harvest during the month of November (11 mt per hectare) and subsides by mid- February (1 mt per hectare). Bigeye scad, with the second highest relative abundance at 13%, peaks during the month of April (14 mt per hectare) and becomes scarce also in mid-February (0.3 mt per hectare). The fish caught in Lamon Bay have different peak and lean months of harvest. This shows why the route of hook and line fishermen is scattered (Figure 1) since they have to go to other parts of the bay where fish are in abundance.

The high number of fishing boats (596 on the average) which comprises 63% of the total municipal fishing boats is an indication of fishing pressure resulting from an increase in the fishing community population. In Barangay Dinahican, Infanta, many transitory fishermen from faraway places like Bicol and Visayas become informal dwellers of the place. They have heard about the bountiful harvest in Lamon Bay only to find out when they arrive that they have come for the worst. This is evidenced by the high exploitation rate of Lamon Bay and shorter length fish catch compared to other bays in the Philippines where some of the transitory fishermen come from. They exert pressure on fisheries and other resources of the community. The people in the community do not have access to other sources of income in the vicinity. The fish catch is so low that it is almost always used for domestic consumption by the fisherman's family. The hook and line fisherman often uses at least one other gear because of the low catch and seasonality of harvestable fish. He uses other gears to meet the food requirements of his family.

The declining productivity of the bay caused by man's exploitation has prompted the fishermen to make use of more innovative fishing implements. One of these is the multiple hooks which is a variation of the single hook and line. Multiple hooks range from 100 to 1,000 hooks attached to a long line. Upon his return from the sea, the fisherman's wife cleans each hook after which she painstakingly attaches bait to each hook. This tedious process keeps the wife occupied most of the day. Multiple hooks are used by fishermen operating both the motorized and non-motorized boats. *Nemyptherus bathybus* and *Auxis thazard* comprise nearly half of the total catch (54% or 50 mt) with an average CPUE of 1 kg per hour. The common species that are caught by hook and line and multiple hooks are the yellowthread fin bream, thumbprint emperor, grouper, flame colored snapper, goat fish and the big trevally. The peak months for harvesting fish species like thumbprint emperor, flame colored snapper and goat fish using both the fishing gears are in March, January and November respectively. May is the lean month for catching yellowthread fin bream, also using both fishing gears. No goat fish nor thumbprint was caught in February using hook and line.

The gill net traps fish through entanglement of the operculum and gills against the net. Two types of gill net that are commonly used in the area are the drift and the bottom set net. Two persons on board a motorized or non-motorized boat deploy the net and retrieve them 3 to 4 hours later. The average CPUE is 10 kg per hour. The dominant species caught by the gill net are *Sardinella spp* (18% relative abundance or 11 mt) and *Stolephorus spp*. (13% or 8 mt). Electric shiners are not operated by fishermen using hook and line but by those using multiple hooks and gill nets.

Milkfish fry gathering is practiced along the coastline of Infanta during the spawning months of March to October. The gatherers walk in pairs, one person holding either side of the net, to traverse the stretch of the coastline. The net catches milkfish fry and other juvenile fishes. At the end of the walk, the pair scoop the milkfish fry with their bare hands and place them in containers while culling the unwanted juvenile fish. If the size of the fish is too small for home consumption or for sale, these are either returned to the sea or thrown in the sand. The mortality rate of the culled fish is very high. Res No. 1 (1998) of the Municipality of Infanta bans gathering of milkfish fry for two years. During the monitoring months of March to August 2001, about 15 million pieces of fry were gathered. However, the culled fish as well as other juvenile fishes caught were unaccounted for. These could have commanded a higher price if they were left to grow to maturity.

Three fish cages were found in the cove between the boundary of Infanta and Real with 1 mt harvest. MO No. 1 (1997) orders the demolition of illegal fish cages.

The average productivity per boat per fishing trip has been declining. In 1965, it was about 2 kg for the hook and line and 52 kg for the gill net. Ten years later, the figures dropped by half - 0.7 kg for hook and line and 19 kg for gill nets, respectively.

Since 1995, only 23 fishermen using electric shiners were apprehended in Polillo. The total annual fish catch of these violators is about 10 mt of fish of varied species.

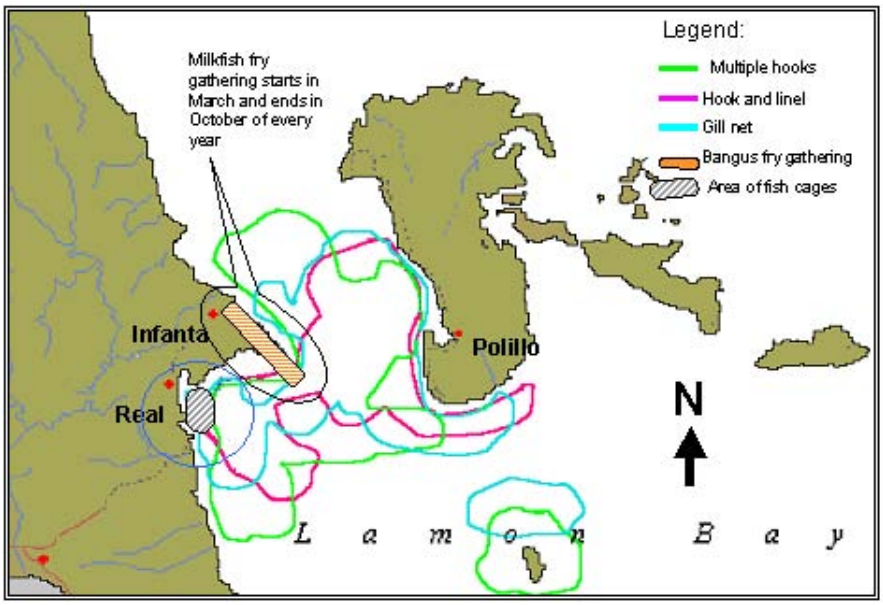

Figure 2 The Operation Area of Municipal Fishing Gears, Lamon Bay.

MOs No. 5 (1995) and No. 9 (1996) of Polillo and Infanta, respectively ban the use of electric shiners. The operation area of the various municipal fishing gears in Lamon Bay is shown in Figure 2.

5.3 Fishing Households

Most municipal fishermen rely heavily on fishing as a source of income. Only a small proportion has a secondary occupation. Majority of their spouses are not employed nor engaged in gainful activities despite the fact that they are better educated compared to the fishermen. A large percentage of the respondents' children who belong to the labor force - those who are 15 years old and above - are either unemployed or engaged in non-gainful activities (for example, helping out their father with the fishing or farming activities). It is worth noting that a great number of these children reached high school level. This indicates that many members of the municipal fishermen's households are idle and have time to engage in possible employment opportunities (for example, livelihood projects) especially since some of these household members are equipped with the appropriate educational requirement.

Some are engaged in crop and livestock/poultry production in order to augment household income. However, income from these activities are still low particularly for crop production. This is because productivity levels are quite low, at times not even reaching the national average.

Majority of the respondents own the boats they use. Most of these boats are motorized. The most common fishing gear used is the hook and line or *kawil/biwas*, in the vernacular while others use the multiple hooks and line or *kitang* which is more costly. Bottom gill nets are often used although some prefer the drift gill nets.

Fish catch is quite low. Furthermore, harvests are high for fish that command low price while the average catch for expensive species are relatively low. Species which have high prices are groupers, flame-colored snapper and Spanish mackerel while yellowbelly threadfin bream, frigate tuna, round scad and yellow fin tuna are quite cheap. This explains why net income from fishing is low, averaging PHP 10,170 (USD 190). Polillo respondents reported the highest mean income [PHP 16,664 (USD 311)] while those from Real suffered a net loss of PHP 8,188 (USD 153).

Around three-fourths of the respondents in Real lamented they have fishery-related problems: decreasing volume of fish catch, incidence of illegal fishing, low fish prices, lack of capital, costly fishing gears and net losses. The findings revealed that small fishermen in Real incur losses.

Compounding their problem is the lack of support services. The survey results showed that only 14% of the respondents received assistance mostly from government agencies and NGOs.

Credit is another assistance that is inadequate. Less than one-fourth was able to borrow. Informal groups such as relatives/friends, private moneylenders, input dealers and traders are the major sources of financial assistance. Only a handful of the borrowers were able to get loans from formal sources such as banks and cooperatives.

Although a large percentage of the respondents are affiliated with POs, many believe that these associations have not been helpful to them. In some instances, the organizations are inactive, thus these groups could not serve as channels of support services.

The majority of respondents acknowledged the existence of illegal activities in Lamon Bay, foremost of which is dynamite fishing and encroachment of commercial boats along the municipal waters. Nevertheless, incidences of violations appear to be most rampant in Real and the least in Polillo based on perceptions gathered from the respondents. Most respondents claim that violators are non-residents of their respective villages.

Respondents were asked to rate the effectiveness of existing local ordinances that aim to stop illegal fishing. Three rating scales were used: (a) 1 for very effective; (b) 2 for effective; and (c) 3 for not effective. Very few gave a very effective rating while almost equal numbers considered the policies as effective and not effective. More respondents in Polillo gave a very effective rating while in Real, only one respondent gave this rating. Congruently, the majority of respondents in Real felt that their ordinances are not effective in controlling illegal fishing.

To contain the violations, many respondents stressed the need to implement the policies strictly. Unity among stakeholders was also highlighted along with the need for a sincere attitude among government officials. Sincerity among government executives was cited mainly in Real where the effectiveness of existing ordinances to eradicate illegal fishing was low.

6.0 RESULTS AND DISCUSSION

6.1 Policy Awareness and Perception

A total of 17 ordinances are being implemented in the study areas. Only one ordinance - that of banning dynamite and other means of illegal fishing - is common to all three municipalities while ordinances unique to Infanta are fish cage ban and milkfish fry gathering.

Further clustering of the policies yielded three major groupings, namely: (a) developmental or environmental quality maintaining; (b) protective or damage avoidance; and (c) economic-incentive in nature. One policy implemented in Real, Quezon uses economic instruments by providing cash incentives to apprehending officers. It was observed that the ordinances were mostly patterned after the traditional fishery resource management approach covering area restriction, catch limitation, closed season and specification of permissible fishing techniques. In a way, these are developmental in nature.

On the average, 95% of the respondents are aware of fishery policies and ordinances for the protection or avoidance of damages to nature such as the use of destructive means (dynamite and poison) or active gear (*hulbot hulbot* or Danish seine). However, awareness of the aforementioned illegal fishing related policies ranges an average of 54 to 83%, due to the fact that these policies: (a) have concrete, adverse and lasting effects

on the environment and on their very source of livelihood; (b) are frequently violated; and (c) have economic disincentives that are prohibitive.

The low awareness level of the policies - use of shiners, demolition of fish cages and ban on milk fish fry - which ranges from 0.4 to 5.0% is attributed to their less observable detrimental effects. These policies have less recall impact to respondents as shown by the household survey.

6.2 Policy Analysis

Policy analysis usually starts with the description and explanation of how the policies came about (determination type or historical) followed by the consequences (impact). This process was adopted in the analysis.

6.2.1 Initiation and Implementation

Policy Initiative

The policies were products of local initiatives in recognition of the fact that fishing activities are the major source of livelihood of the residents in the coastal areas of Infanta, Real and Polillo. These were formulated to protect small and marginal fishermen from illegal fishing and unfair competition (ban on electric shiner), provide them a wider area within which to operate (regulation on use of fish cages) and address the problem of declining fish catch (moratorium on catching of milk fish fry).

Initiated during the later part of the 1990s (1996-1999) by the fishermen themselves, the policies are of varying forms by virtue of the instruments used to enact them. The policy on the ban of electric shiner was enacted through a municipal ordinance, fish cage regulation policy was enacted through a municipal order while the ban on the gathering of milkfish was through a resolution.

While ban on electric shiners and gathering of milkfish fry addresses related objectives of preventing very large volumes of fish being caught in the area which may include small fishes and preventing further depletion of fish resources along coastal areas, fish cage regulation, on the other hand, aims at removing obstruction to navigable areas and illegal structures in mangrove areas.

Policy implementation was envisioned to be carried out by (a) limiting the number of lights that can be used in electric shiners; (b) providing for a grace period of one month from the effective date of the ordinance to allow fishermen to transfer fish from fish cages to licensed fishponds; and (c) banning milkfish fry gathering for two years.

Implementation

A six-year time lag is observed from fishery policy formulation at the national level to its adoption at the LGU level. A case in point is Executive Order No. 240 issued in April 1995 creating the Fisheries and Aquatic Resource Management Councils (FARMCs). As of this report, the Municipal Fisheries and Aquatic Resource Management Councils (MFARMC) in the three municipalities covered have just been organized and are not yet fully operational.

LGUs tend to adopt informal procedures in carrying out fishery related activities covered by policies formulated at the national level. Of the three municipalities, only Polillo maintains official documents as far as fishery resource protection activities are concerned. While the *Bantay Dagat* group was organized in the municipalities of Real and Infanta, there are no official documents on the said activities.

Factors like political will as well as lack of funds and staff tend to be the major full operationalization determinants of fishery policies.

In terms of policy violation, only Polillo has records of apprehensions for illegal fishing. A total of 386 cases since 1990 was reported where 23 or 6% fall collectively under unauthorized fishing through the use of electric shiner (Sec. 93 of RA 8550).

Policy implementation problems stem mainly from the lack of political will, graft and corruption among the implementors as well as indifference on the part of the stakeholders. It is therefore imperative to acquire a deeper knowledge and understanding as to their prevalence in supporting any measures aimed at addressing such problems.

The organization assessment framework model in evaluating the capacity of the LGUs to plan and implement the policies is related to the institutional mechanism and systems present in the study area. Given the state they are in with the exception of the OMA, planning functions are overshadowed by organizational concerns.

6.2.2 Organizational Assessment

An organization's capacity to plan and implement policies is a function of its operational environment (legal, social and economic context), its motivation (direction, coherence of activities and energy displayed), and its capacity to function as expected. The LGUs are mandated by law to enforce all fishery laws, rules and regulations. Valid fishery ordinances enacted by the municipality/city council were assessed in this regard.

Operational Environment

Four institutional mechanisms, namely the MFARMC, OMA, *Bantay Dagat* and Municipal Agriculture and Fisheries Council (MAFC) are legally mandated to implement fisheries policies. However, it is not the legal basis but more the nature of the organization that has a bearing on their performance.

Of the four, only the OMA has a definite organizational identity by virtue of its being a department of the municipal government. As such, its functions are clear with corresponding budget allotment. Its employees are tenured leaving no organizational structure related impediments to performance. This is supported by the active participation of institutions in all three municipalities. The same cannot be said of MFARMC, *Bantay Dagat* and MAFC which are of varying organizational status. The MFARMC is either inactive or requires reorganization while *Bantay Dagat* is inactive. Selection of members to the said councils or groups is also a problem.

The issue on organizational status and membership contributes to their minimal recognition as an institutional mechanism for fishery policy implementation giving no bite to their functions. Relatives of the *Sangguniang Bayan* who are caught violating the

law by influence peddling is causing a social concern and threatening the organizational identity.

Motivation

While motivation among members of the institutional mechanisms may be initially present, these are gradually being eroded by disappointments brought about by organizational dysfunctions, inadequate resources both physical and financial, as well as lack of economic incentives for basic participation. Enough motivation is provided by the quality of choices for electoral posts who, according to many, are very well qualified. These give hope to the constituents that activities will be carried out as planned.

Capacity

Capacity in terms of number of manpower and readiness to assigned functions are problems confronting the MFARMC, *Bantay Dagat* and MAFC. If ever membership issues would have been resolved, the absence of support staff on a regular basis (although support groups are available) affects operations. The members should undergo training to better equip themselves with their tasks.

Seven S McKenzie Framework Analysis

A comparative analysis of the institutional mechanisms is shown in Table 5 using the 7S McKenzie Framework.

Structure

In terms of structure, the MFARMC is the most represented institutional mechanism. It is highly multisectoral as mandated by law. *Bantay Dagat* has a relatively loose membership since this actually depends on who would volunteer. The MAFC gets its members from the member NGOs and cooperatives. However, the OMA appears to be a more stable mechanism since it is a regular department of the LGU.

The MFARMC is mandated to perform technical, regulatory and developmental functions. MAFC and OMA are mainly involved in the implementation of development projects for fishermen. However, *Bantay Dagat* (together with a composite team including the Philippine Navy and the Philippine Coast Guard) is the sole mechanism mandated to apprehend violators of fisheries policies.

All the institutional mechanisms do not have adequate physical, financial and manpower resources to implement either regulatory or development activities on fisheries. Motorboats which could be used for monitoring activities are wanting in all the organizations mentioned. Except for the OMA (that gets an annual allocation from the LGU), all the institutional mechanisms do not have any regular funds to sustain their operations. OMA is the only organization that has a regular staff complement with proper training, if not the appropriate educational qualifications on fisheries. The MFARMC and MAFC are highly dependent on the NGOs for manpower to provide technical assistance.

There are no clear linkages between the institutional mechanisms and the national as well as local government agencies, NGOs and POs. The relationship is mainly on a per project or activity basis.

Systems

There is neither an information system nor monitoring and evaluation system that is in place in any of the institutional mechanisms. In the case of MFARMC though, the DA central office is supposed to develop the system for the MFARMCs to operate. However, data and information on fisheries (e.g., number of fishermen, production and other data) are collected by the OMA when required by the local chief executive as part of its regular reporting system.

Style of Leadership

All heads of organizations claim to be consultative in leadership style. The leaders interviewed said that they sought suggestions from their constituents in the performance of operations. It is worth to note here that the *Bantay Dagat* of Infanta became active only during the term of its previous president, whose name can be released upon the reader's request. When the president resigned, *Bantay Dagat* also ceased to operate.

Skills

The members of both the MFARMC and MAFC may be familiar with fishing activities, but are not keen on the types or forms of violations that may be committed by fishermen. The *Bantay Dagat* could function more effectively if one of its members is a Fish Examiner from the OMA.

Staff

Except for the OMA that has its own staff complement, no institutional mechanisms have a regular workforce. They are highly dependent on the support of NGOs as well as some departments of the LGU for assistance.

Strategies

The institutional mechanisms implementing fishery policies work within their mandates. However, they are not keen on the formulation of specific strategies to meet the desired goals. More often, activities are planned and implemented consistent with the functions that they are supposed to perform.

Super ordinate Goals

Despite some odds, the operations of MFARMCs are taking off. Activities of the OMA as a department of the LGU are currently being sustained. MAFC took over the MFARMC's role as the latter was inactive. On the other hand, *Bantay Dagat* has ceased to exist due to some operational problems and constraints.

Table 5 Seven S McKenzie Analysis of the Existing Institutional Mechanisms Implementing Fishery Policies in Infanta, Real And Polillo, Quezon

Aspect	*MFARMC*	*Bantay Dagat/ Bantay Polillo*	*OMA*	*MAFC*
1) STRUCTURE				
Composition	Highly multi-sectoral representation to include those from LGU, NGO, DA, and fishermen (women, children and commercial fishermen)	Representation from fishermen, NGOs, POs and other professionals. Joined Philippine Navy and Philippine Coast Guard as a composite team to apprehend violators	A department under the LGU with three sections: crops, livestock, and fisheries; with about 4-11 staff members on full-time basis; 2 – 3 engaged in fisheries Some staff members actually devolved by the DA to the LGU by virtue of the Local Government Code of 1991	Representation from various NGOs and cooperatives operating within the area
Functions	Reporting of fishermen who violate fisheries policies; Implementation of fisheries projects; Participation in the preparation of plans on fisheries as well as pertinent local ordinances	Apprehension of violators of fisheries policies	Implementation of fisheries projects	Implementation of fisheries projects
Resources				
Physical	None	None	None	None
Financial	No regular source of funds	No regular source of funds but *Bantay Polillo* sought donations from those caught violating fisheries policies	Limited and dependent on the allocation of the LGU	No regular source of funds
Manpower	None, except the regular members; Enjoy technical assistance from participating NGOs	None	About 2-4 staff members directly involved in fisheries related activities	None. Except the regular members; Enjoys technical assistance from participating NGOs

Continuation Table 5

Aspect	*MFARMC*	*Bantay Dagat/ Bantay Polillo*	*OMA*	*MAFC*
Linkages				
Government	Linkages with DA – BFAR and MPDC, among others	No clear linkages	Linkages with DA – BFAR, among others	Linkages with LGU
NGO	Linkages with ICDAI, among others	No clear linkages	Linkages with ICDAI and CREDO, among others	Linkages with CREDO and member NGOs of MAFC
PO	Linkages with BIHADA	No clear linkages		Linkages with member cooperatives of CREDO
2) SYSTEMS				
M & E	None	None	None	None
Information System	None	None	None	None
Rules & Policies On Members	Usually on attendance to meetings	Usually on attendance to meetings	Not applicable	Usually on attendance to meetings
3) STYLE OF LEADERSHIP				
	Consultative	Consultative	Democratic, Leadership by example	Consultative
4)STAFF				
	None	None	With regular staff members	None
5)SKILLS				
	Not all members have the necessary skills to identify fishermen committing violations	Not all members have the necessary skills to identify fishermen committing violations	Some staff have the proper background in fisheries both in terms of educational attainment and training	Not all members have the necessary skills to identify fishermen committing violations
6) STRATEGIES				
	Anchored on the functions of the council	Anchored on the functions of the *Bantay Dagat/Bantay Polillo*	Consistent with that for the municipality	Anchored on the functions of the council
7) SUPER ORDINATE GOAL				
	Slowly being achieved	Not met, mechanism ceased to operate	Slowly being achieved	Slowly being achieved

Summary of SWOT Analysis

Table 6 presents a summary of the SWOT Analysis of the following institutional mechanisms: MFARMC, OMA and MAFC.

MFARMC

The strength of MFARMC as an institutional mechanism to implement fisheries policies lies in good representation from the fishery sector. In addition, it benefits from the technical and other forms of support given by active NGOs in the area. However, the organization has some weaknesses to address which are (a) difficulty to sustain members due to financial constraints; (b) weak organization at the local or *barangay* level; and (c) lack of financial resources.

Opportunities for MFARMC include potential linkages with national government agencies, LGUs, NGOs, POs as well as foreign donors. Posing a threat among members of MFARMCs are the influential people who are involved in illegal fishing activities or influence peddling.

OMA

OMA has the advantage of having a regular staff complement. However, it has limited funds given that it is highly dependent on its LGU allocation. It has insufficient staff members to cater to the various support services needed by fishermen in the area.

As with the MFARMCs, linkages with various organizations pose as an opportunity for the OMA. Nonetheless, the opinion that NGOs compete with OMA persists. This is perceived as a threat to the OMA as an organization.

MAFC

MAFC has very good representation from NGOs and cooperatives. It benefits from the assistance given by an NGO actively operating in the area. However, it lacks funds for operations as well as skilled people to implement fisheries projects.

MAFC could take advantage of linking with various organizations (government or non-government) in performing its functions. A threat to its operations, though, is the presence of violators of fisheries policies that are not necessarily from the area or municipality.

Table 6. Summary of SWOT by Institutional Mechanism

Institutional Mechanism	*Strengths*	*Weaknesses*	*Opportunities*	*Threats*
MFARMC	Good representation from the fishing sector	Difficulty to sustain membership due to financial constraints	Linkages with government agencies (national and local), NGOs, POs, and foreign donors, especially for financial assistance	Influential people intervening in the apprehension of violating fishermen
	Active participation of NGOs	Weak organization at the local level Unsustained financial support		Lack of support from LGUs
OMA	With regular staff complement	Limited funds from local government	Linkages with government agencies (national and local), NGOs, POs, and foreign donors, especially for financial assistance	NGOs compete instead of complementing OMA
		Limited staff complement to cater to the needs of fishermen		Influential people intervening in the apprehension of violating fishermen
MAFC	Good representation from NGOs and POs	Limited funds for operations	Linkages with government agencies (national and local), NGOs, POs, and foreign donors, especially for financial assistance	NGOs compete instead of complementing OMA
		Lack of skills among members		Influential people intervening in the apprehension of violating fishermen

6.3 Policy Effectiveness

The attitude of the coastal communities towards marine resources is "open access" where anybody can utilize and exploit the bay. Any policy implemented in an "open access" territory is bound to fail unless that policy limits the entry of fishermen. Moreover, seminars must be conducted to re-orient people's knowledge from "open access" to "common property management". The number of fishermen in a given locality is an important element giving rise to the community-based management approach of coastal resources. If communities are allowed to control resources then they are able to prevent encroachment or even control the entry of legal or illegal fishermen. They may even be empowered to set the limit on the number of fish catch that can be allowed.

While the respondents' awareness on policies greatly varied, majority perceived that all existing policies are slightly effective in as far as protecting the coastal resources are concerned. Policies on the establishment of sanctuaries as well as securing of permits and licenses were, however, perceived not to be effective.

The ineffectiveness of the policy on permits and licenses is statistically supported by survey results showing that 84% of the respondents are operating without fishing licenses. The existence of three license issuing units - the mayor's office, barangay officials and coast guard - and the seeming lack of coordination among them as well as the absence of concrete policy guidelines are the root causes of the ineffectiveness of the policy.

In terms of fish CPUE which is also an indication of improved or deteriorating resource quality, fish catch monitoring reveals a decrease in catch despite the increase in the level of fishing efforts.

With regards to achieving the policy objective of providing wider fishing grounds, the respondents perceived that most ordinances are slightly effective. In fact, the policy on banning the use of electric shiners in Polillo is even rated as effective along this concern. This perception, however, is not supported by the average productivity statistics as declining productivity was recorded. This indicates declining resource quality in the bay.

The foregoing observations, however, cannot solely be attributed to the effectiveness or lack of it. There are previous allegations that Lamon Bay is already overfished and overexploited even prior to the study. What the study provided is empirical support to these allegations.

No amount of effectiveness of policies geared towards enhancing resource quality - particularly sectoral ones like those under study - can facilitate a complete turnaround or be hindered by its deterioration when it has already reached its maximum sustainable yield. What is required is a more comprehensive management approach that will regulate the use of the bay anchored on a definite identification of its purpose.

Applying the systems approach, the success and failure of the policy implementation is dependent on how well the objectives have been articulated to a level appreciated by the target beneficiaries including the social, economic and politico-legal dynamics aspects.

People behave rationally within their own system of material incentives and social organization (Baum and Tolbert 1985).

In the area studied, the prevalence of the indifferent attitude among the stakeholders is initially rooted to the failure of connecting the policy objectives to daily activities or at a level easily appreciated. As study results show, respondents are protective of the bay and wary of its destruction, it being the source of their livelihood. Complication sets in when community dwellers aside from not being aware of the policies' existence cannot also relate to them. This is when the objectives, such as providing them a wider area within which to operate and addressing the problem of declining fish catch, are far removed from the daily concerns to be appreciated. These objectives are not easily translated to meals made available at one's table.

Indifference among committed stakeholders are enhanced when efforts exerted fail to connect with objective achievement, as in cases of unsuccessful apprehension due to premature tipping off, and if apprehended, the uncooperativeness of witnesses to testify, and further, if cases have been filed and ready for trial, protection from political and well-known personalities or lack of interest by the authorities often lead to delay in judicial process or even non-conviction (Figure 3).

Factors contributing to this problem are the lack of economic incentives and the attendant cost of participation involving use of personal funds. Likewise, personal and family security risks as well as ostracism by the community as a consequence of tipping off or being witness against offenders have also been identified as contributory factors. Other contributory factors include unclear policies that encourages graft and corruption.

The efforts taken to address the cited policy implementation problems would involve awareness enhancing policy education, appropriate incentives and cooperation among stakeholders as well as sincerity among the policy implementors. These support Baum and Tolbert's view that in dealing with a large number of people where the institution cannot command compliance, indirect authorities such as material incentives, gradual process of education and persuasion will do the trick. Identification and allocation of scarce resources for primary activities should be prioritized over secondary activities until they are well established to facilitate faster realization of objectives.

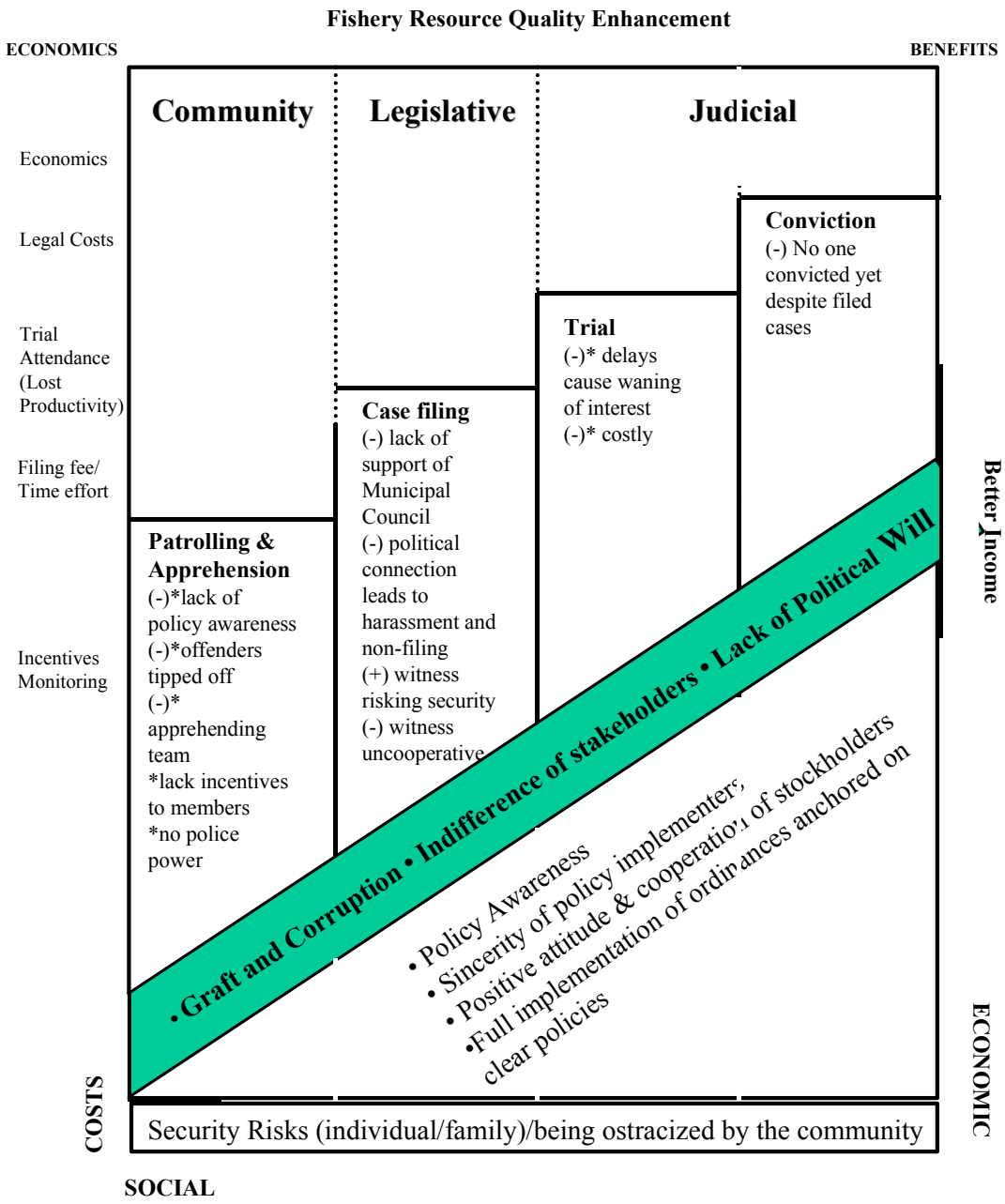

Figure 3 Systems Interaction

6.4 Policy Efficiency

While the initial intention was to compare the implementation cost of the institutions involved, the uncertainty of the fund source or the lack of it made it impossible to do so. The most that can be said is that out of the four institutional mechanisms studied, only

the OMA has the most investments in terms of a sustained and increasing financial allocation as to manpower investment. It has likewise the most investment not in terms of number but regularity of assigned staff (two to four), compared to MFARMC, *Bantay Dagat* and MAFC. Given limited funds and manpower as well as its sustained participation in regulatory and developmental fishery activities, policy efficiency is showcased by OMA if only for effort and commitment.

The same cannot be said of the three other mechanisms although patches of efficiencies can be glimpsed in terms of good membership representation for MFARMC and commendable mandate for *Bantay Dagat.*

At the stakeholders level, particularly members of the *Bantay Dagat*, cost efficiency in terms of time and personal funds contributed is achieved only if and when patrolling and monitoring lead to apprehensions. More so if it leads to case filing and consequent conviction.

As to BCA, the combined effect on the ban on both shiners and fish cages proved to have the most impact in terms of increase in fishermen's income. Generally, however, if compared to no regulation, imposition of the policy has little impact on the fishermen.

6.5 Policy Impact

The impact of the policies was determined using the bioeconomic model, the resulting yield of which was run into a BCA.

6.5.1 Estimated Yield Equations

The preceding discussions showed that fishery production in Lamon Bay is constantly declining. This has been blamed on many factors yet the actual effects of each of these factors had not yet been determined empirically. This section will help settle the issue on the real determinants of the declining productivity of Lamon Bay. Separate analysis was done on the different fish species commonly caught by municipal gears like hook and line, multiple hooks, and gill nets using the present or existing scenario, including regulations (banning of illegal fish cages, seasonal regulation of milkfish fry gatherers, banning of electric shiner devices) in order to identify the parameters that would likely affect their exploitation.

The logarithmic transformation of all variables given by a Cobb-Douglas functional form and stochastic specification were used to estimate the yield equations. The Ordinary Least Squares (OLS) regression technique was used in the estimation which explained the change in yield in relation to changes in some of the identified parameters.

Multicollinearity among the independent variables was observed in the initial attempt of estimation. Several equations were run and the estimated results were evaluated with respect to the statistical significance of individual regression coefficients, the hypothesized a priori signs and the R^2 values (coefficient of determination) which measure the proportion of variability explained by the regression on the independent variable.

Models were run both for no regulation and with regulation scenarios: ban of electric shiners, regulation of fish cages, seasonal regulation of milkfish fry gatherers and combined regulation of fish cages and ban of electric shiners. The explanatory variables found to have significant effects on fish yield were number of boats in operation and price of fish.

The equations estimated included the following explanatory variables – namely, population in the Lamon Bay communities; number of fishermen (affected by milkfish fry gathering, by electric shiners and fish cages); number of fishing gears (hook and lines, multiple hooks, gill nets) and price of fish (mackerel, barracuda, yellowbelly thread fin bream, thumbprint emperor, grouper, flame colored snapper, goatfish, sardine and bigeye trevally).

6.5.2 Fishing Effort

Fishing effort is negatively related to fish catch which implies that Lamon Bay is overexploited. Referring back to the standard economic model of fishery, the coefficient shows that Lamon Bay has already reached the maximum sustainable yield. A 100% increase in the level of fishing effort did not increase yield for all fishing gears but instead resulted in declining fish catch. For the hook and line, the decline in catch is 45% for mackerel, 40% for barracuda, 22% for yellowbelly thread fin bream, 21% for thumbprint emperor, 33% for grouper, 14% for flame colored snapper, 22% for goat fish, 24% for sardines and 25% for trevally**.** In the existing or present scenario, the results showed that a 100% growth in the level of fishing effort did not result in a corresponding yield in fishing gears as well as fish catch.

If there is a 100% increase in the level of fishing effort, mackerel catch from gill nets would decline by 11%, barracuda (20%), goat fish (14%), sardines (0.2%) and trevally (22%). The results are all significant. These estimated values supply the necessary information in the calculation of the marginal productivity of the fishing gear. The marginal product of the input gill nets on mackerel is negative (-0.14) which means that one additional unit of boat using gill net will decrease the fish catch by this amount. All these coefficients proved to be significant. This assertion can also be evidenced by a decreasing average catch per boat. The same holds true for all other fishing gears and fish species.

In classical economic theory, price is a single valued function of output. An increase in the price of the commodity will motivate the manufacturers to produce more of that particular good. The results show that the coefficients for prices of fish are all statistically significant. This implies that an increase in the prices of the different fish species caught incites the fishermen to increase their catch. For hook and line fishermen, a 100% increase in the level of fishing effort resulted in declining fish catch.

6.5.3 General Assessment of Yield Equations

All equations gave the characteristics of a good fit as evidenced by the consistency signs of coefficients, statistical significance of coefficients, high values and high coefficient of determination, R^2 except for banning of fish cages.

The log-linear model for fish catch using municipal fishing gears represented the existing scenario where regulations had been on hand but with very minimal violators

apprehended like 23 electric shiners in the whole Lamon Bay. The yield equation for mackerels for instance has a R^2 of 0.95 which implies that 95% of the variation in mackerel yield is explained by all variables included in the model. The high F-value (25.84) connotes that the random impact of unspecified variables is less, therefore, the derivation of the curve from straight line is likewise less. [An F-test (Snedecor and Cochran 1983) is used to test if the standard deviations of at least two populations are equal. The resulting F-value in this study revealed that the results are statistically significant]. The same independent variables cause a decline in productivity of other fish in Lamon Bay. The presence of the three fish cages are not significant, meaning that they are so few that they do not affect yield of other fish species like mackerel, barracuda, yellowbelly thread fin bream, thumbprint emperor, grouper, flame colored snapper, goat fish, sardines and bigeye trevally. Milkfish is cultured in these fish cages. The sardines' equation gave the best fit of data with a high R^2 (0.97) and F value (41.98).

The results of the second model was a regulation scenario for banning of electric shiners. The R^2 are all significant and high. As in the first model, the presence of fish cages remain to be insignificant. The best fit is seen in the yield of yellowbelly thread fin bream with F-value of 38.74.

For regulation of fish cages, the log-linear results are all insignificant with very low R^2 ranging from 0.16 to 0.48. This implies that there are more unexplained variables that have been unspecified in the equation. The fish cages in the project site have no impact on fish yield in the bay. Besides, they are located in inland waters and involve culture of milkfish as compared to the other municipal gears which engage in capture fishery.

The results for seasonal regulation of milkfish fry gatherers showed that the R^2 values are high and significant, ranging from 0.73 to 0.99. Only the presence of fish cages remain insignificant.

Combination of regulation of fish cages and banning of electric shiners show very high coefficient of determination, R^2 ranging from 0.83 to 0.95. The effect of fish cages is also insignificant. All significant values are at 1% level of probability.

6.5.4 Benefit Cost Analysis

Yield results of the bioeconomic model in the Fisheries Resource Quality Assessment were used as inputs to the BCA. Two scenarios were considered: without any regulation and with regulation. Regulation called for the following policy options: ban on shiners, regulation of fish cages, as well as ban on both shiners and fish cages. Furthermore, in imposing these policy options, two levels of investment were looked into: (1) low level of enforcement which is the current practice, and (2) high level of enforcement where additional investments have to be made. The former refers to the current procedure where the LGUs allot a certain amount [PHP 30,000 (USD 560)] for implementation and monitoring in order to apprehend violators as attested by the OMA during the key informant interview. On the other hand, the second case pertains to the condition wherein the LGU will be providing PHP 614,500 (USD 11,470) in order to implement the policies fully. This is the proposed budget of the OMA for full implementation which is allocated as follows: per diem [PHP 365,000 (USD 6,814)], labor [PHP 54,000 (USD 1,008)], fuel/oil (PHP 109,500 (USD 2,044)], supplies [PHP 12,000 (USD 224)], litigation [PHP 24,000 (USD 448)] and training [PHP 50,000 (USD 933)]. It was

brought up during the survey as well as in key informant interviews that because of the limited funds being utilized in policy implementation and monitoring, the laws hardly have any impact at all. Hence, the option of full implementation and monitoring (accompanied by the needed resources and additional funds) was also considered in the analysis (Table 7). The BCA was done for five years from 2002 to 2006.

Benefits

Benefits consist of sales from fish catch which was derived by multiplying price and volume of fish catch. Prices were based on the average price per fish species taken during the survey. Volume of fish catch for the different scenarios were taken from the yield results of the bioeconomic model which has the following explanatory variables: human population of the Lamon Bay watershed; number of fishermen affected by a particular fisheries policy; number of fishing gears (specified as either milkfish fry gatherer, hook and line, multiple hooks, gill nets, electric shiner or fish cage); and average price of fish. Yield results varied by scenario since fish regulation would affect the number of fishermen and fishing boats plying Lamon Bay. Fish commonly caught in Lamon Bay are mackerel, barracuda, yellowbelly thread fin bream, thumbprint emperor, grouper, flame colored snapper, goat fish, sardines and trevally.

Without any regulation

Without regulation, it is assumed that the apprehended boats and fishermen would still be catching fish in Lamon Bay. Municipal records show that the average number of apprehensions annually was 39. The yield results of the bioeconomic model for the no regulation scenario is 413 mt in 2002 (Table 7).

Table 7 Projected Fish Catch (mt) from Lamon Bay, with and without Regulation, 2002-2006.

POLICY	*YEAR*				
	2002	*2003*	*2004*	*2005*	*2006*
No regulation	413	358	309	267	231
With Regulation					
Shiner ban					
Low	423	376	335	299	268
High	423	432	440	449	458
Fish Cage ban					
Low	415	360	313	272	236
High	415	419	423	428	432
Both shiner/fish cage ban					
Low	424	378	338	303	273
High	424	435	446	457	468

With regulation

In the scenario where regulation is imposed, yield estimates for low level of enforcement were based on the present situation where 39 violators were apprehended. Under this scenario, three policy options were tested: with ban on electric shiners, fish cage regulation, as well as both electric shiners and fish cages.

For high level of enforcement, it is assumed that all people fishing today would continue to fish as long as they purchase individual transferable permits (ITPs) from the LGUs. This includes both licensed and unlicensed fishermen. As derived from the household survey, at present 84% of the fishermen are operating without permits and licenses.

The proposed ITPs will be issued by the LGUs to resident-fishermen of the three coastal municipalities. One ITP is allotted for each fisherman. It is further assumed that the existing total number of fishermen shall remain because their number is limited by the ITP. No new fisherman can enter the industry unless one with an ITP agrees to sell it to him. It is no longer viable to accept another fisherman as revealed by the results of the bioeconomic model where the marginal productivity of all fishing gears for all fish is declining. This means that an additional unit of boat results in decrease in average catch per boat.

Costs

Costs include the expenses involved in the implementation of the policy and monitoring the bay, plus the expenditures of all fishermen: operating cost of fishing; fuel; oil; ice; bait; rental of banca/boat, fishing gear, etc; labor; repair; licenses; mayor's permit, sticker, barangay permit; registration and others. The cost of implementation and monitoring is PHP 30,000 (USD 560) under the existing practice while it amounts to PHP 614,500 (USD 11,470) at high level of implementation as proposed by the OMA. The remaining costs would vary depending on the fishing gear and policy scenario. These were taken from the household survey.

BCA

Without any regulation

Without any regulation, fishermen incur losses. In the BCA, it is notable that the NPV is negative [PHP 14.6 million (USD 272,541)] as shown in Table 8. The losses could be attributed to the declining fish catch in the bay. Accordingly, the BCR is only 0.85 while the IRR is less than zero. (Indeterminate or zero IRR in this scenario and in the succeeding cases are due to the fact that even on the first year of operation, fishermen already incur positive net income unlike in most business operations.) This implies that with no regulation at all, fishermen are losing income.

With regulation

Under this scenario, three policy options were tested: ban on electric shiners, regulations on fish cage as well as both electric shiners and fish cages.

Ban on electric shiners

Low level of implementation. If the local government continues to allot a meager amount for the implementation and monitoring of fishery laws, fish catch will continue to decline in the area. This scenario of low level enforcement will result in a negative net benefit of PHP 10.8 million (USD 201,605), a BCR of 0.89 and a negative IRR. Banning shiners alone will not give returns on government's investment in monitoring and implementation. Fishermen's income will increase slightly than without regulation although they still sustain a loss.

High level of implementation. In contrast, high level of enforcement or provision of additional funds in policy implementation and monitoring will yield positive gains. It is worth noting that NPV for this condition is PHP 1.4 million (USD 26,134). The BCR is 1.01 and the IRR, 62%. This is a better deal when compared to the low enforcement level. However, the government's return from its investment does not commensurate with the implementation. Fishermen's income are positive and increasing slightly.

Fish cage regulation

Low level of implementation. The results show that fish cage regulation is not as effective as banning shiners. It is worth noting that with the current level of investment, there is hardly any difference in NPV, BCR and IRR compared to the results obtained in the no regulation scenario. The impact of fish cage regulation is nil since there are only three existing in the area which do not affect fishermen's catch.

High level of implementation. Pouring in additional funds or high enforcement improved the NPV [-PHP 1.2 million (-USD 22,400)] but still the government is not getting more out of its investment as shown by the BCR of 1.00 (where benefits are just equal to the costs). Fish cage regulation is not an effective measure which is also justified by its insignificant contribution to yield in the bioeconomic model.

Regulation of both electric shiners and fish cages.

Low level of implementation. Imposition of both controls yielded best results. Nevertheless, with the current investment levels or low enforcement, outcome of the NPV [-PHP10.4 million (-USD 194,139)], BCR (0.89) and IRR (less than 0%) are still not favorable. This is because the increase in fish catch brought about by the implementation of law is quite small to offset the diminishing productivity of the bay.

Table 8 Net Present Value, Benefit Cost Ratio and Internal Rate of Return by Scenario/Policy Option, 2002-2006.

Scenario/Policy Option	*NPV*	*BCR*	*IRR(%)*
No regulation	(14,565,542.83)	0.85	<0
Shiner ban			
• Current or low level of investment/resources	(10,838,875.81)	0.89	<0
• With additional or high investment	1,422,314.36	1.01	61.73
Fish cage regulation			
• Current or low level of investment/resources	(14,102,989.61)	0.85	<0
• With additional or high investment	(1,207,723.15)	0.99	<0
Shiner and fish cage ban			
• Current or low level of investment/resources	(10,356,433.41)	0.89	<0
• With additional or high investment	2,294,793.92	1.02	93.29

High level of implementation. Provision of additional resources or high enforcement indicates that the government is not getting more out of its investment as shown in the BCR of 1.02 and 1.01. The benefits exceed the costs but only by a slight margin.

However, fishermen's income will increase if ban on shiners as well as ban on both shiners and fish cages are strictly enforced as shown by the positive NPV. Restricting the total number of ITPs awarded as is through the years requires maintaining the same number of fishermen/boats. The bay cannot afford to maintain another boat as indicated by the bioeconomic model where the marginal product is declining. Furthermore, historical data shows a drop in CPUE from 1965 to 2001 by 12 to 2 kg per fishing trip for hook and line, and by 52 to 10 kg per fishing trip for gill net. The model showed that fishing effort of milkfish fry gatherers, electric shiners, fish cages, hook and line, multiple hooks and gill nets are negatively related to yields of fish, reflecting the fact that Lamon Bay is overexploited. An increase in the level of fishing effort did not increase yield in all fishing gears but instead resulted in declining fish catch. One option for the LGU is to look into the Total Allowable Catch (TAC) policy for different fish species. Not yet enforced, this option is stipulated in Fisheries Code, Sec 2*: " it is the policy of the State to protect the rights of fishermen, especially of the local communities with priority to municipal fishermen, in the preferential use of the municipal waters. Such preferential use, shall be based on, but not limited to, Maximum Sustainable Yield (MSY) or Total Allowable Catch (TAC) on the basis of resources and ecological conditions, and shall be consistent with commitments under international treaties and agreement."*

Maintaining the number of ITPs as is through the years does not reflect significant changes to the bay's resources and the fishermen's income. The LGUs should confiscate and even recall the ITPs awarded to fishermen who continue to violate the regulations in the succeeding years. In this way, the ITPs will decrease yearly, as an economic disincentive, although this was not used as an assumption in the BCA.

There is a need for other livelihood activities and income diversification for fishing households to reduce fishing and economic pressures exerted on the bay. Only a small number of fishermen respondents have a secondary occupation. Most members of the fishermen's households are idle. They have time to engage in possible livelihood employment opportunities and are equipped with appropriate educational requirement. If the alternative sources of income are sustainable, fishermen can also be attracted to shift their economic activities thus reducing fishing pressure on the bay.

Sensitivity Analysis

A sensitivity analysis was conducted on the condition that supplementary funds will be used to fully implement and monitor the considered policies. It was assumed that increases in fish catch are: 1% for the imposition of ban on electric shiners; 0.5% for the regulation of fish cages; and 1.25% for the enforcement of both policies.

Results showed that even if fish catch decreases by half the expected yields and fishermen obtain a positive income, regulations on the prohibition of electric shiners and fish cages will produce small returns of investment to the government.

Given the low income from fishing and the idle time of the fishermen as well their spouses and children, provision of alternative sources of income is imperative. Organizations of municipal fishermen should be strengthened so they could eventually serve as conduits of support services. There should be regular monitoring of the bay and strict implementation of the policies coupled with the political will to execute these regulations.

7.0 SUMMARY AND CONCLUSION

Although Lamon Bay is one of the top ten fishing grounds in the Philippines, fish catch in this area has been declining by 13.5% annually which is more than twice the national average of 5.4%. Several fishery policies had been implemented in Lamon Bay for its development, management and conservation. However, no study has been conducted to determine the efficiency and effectiveness of these policies.

Using data from secondary sources and from an original survey, a bioeconomic model was used to simulate the effects of changes in enforcement levels of three current fisheries policies : ban on electric shiners, regulation on fish cage, as well as both shiners and fish cages. These were evaluated using the BCA.

The following conclusions can be drawn from this study:

Lamon Bay is overexploited as indicated by the small length and high exploitation rate values of most fish species.

An increase in the level of fishing effort did not increase yield in all fishing gears but instead resulted in a decline in fish catch. This implies that the bay is overfished.

The marginal productivity of Lamon Bay is decreasing for all gears, meaning that one additional gear in the bay will reduce the average fish catch of all gears.

A typical fisherman in Lamon Bay lies below the poverty line and has no secondary source of income. His household members are mostly idle but are equipped with educational requirements for gainful activities.

The institutions responsible for implementing fisheries policies in Lamon Bay are constrained by lack of funds, political will and technical know-how for monitoring.

Stringent enforcement of current fisheries policies [costing the government PHP 614,000 (USD 11,500) per year] would result in insignificant benefits relative to costs (i.e. benefit-cost ratios of 1.02 or less). The return on the government's investment would be negligible because enforcement of current regulations does nothing to reduce open access, the root cause of overfishing.

A potentially more effective policy to deal with open access and overfishing is to set a limit on the total number of fish that can be caught and divide this quota among Lamon Bay's fishermen. Although the imposition of a total allowable catch is stipulated in the new Fisheries Code, no effort has yet been made to implement this in Lamon Bay. This scheme would limit the volume of fish harvested particularly overexploited species. Over time, the total allowable catch might be reduced. (The easiest way to make the initial reductions would be to revoke the permits of fishermen who contravene the fishing regulations). To allow flexibility, the quotas allocated to individual fishermen might be tradable. Among other things, this would allow new fishermen to enter the industry - but only by buying a quota from an existing holder. This system of individual tradable quotas or permits has been very successful in New Zealand (New York Times Magazine: August 2000).

Complementing this could be alternative livelihood projects to wean fishermen and their family members away from fishing. Most fishermen are poor and have no secondary source of income. Their household members are usually idle but employable. An integrated coastal management plan is imperative; it should seek to develop alternative sources of income that will reduce fishing pressure on the bay.

8.0 RECOMMENDATIONS

Policies are important in regulating open access fishery resources. High enforcement of fishery policies, however, do not necessarily mean that the government will be getting more out of its investment in monitoring and implementation particularly when the bay is overfished, overexploited, its marginal productivity decreasing and CPUE is likewise decreasing. Therefore, in order to effectively implement fisheries policies to benefit both the government and the fishermen, as well as increase productivity of the bay, government policies should give priority to the following recommendations:

- The Government should require and sell individual transferable permits to existing resident-fishermen so that new entrants will not be allowed to fish unless they purchase from one who owns. Individual transferable permits of violators should be confiscated and suspended. This will maintain if not decrease the number of fishermen in the bay.

- The Government should enforce the policy of total allowable catch on overexploited fish to allow the species to increase productivity, as stipulated in the new Fisheries Code.

- The Government should look for alternative sources of income for the fisherman and his household members who belong to the labor force are educationally equipped yet remain idle and engaged in non-gainful activities. This can be done through the cooperation of NGOs, POs and community organizations to decrease fishing pressure on the bay and increase fishermen's income which is currently below the poverty threshold. Training and support services (credit facilities, market) should be provided to ensure sustainability of these projects.

- The Government should design an integrated coastal management plan for the area, incorporating out-migration programs for alternative sources of income to fishing which should be sufficient to offset rapid population growth in the coastal communities. This should be backed up by adequate support to the institutional mechanisms in the bay.

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LIST OF ABBREVIATIONS AND ACRONYMS

A priori	A term used to identify a type of knowledge which is obtained independently of experience
BCA	Benefit Cost Analysis
BCR	Benefit Cost Ratio
BIHADA	*Biyayang Handog ng Dalampasigan*, a non-governmental organization that opposed a resolution passed in 1998 in Infanta imposing a two-year ban on gathering of milkfish fry in the municipal waters.
BFAR	Bureau of Fisheries and Aquatic Resources
CB-CRMP	Community Based - Coastal Resource Management Program
COPE Foundation	Community Organization of the Philippines Enterprise
CPUE	Catch per unit effort
CRM	Coastal Resource Management
DA	Department of Agriculture
FARMC	Fisheries and Aquatic Resource Management Council
GO	Government Organization
ICDAI	Infanta Integrated Community Development Assistance, Inc.
IRA	Internal Revenue Allotment
LGU	Local Government Unit
MAFC	Municipal Agriculture and Fisheries Council
M & E	Monitoring and Evaluation
MDC	Municipal Development Council
MFARMC	Municipal Fisheries and Aquatic Resources Management Council
MO	Municipal Ordinance
MOr	Municipal Order
MPDC	Municipal Planning and Development Coordinator
Multicollinearity	Multicollinearity among independent variables was observed in the initial attempt of estimation. This means that though the original overall yield value was very low, all of the individual

	yield values were high. The model fits the data well, even though none of the independent variables has a statistically significant impact on predicting yield. This is possible when two independent variables are highly correlated and they both convey essentially the same information. In this case, neither may contribute significantly to the model after the other one is included. But together they contribute a lot. If you remove both variables from the model, the fit would be much worse. So the overall model fits the data well, but neither independent variable makes a significant contribution when it is added to your model last. When this happens, the independent variables are collinear and the results show multicollinearity.
NGO	Non-government Organization
NPV	Net Present Value
OMA	Office of the Municipal Agriculturist
PISAMAKPO	*Pederasyon ng Samahang Makakalikasan ng Polillo* – Federation of Environmentalists in Polillo
PO	People's Organization
Res	Resolution
SAMALIB	*Samahang Likas Bisig ng Infanta* – Association of Environmentalists in Infanta
SB	*Sangguniang Bayan* – law-making body at the village level
SIPAKAT, Inc.	*Samahang Ipagtanggol ang Kapakatan* – organization formed to protect the rights of fishermen
SWOT	Strengths, Weaknesses, Opportunities, Threats