


Initial Valuation of Selected Uses and Habitats and Damage Assessment of Manila Bay

Manila Bay Environmental Management Project

GEF/UNDP/IMO Regional Programme on Partnerships in Environmental Management for the Seas of East Asia

Department of Environment and Natural Resources

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GEF/UNDP/IMO Regional Programme on Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)

Department of Environment and Natural Resources (DENR)

15 December 2005

MISSION STATEMENT

The Global Environment Facility/United Nations Development Programme/International Maritime Organization Regional Programme on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) aims to promote a shared vision for the Seas of East Asia:

> "The resource systems of the Seas of East Asia are a natural heritage, safeguarding sustainable and healthy food supplies, livelihood, properties and investments, and social, cultural and ecological values for the people of the region, while contributing to economic prosperity and global markets through safe and efficient maritime trade, thereby promoting a peaceful and harmonious co-existence for present and future generations."

PEMSEA focuses on building intergovernmental, interagency and intersectoral partnerships to strengthen environmental management capabilities at the local, national and regional levels, and develop the collective capacity to implement appropriate strategies and environmental action programs on self-reliant basis. Specifically, PEMSEA will carry out the following:

- build national and regional capacity to implement integrated coastal management programs;
- promote multi-country initiatives in addressing priority transboundary environment issues in sub-regional sea areas and pollution hotspots;
- reinforce and establish a range of functional networks to support environmental management;
- identify environmental investment and financing opportunities and promote mechanisms, such as public-private partnerships, environmental projects for financing and other forms of developmental assistance;
- advance scientific and technical inputs to support decision-making;
- develop integrated information management systems linking selected sites into a regional network for data sharing and technical support;
- establish the enabling environment to reinforce delivery capabilities and advance the concerns of nongovernmental and community-based organizations, environmental journalists, religious groups and other stakeholders;
- strengthen national capacities for developing integrated coastal and marine policies as part of state policies for sustainable socioeconomic development; and
- promote regional commitment for implementing international conventions, and strengthening regional and sub-regional cooperation and collaboration using a sustainable regional mechanism.

The 12 participating countries are: Brunei Darussalam, Cambodia, Democratic People's Republic of Korea, Indonesia, Japan, Malaysia, People's Republic of China, Philippines, Republic of Korea, Singapore, Thailand and Vietnam. The collective efforts of these countries in implementing the strategies and activities will result in effective policy and management interventions, and in cumulative global environmental benefits, thereby contributing towards the achievement of the ultimate goal of protecting and sustaining the life-support systems in the coastal and international waters over the long term.

Dr. Chua Thia-Eng
Regional Programme Director
PEMSEA

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ACRONYMS

AWC	Asian Waterfowl Census
BAS	Bureau of Agricultural Statistics
BFAR	Bureau of Fisheries and Aquatic Resources
BSWM	Bureau of Soils and Water Management
CVM	Contingent Valuation Method
DE	Department of Economics
DENR	Department of Environment and Natural Resources
DOH	Department of Health
DOT	Department of Tourism
DPWH	Department of Public Works and Highways
EMB	Environmental Management Bureau
ERV-MB	Environmental and Resource Valuation of Manila Bay
FIES	Food and Income Expenditure Survey
GDP	Gross Domestic Product
GVA	Gross Value Added
HAB	Harmful Algal Bloom
IEMP	Integrated Environmental Monitoring Program
IIMS	Integrated Information Management System
IMO	International Maritime Organization
NEDA	National Economic Development Authority
LGU	Local Government Units
MADECOR	Mandala Development Corporation
MBEMP	Manila Bay Environmental Management Project
MMDA	Metro Manila Development Authority
NAMRIA	National Mapping and Resource Information Authority
NSCB	National Statistical Coordination Board
NSO	National Statistics Office
PAWB	Protected Areas and Wildlife Bureau
PCG	Philippine Coast Guard
PEMSEA	Regional Programme for Partnership in Environmental Management for the Seas of East Asia
PMO	Project Management Office
PPA	Philippine Ports Authority
PSP	Paralytic Shellfish Poisoning
PVE	Present Value of Earnings
RAD	Restricted Activity Days
REA	Resource and Environment Assessment
SMO	Site Management Office
SWI	Salt Water Intrusion
TWG	Technical Working Group
UNEP	United Nations Environmental Program
UPLB	University of the Philippines at Los Baños
WLD	Work Loss days

GLOSSARY OF TERMS

Aesthetic Value - The intangible value of property created when the property possesses unique characteristics or features that make it attractive.

Aquaculture – The cultivation of aquatic organisms, such as fish, shellfish, algae and other aquatic plants.

Attribution Factor Approach – a method of estimating physical health effects of pollution which recognizes the fact that not all morbidity cases can be attributed to pollution, therefore, needs to be adjusted to reflect this fact.

Benefit Transfer Techniques - are used to estimate benefit values for resources where benefit data on a resource are unknown. The technique is used to estimate non market values for cost benefit analyses in situations where the estimation of willingness to pay using other techniques would be prohibitively expensive.

Bequest value (BV) - the value derived from preserving the natural heritage for use by future generations. It is the willingness to pay to preserve ecosystems and leave an 'undamaged' world for the benefit of one's descendants.

Brushland - an area with shrubs and little other vegetation.

Carbon Sequestration - the long-term storage of carbon CO2 in the forests, soils, ocean or underground in depleted oil and gas reservoirs, coal seams and saline aquifers. Examples include the separation and disposal of CO2 fuel gases or processing fossil fuels to produce H2- and CO2-rich fractions, and the direct removal of CO2 from the atmosphere through land use change, afforestation, reforestation, ocean fertilization and agricultural practices to enhance soil carbon.

Choice Modelling - A multivariate statistical technique which can provide a dollar value for non-marketed goods and services.

Commercial Fishing - refers to fishing using fishing vessels of more than three (3) gross tons

Commercial Forestry – mode of forestry (science of planting and managing forests and plantations, and relative natural resources) having financial gain as an object.

Contingent Valuation Method (CVM) – provides a means of assigning monetary values to resources and service flows that are unpriced or under-priced by the market. It entails the use of carefully designed survey and involves the direct questioning of consumers (using questionnaires or experiments) to determine their willingness to pay (WTP) and/ or willingness to accept (WTA) for an environmental change.

Coral reef **-** a structure that is made from the skeletons of soft-bodied coral animals or polyps, and is found in warm waters.

Direct Use Value – the value that describes the benefits of the goods and services that enter directly into human economy.

Dose-Response Method – a method of evaluating change in effect on an organism caused by differing levels of exposure to a substance. It is central to determining “safe” and “hazardous” levels and dosages for drugs, potential pollutants, and other substances that humans are exposed to.

Ecosystem - an organizational unit consisting of an aggregation of plants, animals (including humans) and micro-organisms, along with the non-living components of the environment.

Employment Rate - the percentage of a body of persons available for employment at any time actually in employment at that time.

Endangered species - a species that is in danger of extinction and whose survival is unlikely if the causal factors continue; included are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that the species are deemed to be in danger of extinction.

Eutrophication - is the gradual increase and enrichment of an ecosystem by nutrients such as nitrogen and phosphorus. Although traditionally thought of as enrichment of aquatic systems by addition of fertilizers into lakes, bays, or other semi-enclosed waters (even slow-moving rivers), there is gathering evidence that terrestrial ecosystems are subject to similarly adverse impacts.

Existence Value – arises from the satisfaction of merely knowing that an ecosystem or species exists, regardless of whether it will be used or not. It can be closely tied to aesthetic, cultural, religious and moral aspects.

Habitat **–** place where a plant or animal lives, often characterized by a dominant plant form and physical characteristics.

Indirect Use Value – deals primarily with functions of ecosystems and do not normally appear in national income accounting system but they may far outweigh direct use values when they are computed.

Labor Force Participation Rate - the proportion of a particular population group that is in the labor force—that is, either working (employed) or actively looking for work (unemployed).

Mangrove - trees, shrubs, or forests that grow along riverbanks and ocean coastlines in tropical areas. Their roots provide a breeding ground for plant and animal biodiversity, and also aid in building up coastlines.

Mariculture – cultivation of marine organisms, either in their "natural environment" or in seawater, in ponds or raceways.

Morbidity – non-death incidences from a particular disease/ illness

Mortality – loss of life on a large scale, as caused by disease/illness, war, etc.

Mudflats – are relatively flat, muddy regions found in intertidal and sheltered areas such as bays and estuaries. The material that forms it is deposited by the tides or rivers

Municipal Fishing - refers to fishing within municipal waters using fishing vessels of three (3) gross tons or less, or fishing not requiring the use of fishing vessels.

Net Present Value (NPV) – the current value of net benefits (benefits minus costs) that occur over time. A discount rate is used to reduce future benefits and costs to their present time equivalent. In equation form it would be:

$$NPV = \frac{B_1 - C_1}{1+r} + \frac{B_2 - C_2}{(1+r)^2} + \cdots + \frac{B_n - C_n}{(1+r)^n} = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+r)^t}$$

Non-use Value – value conferred by people on the ecosystem without regard to their personal use.

Option Value - an economic value people place on an environmental or natural resource because people want to have the option of using the resource in the future.

Quasi-option value (QOV) – refers to the utility gains expected to be realized from not undertaking irreversible decisions; and so maintaining options for future use of some resource, given expectations of future technological advance and/or growth of knowledge.

Resource and Environmental Assessment - a process to predict the resource and environmental effects of proposed initiatives before they are carried out.

Resource rent – is an economic term of abnormal or supernormal profit which derives from the exploitation of natural resources. It can be derived by multiplying the resource area with the net economic benefits per hectare.

Restricted Activity Days (RAD) – days spent in bed, days missed from work, and other days when activities are significantly reduced due to ill health.

Seagrass - rooted, submerged marine or estuarine macrophytes of several species. Habitats created by seagrass meadows are among the most diverse and productive estuarine environments.

Shadow Cost/Project – sometimes, a private good may be used as a substitute for an environmental good or service provided by a natural resource. For example, the value of a clean lake may be calculated by estimating the cost of constructing public and/or private swimming pools or building a new reservoir with treatment facilities.

Subsistence Forestry – is a mode of forestry (science of planting and managing forests and plantations, and related natural resources) carried out for survival – with few or no crops available for sale.

Total Economic Valuation – estimated worth of all net benefits from all compatible use and non-use values of the natural environment and resource.

Total Economic Value – the sum of all benefits from all compatible use and non-use values. It focuses on monetizing a set of human preferences for natural resource and environment.

Use Value –an economic value based on the tangible human use of some environmental or natural resource.

EXECUTIVE SUMMARY

This report presents the results of the economic valuation of selected uses and habitats of Manila Bay, as well as the value of damages from different risk factors around the Bay. The study was done with the following objectives:

a. To calculate the use values of major uses of the Bay and its major habitats.

b. To calculate the non-use values, whenever possible for the major habitats of the Bay.

c. To calculate the socio-economic, ecological and health impacts of major disturbances such as pollution and unsustainable use of the Bay's resources.

d. To create awareness on the potential total value of the Bay.

The study relied on a variety of valuation techniques and on secondary data to meet these objectives. It also relied on the results of the ground-truthing activities of the Site Management Offices (SMOs) and the Integrated Environmental Monitoring Program (IEMP) of the Manila Bay Environmental Management Program (MBEMP). Due to constraints on data availability and budget, the study was directed towards the valuation of selected use values, habitats and specific damages. In particular, it focused on the value of four major uses namely: a). off-shore fisheries; b). major ports and harbors; c). tourism; and d). aquaculture (brackishwater). Valuation of habitats concentrated on the mangrove and mudflat ecosystem around the Bay, and coral reef in one island. The damages that were assessed were related to: a). health costs of diseases related to water pollution; b). damages to mangrove habitats; c). effects of excessive groundwater pumping and the attendant salt water intrusion (SWI); and d). harmful algal blooms. Non-use values, such as bequest values, existence values, and option values, were not quantified. It is hoped that future studies will fill in the limitations of this valuation exercise.

Total Value of Selected Major Uses and Habitats

Current economic value of the selected major uses and the mangrove ecosystem amounted to **8.3 billion pesos** 2004. This can be considered as an underestimate as the non-use values, as well as the use values of other habitats were not considered because of the aforementioned constraints. This value can be attributed to: offshore fisheries (641.3 million pesos), aquaculture/ mariculture (5.1 billion pesos), ports and harbors (865.9 million pesos), and tourism (1.97 billion pesos). Mangrove habitats, on the other hand varied in their value depending on the institutional assumption. For managed mangroves (i.e. with secure property rights, the total use value is roughly 246.8 million pesos, while the open access set up amounts to 232.7 million pesos. Also indirect use values, primarily composed of ecological functions, constitute around 95% of the total use value of mangroves.

Valuation of Selected Damages

In summary, the total cost of morbidity and mortality in terms of income loss is 15.8 million pesos and 309.5 million pesos respectively. While these figures are due to water pollution related diseases, salt water intrusion and the attendant renal related deaths resulted in an income loss of 81.2 million pesos per year. Mangrove depreciation due to degradation is roughly 18.6 to 19.9 million pesos per year in nominal terms depending on the institutional assumptions.

The highest damage is associated with harmful algal blooms (HAB) or Red Tides. Morbidity and mortality are around 151.6 million pesos per year from 1988 to 1998, the periods where red tide occurred in Manila Bay. A larger portion of the red tide damage can be attributed to income loss from shrimp exports and fishing operations. A further cost is the expenditure of the government in its relief operations. During the 1992 incident, the total cost was around 3.5 billion pesos. If we consider HABs as an indirect effect of water pollution, then the total damages associated with water pollution can reach as high as 3.9 billion pesos.

Limitations and Recommendations

The study mainly estimated the use values of major uses of Manila Bay and its specific habitats. It failed however, to obtain non-use values for these major uses and the specific activities on major habitats. Likewise, non-consumptive direct use values such as aesthetic values were also not calculated. These values may require survey based methodologies such as Contingent Valuation Methods and Choice Modeling. However, these kinds of studies are often expensive and time consuming. Thus, the study was not able to capture these values.

Also the valuation exercise relied mostly on published secondary data, which might lend the estimates some degree of inaccuracy. The valuation based on published data can be extended or refined through the use of alternative data sets. For instance, for off-shore fisheries the use of stock assessment data could improve the estimates. In the case of aquaculture/ mariculture, refinement can come from two sources. First is to increase the species coverage and disaggregate the data by province, species, and aquaculture environment. The second improvement would be to secure more recent cost and returns studies to improve the assumptions that can be used in the valuation. Furthermore, these costs and return studies should be species- and province-specific, if possible.

In terms of the estimates for mangrove use values, adjustments are necessary to account for the differences between other areas and Manila Bay. In particular, Manila Bay is noted for being one of the most heavily polluted Bays and therefore productivity of mangrove areas maybe lower. This is necessary since the values used were from studies in other areas.

The immediate information needed for refinement of values for coral reef and seagrass systems is the areal extent and quality of these systems in Manila Bay. Another important information is the identification of fish and other species that use the reefs and seagrass as sanctuaries. The biomass of these species should also be taken into account. If permitted, the potential of having tourist attractions based on the coral reefs should also be assessed.

Arriving at an accurate and complete Total Economic Valuation, therefore, requires both financial resources and time. Moreover, the “science” part of the activity should also be developed thoroughly to support the economic side of the valuation. Necessary tasks include a comprehensive on-the-ground Resource and Environmental Assessment (REA) and a series of technical biological studies. Furthermore, a community based monitoring system is recommended as an efficient and effective way of collecting data and it can complement the proposed long-term IEMP to generate key information for policy– and decision-making at the local, regional and national levels. Lastly, in terms of the damage assessment, future studies should determine the attribution of damages to specific risk or threats. This is the next step towards making the results of this study relevant or useful to policy making.

Conclusion

The initial economic valuation of Manila Bay’s major uses and key habitats amounts to 8.3 billion pesos. Since this amount represents a *partial and underestimation* of the total economic value of Manila Bay, then the actual total economic value must be in all accounts, larger. This is enough to assure us that the Bay is still useful, but it is also a warning sign that we stand to loose a larger amount if we do not manage it properly. The initial valuation of damages to health and ecosystems results in the amount of 3.98 billion pesos, which is about half of the total use value. This is a major indication of the ecological, economic and social consequences of human activities. A holistic and integrated approach to the management of the economy, environment and resources in Manila Bay and its watershed areas is therefore warranted.

INTRODUCTION

1.0 THE STUDY AREA

1.1 Manila Bay and its Environs

Manila Bay is one of the most popular bays in the Philippines, and one of the best natural harbors in the world. It is an almost land-locked bay facing the South China Sea, and covers an approximate area of 180 hectares (1,800 sq. km.). Manila Bay area played a prominent role since the pre-Spanish times, being the location of Muslim settlements and trading post with the Chinese, and the seat of power of the kingdom/sultanates of Rajah Sulayman, Matanda and Lakandula who fought the Spanish conquistadores, led by Miguel Lopez de Legazpi in 1570. It was the terminus site of the Manila-Acapulco galleon trade during the Spanish era. The mock Battle of Manila Bay in 1898 signaled the start of the American occupation. At present, major economic zones, financial and commercial centers can be found in cities and municipalities around Manila Bay. It is a major transport hub due to the presence of major domestic and international airports and sea ports. Its proximity to Manila, the capital of the Philippines, makes it the busiest bay in the country.

The coastal municipalities and cities of the National Capital Region (Manila, Pasay City, Parañaque, Las Piñas and Navotas), Bataan, Bulacan, Pampanga and Cavite border Manila Bay (Figure 1). The towns bordering the Bay account for roughly 217,865 hectares (Table 1). Also within the watershed of Manila Bay are the non-coastal provinces of Nueva Ecija and Tarlac in Region 3, Laguna and Rizal in Region 4, and the non-coastal municipalities and cities of the National Capital Region (Caloocan City, Quezon City, Malabon, Makati, Mandaluyong, Marikina, Muntinlupa, Pasig, San Juan, Pateros, Taguig and Valenzuela), Bataan, Bulacan, Pampanga, Cavite. The Pasig River Basin (9,000 km^2) and the Pampanga River Basin (3,900 km^2) – two major catchment areas – make up more than 75% of the watershed of Manila Bay.

These provinces can be further classified according to the dominant environment-economic zones. Table 2 shows that there are 10 distinct economic-environmental zones around Manila Bay.

Table 1. Area of Municipalities Surrounding Manila Bay (ha)

Region	Province	Municipality	Area (ha)	%
Region IV	**Cavite**	Bacoor	5,240	10.9
		Kawit	1,340	2.8
		Noveleta	550	1.15
		Cavite City	1,185	2.47
		Rosario	778	1.62
		Tanza	9,630	20.1
		Naic	8,600	18
		Ternate	4,350	9.08
		Maragondon	16,251	33.9
		Sub-total	**47,924**	
Region III	**Pampanga**	Lubao	15,731	41.2
		Macabebe	9,215	24.1
		Masantol	4,100	10.7
		Sasmuan	9,180	24
		Sub-total	**38,226**	
	Bulacan	Paombong	427	1.29
		Bulacan	7,299	22.1
		Hagonoy	10,310	31.2
		Malolos	8,836	26.7
		Obando	6,190	18.7
		Sub-total	**33,062**	
	Bataan*	Abucay	7,970	9.6
		Balanga City	11,163	13.45
		Hermosa	15,700	18.91
		Limay	10,360	12.48
		Orani	6,490	7.82
		Orion	6,541	7.88
		Pilar	3,760	4.53
		Samal	5,630	6.78
		Mariveles	15,390	18.54
		Sub-total	**83,004**	
NCR		Navotas	1,077	6.88
		Las Piñas	4,154	26.54
		Parañaque City	4,663	29.80
		Manila	3,855	24.63
		Pasay City	1,900	12.14
		Sub-total	**15,649**	
		Grand Total	**217,865**	

Source: BFAR, 1995
*2005 figures

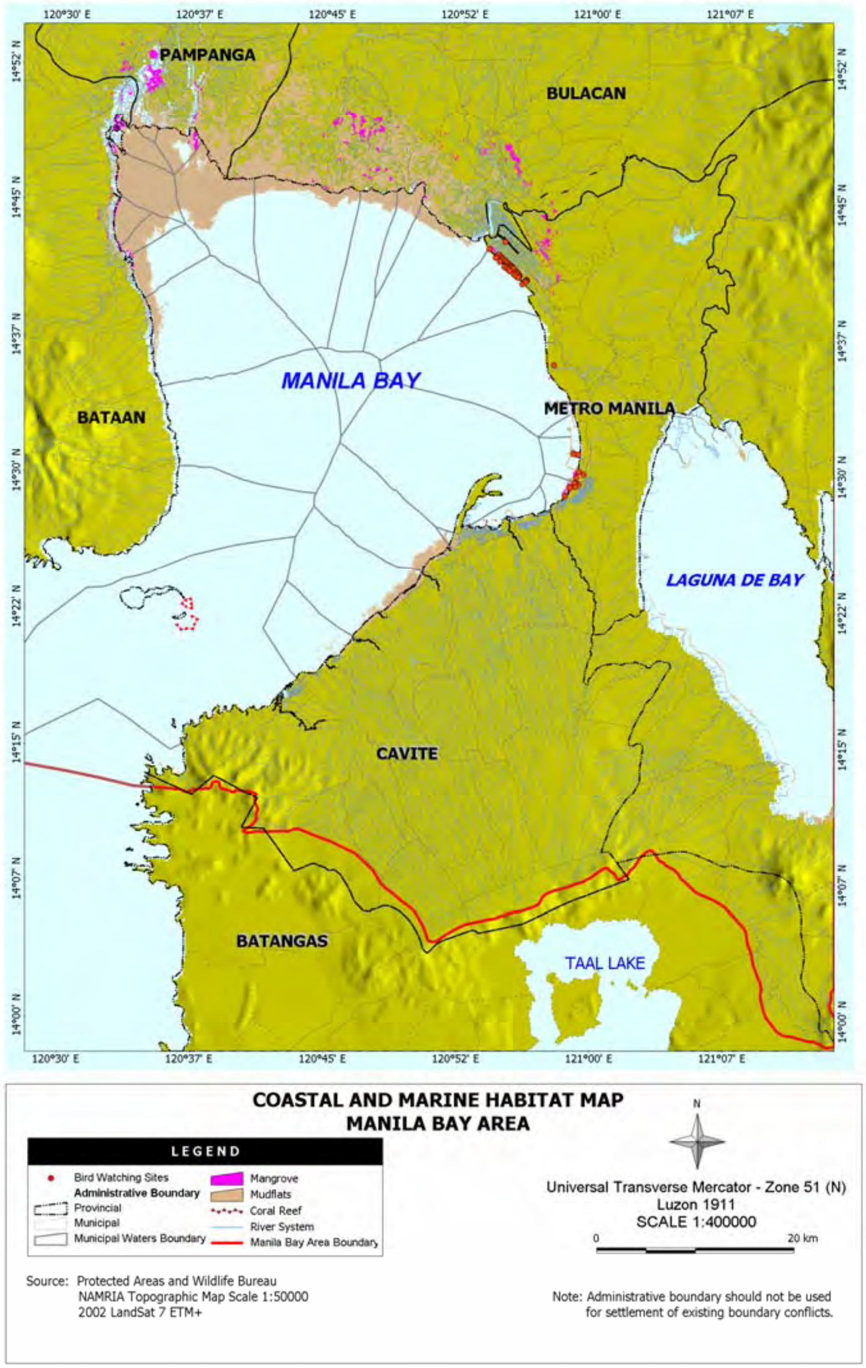


Figure 1. Geographical Area Covered by the Study

Table 2. Environmental-Economic Zones around Manila Bay

ZONE	LOCATION
1. Brushland/Industrial	Southern Bataan (Mariveles and vicinities)
2. Urban/Aquaculture/Agricultural	Bataan (from Limay and northwards)
3. Aquacultural/Agricultural	Coastal Pampanga (Pasac River and environs)
4. Extensive Aquacultural and Agricultural Env't	Coastal Bulacan (Tibaguin and Pamarawan environs)
5. Aquacultural/Industrial	Eastern Bulacan (Meycauayan and eastward)
6. Highly Urbanized and Industrialized Env't	Metro Manila Sub-areas: a. Navotas River and environs b. Pasig River area c. Paranaque area
7. Extensive Open-water Aquacultural/Urbanized Env't	Northern Cavite (Bacoor and vicinities)
8. Limited Aquacultural/Extensive Agricultural/Tourism	Southern Cavite (Rosario to Ternate, Cavite)
9. Natural Env't	Southernmost Cavite
10. Island Env't	Corregidor

Source : BFAR,1995

1.2. Demographic Structure and Income Distribution of the Population around Manila Bay

The social characteristics of the population around Manila Bay can be gleaned from the population and economic statistics. Information on these characteristics is based on the Census of Population (2000) and FIES (2000). The population of the cities and municipalities within the catchment areas is estimated at 16 million people (approximately 27% of the population of the country), with 8 million people inhabiting the Pasig River watershed.

With respect to the total number of people, Manila has the highest population (1,581,082), with all the other municipalities and cities having population of less than half a million (Table 3). In terms of population density, Bataan had the lowest (4.73 people/ha.), while the NCR cities have the highest (196.99 people/ha.). For the coastal areas on the average, there were 23.07 people/ha.

Based on average total household income, Las Pinas has the highest income (Table 4). Majority (99.99%) of its household earnings come from non-agricultural sources. This is followed by Parañaque, which similarly derives the bulk of its household incomes from non-agricultural activities (99.98%) Navotas, which has the lowest household income, has 95.79% of its total earnings contributed by non-agricultural activities.

In terms of expenditure, households in coastal municipalities of Manila Bay spent around 84% of their income (see Table 5). Average annual family household expenditure amounted to Php 187,035 in 2000. Of this amount 42% was spent for food. Residents of Las Pinas and Paranaque had the lowest annual food expenditure while Navotas households had the highest food expenditure.

Fig. 2 illustrates the income distribution in all nine areas surrounding the bay. It shows that the distribution is skewed towards low levels of income, indicating that there is inequality. That is, most of the household in each of the provinces are concentrated on low income levels. Of these areas, Las Piñas and Parañaque could be considered as having the relatively equal distribution of income while Cavite has the most unequal income distribution.

Table 3. Population Statistics of Municipalities around Manila Bay, 2000

Province	Municipality	Population	Number of Households	Population Density
Cavite	Bacoor	305,382	64,067	58.28
	Kawit	62,711	13,510	46.80
	Noveleta	31,939	6,934	58.07
	Cavite City	98,961	21,342	83.51
	Rosario	73,154	15,780	94.03
	Tanza	109,782	23,059	11.40
	Naic	72,402	15,230	8.42
	Ternate	17,179	3,541	3.95
	Maragondon	31,225	6,282	1.92
SUB-TOTAL		***802,735***	***169,745***	***16.75***
Pampanga	Lubao	125,681	23,446	7.99
	Macabebe	65,271	12,141	7.08
	Masantol	48,120	8,899	11.74
	Sasmuan	23,299	4,343	2.54
SUB-TOTAL		***262,371***	***48,829***	***6.86***
Bulacan	Bulacan	62,857	13,577	147.21
	Hagonoy	111,408	22,174	15.26
	Malolos	174,269	36,663	16.90
	Obando	52,881	11,229	5.98
	Paombong	41,067	8,266	6.63
SUB-TOTAL		***442,482***	***91,909***	***13.38***
Bataan	Abucay	31,796	6,593	3.99
	Balanga	70,753	14,065	6.34
	Hermosa	46,176	8,988	2.94
	Limay	46,587	9,490	4.50
	Mariveles	85,317	19,460	13.15
	Orani	52,430	10,810	8.02
	Orion	43,990	8,735	11.70
	Pilar	32,318	6,514	5.74
	Samal	27,382	5,429	1.78
SUB-TOTAL		***436,749***	***90,084***	***5.26***
NCR	Navotas	229,717	49,450	213.29
	Las Pinas	470,154	97,962	113.18
	Paranaque	446,766	94,109	95.81
	Manila	1,581,082	333,547	410.14
	Pasay City	354,908	78,180	186.79
SUB-TOTAL		***3,082,627***	***147,412***	***196.99***
TOTAL		***5,026,964***	***547,979***	***23.07***

Source: Census of Population, 2000

Table 4. Average Incomes of Households in Manila Bay, 2000

Coastal Province/ City	Average HH Size	Average Total Annual Family Income	Average Total Annual Income from Agricultural Activities	% of Average Total Annual Income from Agricultural Activities	Average Total Annual Income From Non-Agricultural Sources	% Average Total Annual Income From Non-Agricultural Sources
Bataan	5	185,394	22,096	11.92	163,299	88.08
Cavite	5	212,757	4,233	1.99	208,524	98.01
Bulacan	5	173,473	7,762	4.47	165,711	95.53
Pampanga	5	168,438	7,000	4.16	161,438	95.84
Navotas	5	155,504	6,546	4.21	148,959	95.79
Paranaque	5	225,425	453	0.20	224,972	99.80
Las Pinas	5	372,558	28	0.01	372,530	99.99
Manila	5	246015	116	0.05	245899	99.95
Pasay	5	256885	268	0.10	256618	99.90

Source: FIES, 2000

Table 5. Annual Family Expenditure of Households in the Coastal Provinces and Municipalities of Manila Bay, 2000.

Coastal Province/City	Total Annual Family Expenditure (a)	Total Annual Family Food Expenditure (b)	% of Food Expenditure
Bataan	155,922.00	74,790.30	48
Cavite	172,154.70	75,293.00	44
Bulacan	132,962.90	60,505.40	46
Pampanga	130,697.60	58,227.00	45
Navotas	131,428.90	66,649.80	51
Paranaque	282,826.70	96,945.80	34
Las Pinas	278,431.70	95,701.40	34
Manila	195,769.10	77,562.50	40
Pasay	203,122.80	79,591.00	39

Source: FIES, 2000

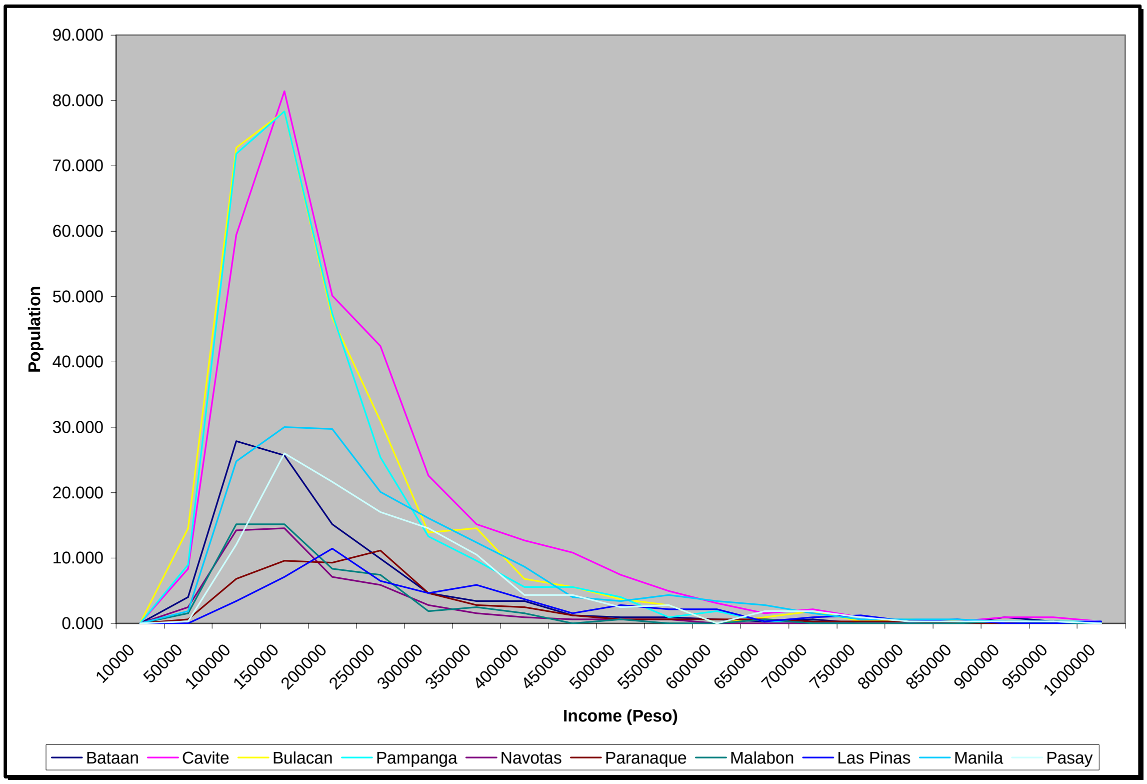


Figure 2. Income Distribution of Household around Manila Bay

1.3 Economic Importance of Manila Bay

The Regions comprising Manila Bay also contribute significantly to the country's GDP. Table 5 and Figure 3 show the relative share of NCR, Region 3, and Region 4 to the GVA for three major sectors in 2004. These sectors are Agriculture (including Fishery and Forestry), Industry, and Services. Figure 4 shows the location of major economic activities in the Manila Bay area.

In real terms, the three regions contribute significantly to the Services and Industry. 60% GVA of the services sector can be attributed to these three regions while 59% of the GVA of the industry sector came from these regions.

The NCR accounts for roughly 42% of the GVA for the Services sector and 34% of the Industrial sector. This is not surprising since the items for the services sector like trade, transportation, communication, storage, finance, ownership of dwellings and real estate, private services and government services are relatively concentrated in this region. On the other hand, Region IVA has a higher relative share in the industrial sector than the services sector. This is largely due to the establishment of industrial parks notably in the CALABAR Zone area. Region III is still predominantly an Agricultural area. For this region the relative shares of Agriculture, Industry, and the Services Sector are roughly equal. Not surprising is the very small contribution of NCR to the GVA of Agriculture.

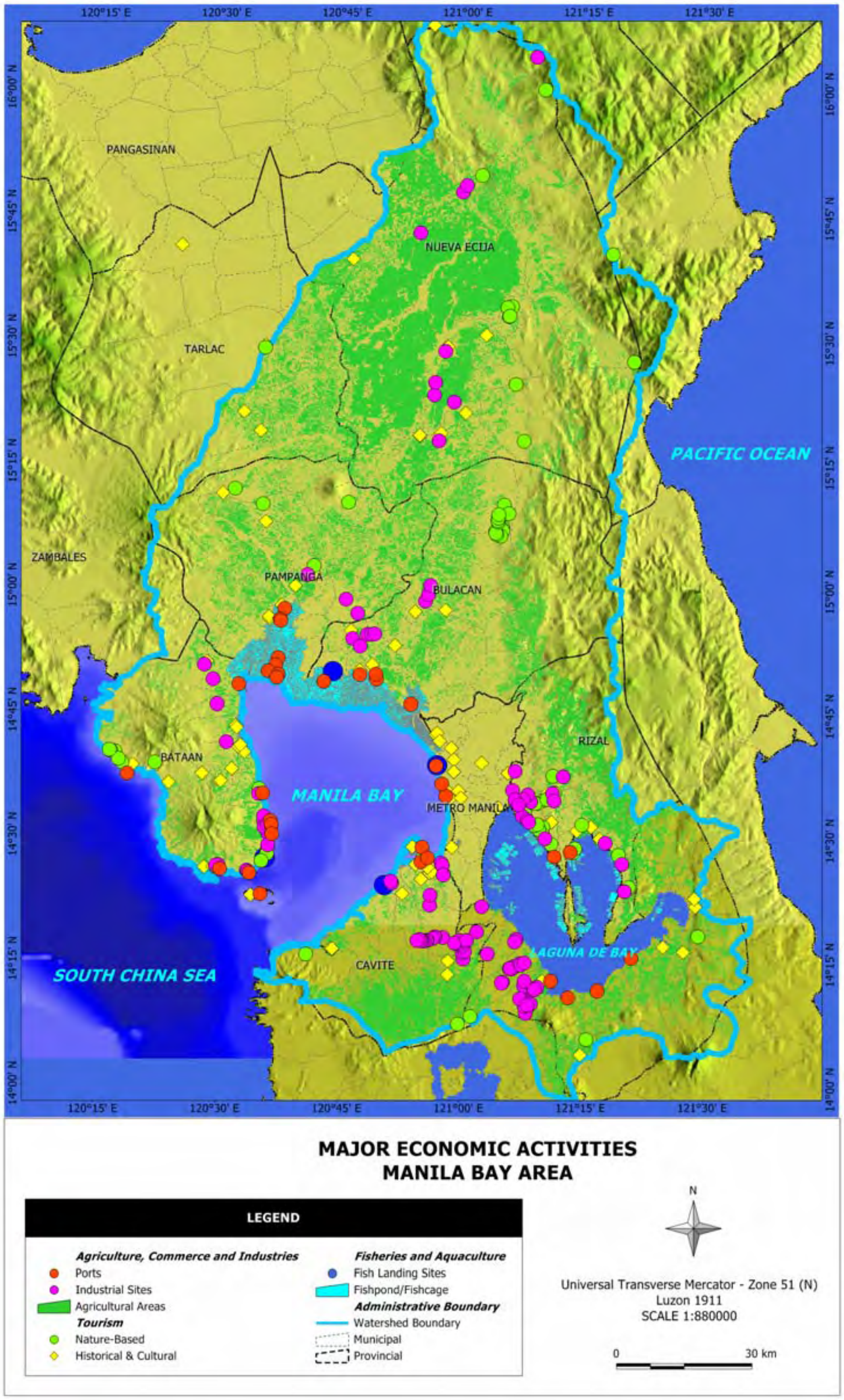


Figure 3: Location of Major Economic Activities in Manila Bay Area

Table 6. Gross Value Added (GVA) of each sector at 1985 constant prices (in thousand pesos), by region, and their percentage share to Gross Domestic Product (GDP) 2004.

REGION	SECTOR						PERCENTAGE SHARE TO GDP
	Agriculture, Fishery and Forestry		Industry		Services		
	GVA	% Share	GVA	% Share	GVA	% Share	
NCR	-	0	127,566,456	34	227,480,614	42	31.3
III	24,132,169	11	37,317,948	10	37,873,533	7	8.61
IVA	25,907,198	18	61,308,058	16	56,194,736	10	12.61
PHILIPPINES	224,669,526	100	380,795,390	100	540,334,001	100	100.00

Source: National Statistical Coordination Board

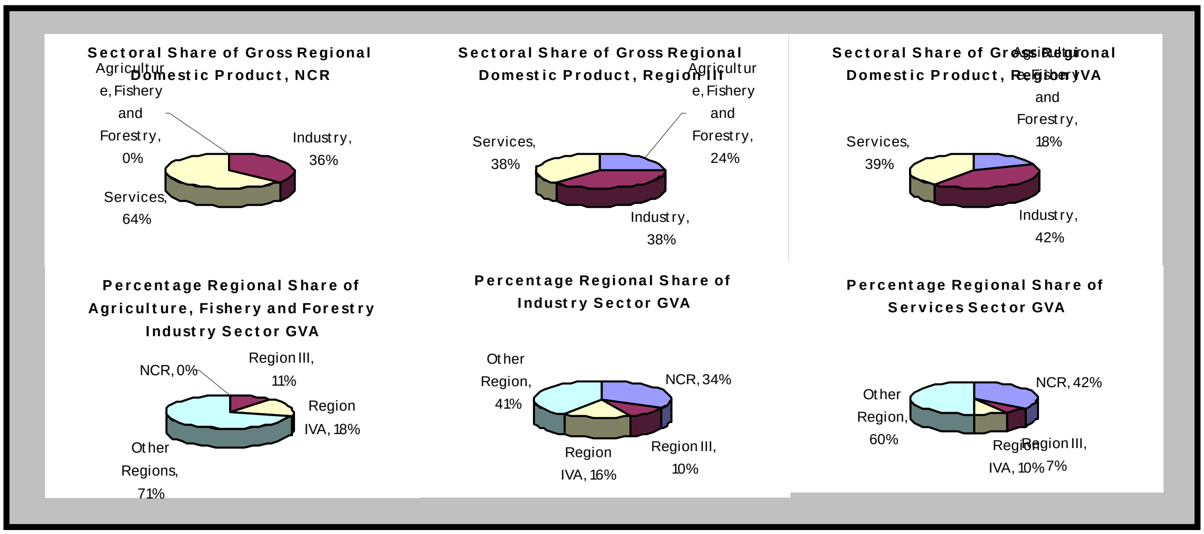


Figure 4. Economic Importance of Manila Bay Regions

1.4 Importance of Manila Bay and Impending Threats: A Rationale for Valuing Resources around the Bay

Aside from its commercial economic value, the surrounding coastal communities in the Bay have benefited from the bounty of its resources. Fishing is a primary source of livelihood around the bay. In fact, it was once known as one of the premier fishing grounds in the country. The varied ecological habitats around the bay also provide numerous benefits. For instance, mangroves along the shorelines have provided directly for coastal communities through serving as breeding grounds for fish and crustaceans. The timber products from these mangroves are also used as poles and roofing materials. These habitats also serve indirect ecological functions such as shoreline stabilization, and storm barriers, and carbon storage.

However, all these benefits from the bay and its ecological habitats are constantly under threat. Its coastline is now being used as settlement areas. The burgeoning coastal population (shown in Figure 4) has put undue stress on the habitats around the bay. Furthermore, it also serves as a dumping ground for household and industrial wastes. It is also an outlet for other inland bodies of water making it a receptacle of agricultural runoff and sediments. The bay also is a busy ship route and the threat of an environmental disaster is very real. For instance, oil spills from ship accidents also threaten the habitats of the bay.

Unsustainable use, pollution, and environmental disasters put the habitats and the benefits they provide at risk. A valuation exercise is therefore, essential to establish the real amount that is being lost or will be lost in the event of an environmental disaster or the persistent unsustainable use and pollution. Thus the main objective of this study is to come up with a rough estimate of the Total Economic Value (TEV) of Manila Bay. This will be done *initially* through an extensive use of secondary data. The results of this study can then be used as baseline information for prioritizing ground-truthing efforts and identifying other methods and studies needed to establish a more precise figure of the Total Economic Value of Manila Bay. The TEV report is a useful source of information for prioritizing mitigation and restoration efforts, especially in an event of a disaster, such as an oil spill. Likewise it can be used to allocate resources towards conserving and promoting sustainable use of the Bay’s habitats.

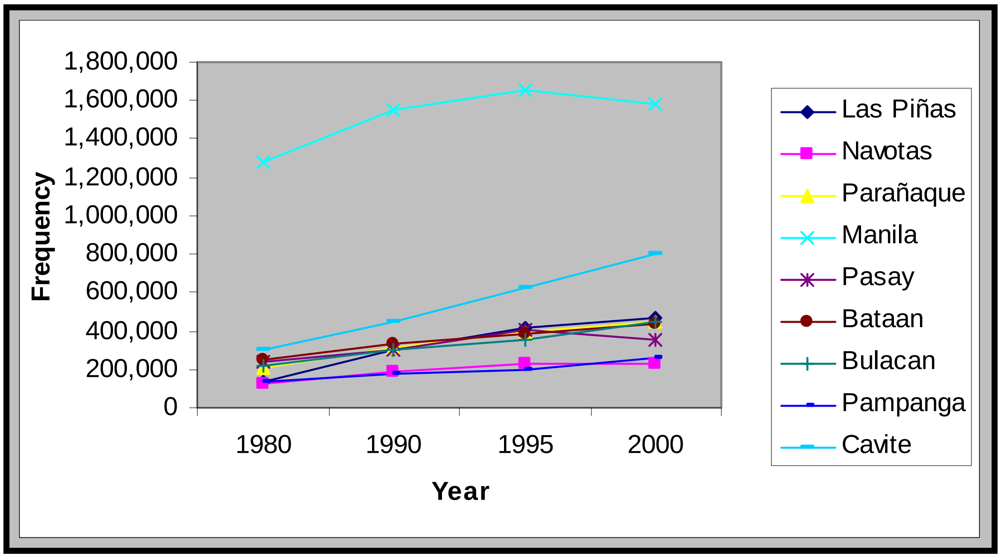


Figure 5. Population around Manila Bay, By Location, 1980 – 2000.

2.0 OBJECTIVES OF THE STUDY

The general objective of the study is to generate the total economic use value for Manila Bay. The specific objectives are:

a. To calculate the use values of major uses of the Bay and its major habitats through use of secondary data and if possible, primary data;
b. To calculate the non-use values, whenever possible for the major habitats of the Bay;
c. To calculate the socio-economic, ecological and health impacts of major disturbances such as pollution and unsustainable use of the Bay's resources; and,
d. To create awareness on the potential economic value of the Bay, and the economic losses due to pollution and resource degradation.

II. CURRENT USE VALUES OF MANILA BAY

1.0 CONCEPTUAL FRAMEWORK FOR RESOURCE VALUATION

The ecosystems of Manila Bay are quite complex and diverse. This means that it provides numerous goods and performs several functions that are beneficial to coastal communities. A useful framework for assessing these varied benefits is anchored on the concept of the *total economic value* (TEV) of a system of natural resources. The total economic value (TEV) of an ecosystem is the sum of all net benefits from all compatible use and non-use values. This concept focuses on monetizing a set of human preferences over a natural ecosystem. The concept of total economic value is shown in Figure 5.

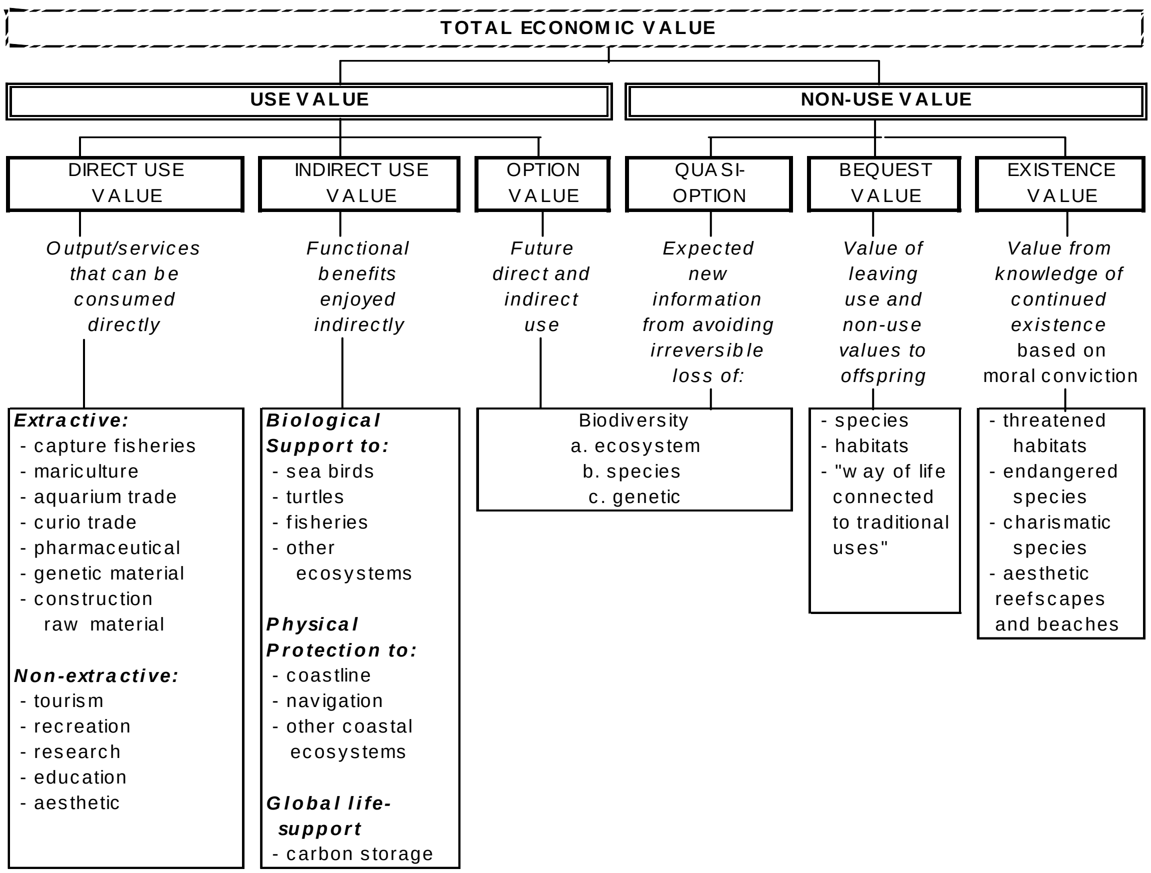
The total economic value consists of (i) Use values and (ii) Non-use values. Use values may be broken down further into direct use values and indirect use values. Direct *extractive* use values are output and services that can be consumed directly either through subsistence use or through trade in a market. Direct use values can also emanate from non-extractive use of a resource or habitat. Examples of non-extractive direct use are recreation from and research in specific habitats. Non-extractive uses are akin to public goods because one's use or consumption does not diminish the available good or service to other users.

Aside from producing consumable products, natural ecosystems also provide valuable ecological functions. For instance, coral reefs and mangroves often protect shorelines from erosion and provide habitat for fish and other animals. Use values are often derived *indirectly* through these support functions. Thus, they are called indirect use values. Indirect use values do not have direct market prices because these ecological functions are non-marketed.

With respect to time, direct and indirect use values are current use values. Potential or future direct and indirect use values are often called option values. The option value is related to the maximum willingness to pay of a user to keep the option of benefiting from future uses. It is like an insurance premium. For example, maintaining the ecological function of coral reefs can increase biodiversity and therefore the available genetic material. These genetic materials may be used in the future to produce medicine for currently untreatable diseases. Thus, preserving coral reefs preserves the option of using these (yet to be discovered) drugs. This option therefore has value in light of an uncertain future as well as the possibility of irreversible damage to an ecosystem.

Lastly, total economic value also includes non-use values. Non-use values consist of existence values, bequests values and quasi option values. Existence values arise from merely knowing that an ecosystem or species exists, regardless of whether they are used or not. Bequest values are related to the value derived from preserving natural resources as a heritage for future generations. Lastly, quasi-option value is related to option value in that avoiding irreversible damage bestows value today. In contrast to quasi option value, option value is a future use value. Table 7 shows some appropriate use and non-use values for some coastal ecosystems.

Figure 6. Framework for Total Economic Valuation of Coastal Resources



Source: modified from Spurgeon (1992).

Table 7. Use and Non-Use Values of Coastal Resources Systems.

Habitat/ Resource	Use Value				Non-use Value
	Direct Use Value		Indirect Use Value	Option Value	
	Consumptive	Non-consumptive			
Mangroves	fish, shellfish & crustaceans charcoal and poles wildlife capture traditional medicine, non-commercial use	Tourism Recreation Research	nursery role for juvenile fish feeding ground for fish, shellfish & crustaceans hydrological shoreline protection nutrient flows to estuaries carbon sink	biodiversity	existence value bequeath value aesthetic value
Mudflats and other Wetlands	fish, shellfish/ mollusks and crustaceans gastropods, snails, benthic invertebrates traditional, non-commercial use salt production	recreation (bird-watching, fishing) Aesthetic Scientific study/research	feeding grounds of birds nursery role for fish habitat of benthos and crustaceans	biodiversity	
Beach/ sandy shore	Aquaculture	Tourism scenic beauty recreation docking area	nursery role/habitat nesting ground of sea turtles, birds		
Coral reefs	fisheries raw materials	tourism research recreation	nursery role/habitat shoreline protection carbon sink	biodiversity	
Seagrass and Seaweeds	fisheries mariculture raw materials	research	nursery role/habitat shoreline protection carbon sink	biodiversity	

2.0 REVIEW OF RELATED LITERATURE

There are studies that calculated the total economic value of coastal resources in other countries and even the world's resources. One of these studies was conducted by Constanza *et al.* (1997). Their study was the first attempt to calculate the value of world's ecosystem services. The valuation involves two important measures that include ecological and economic values. These values were estimated in terms of flow of services per unit area per year.

One study that used the valuation of Constanza *et al.(1997)* was the Strategic Action Programme (SAP) for South China Sea (UNEP, 1999). SAP aims to slow down the current rate of environmental degradation. It contains priority actions that assist participating states in making policies regarding environmental management. As part of the study, they conducted cost - benefit analysis of programme actions that intend to preserve the ecosystems in South China Sea particularly mangroves, coral reefs, seagrass and wetlands. The valuation of the resources of the said area followed the valuation used by Constaza *et al. (1997).*They estimated the value of ecosystems in terms of its ecological functions and economic values. The economic values include food and fiber production, raw materials, genetic resources, recreation and cultural values. The calculated economic value for mangroves is US$ 1,286, US$ 3,256 for coral reefs, US$ 3,400 for sea grass and US$ 1,817 for wetlands.

The coastal resources of the Philippines are one of the most productive and biologically diverse resources in the world. This rich diversity results in high productivity of habitats and high fishery yields. An initial valuation of these coastal resources was done by White and Trinidad (1999). There are also several studies in the Philippines that dealt with the economic valuation of specific coastal habitats. This is discussed in the following section.

2.1 Mangroves

The Philippines has vast areas of mangrove forests, which totaled to 500,000 hectares during the early 1900s (Brown and Fischer, 1920). In Manila Bay alone, there were around 54,000 hectares in 1890 (PEMSEA and MBEMP TWG RRA, 2004). The direct economic values estimated for mangrove wood and fish products in the country have a combined range of US$ 253 to US$ 1,396 per hectare per year (Jansen and Padilla, 1996; Schatz, 1991 and Trinidad, 1993). However, at present, exploitation and conversion of mangrove areas to various uses, has decreased to127,610 hectares (FAO, 2003). This caused reduction in the total economic use value of mangroves in the country. Given this, various studies were conducted to value these resources and their accompanying losses in terms of economic benefits that would facilitate the evaluation of management alternatives for mangrove forests.

One of the mangrove forests in the country that received particular interest is the Pagbilao mangrove in Luzon. It comprises 56% of the total true mangrove areas in the Philippines and has the highest number of true mangrove species compared to other mangrove areas of the country. However, its area has declined in recent decades due to fishponds conversion.

A study was done to calculate the economic value derived from the Pagbilao mangrove and use these values to compare alternatives for its future use (Janssen and Padilla, 1996). The study specifically evaluated the conversion of 110.7 hectare strip of protected mangrove forest in the area. Eight alternatives were presented which ranged from complete preservation to intensive aquaculture. These alternatives were evaluated based on their economic value, social equity and sustainability. With respect to the valuation of uses, the main direct-use values identified in the study were uses derived from forestry, on-site fishery, aquaculture and tourism. On the other hand, indirect use values include uses from off-site fishery, shore protection and soil accretion.

Based on the results generated by the study, preservation of the Pagbilao mangrove forest has a total economic value and equity of US$ 59 per hectare per year whereas subsistence forestry and commercial forestry has a respective total economic value and equity of 183 and 208 US$ per hectare per year. On the other hand, semi-intensive aquaculture, which has the highest total economic value of US$ 6,778, got the lowest equity of US$ 3 per hectare per year.

2. 2 Coral Reefs

The Philippines has an estimated area of 27,000 km^2 of coral reefs. These resources provide significant economic benefits for the country. Around 10-30% of total fisheries production is derived directly from reef fisheries. (Ming et al, 2004) Recent valuation studies indicate that reefs in the whole country contribute an estimated value of US$ 1.35 billion to the national economy. A square kilometer of typical healthy reef in the Philippines with tourism potential was calculated to produce sustainable annual net economic revenue ranging from US$ 29,400 to US$113,000 from uses in fisheries, tourism, coastal protection, and aesthetic and biodiversity values (White et al, 1998).

In relation to this, there are studies that calculated the economic values of coral reefs in specific areas of the country. One of these studies was conducted in Apo Island. Preliminary data indicated a total economic value of US$ 400,000 in 2000. Another study was done in Olango Island in Cebu also calculated the benefits and costs of coral reefs and wetland management. (White et al, 2000).

Olango Island has a total land area of 1,041 hectares. The site is rich in reef and wetland resources having a 4,000 hectares combined area of coral reefs and seagrass beds. Given this large area, it is representative of many coastal areas in the country and in some parts of Southeast Asia.

The study introduced the Olango Island including its resources and economic make-up as part of coastal resource valuation. The economic values and net revenues were compared with the costs of improving the resource base and enhancing the incomes generated from fishing and tourism. These valuations were used to analyze and show the relatively high returns from making small investments in coastal resources management in the area.

The estimated direct use values of coastal resources in Olango Island Reef in terms of its current annual net economic revenue given an area of 40 km^2 ranged from US$ 1,532,000 to US$ 2,536,000. This set of net revenues was based on the relative condition of the coral reef for fisheries, tourism, and for the entire coral reef seaweed farming. On the other hand, the economic value of coastal resources with improved management was calculated to increase to US$ 1.1 million per year in five years.

3.0 MAJOR BAY-WIDE USES

There are generally four major uses of the Bay aside from habitat specific uses. Among these major uses or benefits are: a). off-shore fisheries, b). aquaculture/mariculture, c) tourism; and d) ports and harbors. These benefits comprise the major source of value for Manila Bay. The first part of this report discusses these bay wide uses or values. Most of these values are direct use values and thus, are the most tangible and obvious if one looks at valuation from a macro perspective.

3.1 Off-Shore Fisheries

3.1.1 Production and Value Trends

Manila Bay was once a thriving fishing ground in the country. However, over-fishing and pollution have caused a steady decline in fishery resources both in terms of quantity and composition of catch (PEMSEA and MBEMP TWG-RRA, 2004). BFAR conducted a trawl survey from November, 1992 to October, 1993 (BFAR 1995). Results of the trawl survey show a decrease in fish catch and an increase in the abundance of invertebrates (Table 8). Also reflected in Table 8 is a decrease in catch per unit effort (CPUE). This further supports the fact that off-shore fishery resources of Manila Bay have been over-exploited.

Table 8. Compilation of Information from Different Trawl Surveys in Manila Bay, Various Years.

Year	CPUE (kg/hr)	Composition (%)	
		Fish	Invertebrates
1947	44.0		
1948	45.8		
1957	16.2		
1958	13.3	81	19
1959	12.2		
1960	15.7	96	4
1961	13.6		
1962	16.3	91	8
1966	14.0		
1970	61.8		
1971	37.4		
1983	27.9	80	20
1986	14.0	36	64
1993	10.0	75	25

Source: BFAR, 1995

The valuation of off-shore fishery for this study will rely initially on published statistics collected from the Bureau of Fisheries and Aquatic Resources (BFAR) and the Bureau of Agricultural Statistics (BAS). BFAR and BAS have collected data on specific fishing grounds, including Manila Bay only up to 1995. No new Resource and Ecological Assessment has been published on Manila Bay aside from the MADECOR – National Museum study done in 1995. There is a recent (2003) stock assessment done by the National Marine Development Center of BFAR, but the data is yet to be made available as of this writing.

Commercial fishery production in Manila Bay accounted for an average of 2.8% of total national commercial fishing production from 1987 to 1995 (Table 9). However, from 1987 to 1995, the share of commercial fishing production of the Bay has been declining at a rate of 0.08% every year. We use this information to extrapolate the share of the Manila Bay fishing ground from 1996 onwards both in terms of value and quantity of production. The results of this extrapolation are also shown in Table 9. If the trend in the decline persists and no immediate intervention is done, then commercial fishing from the Bay can only be viable for the next 26 years. Also take note that the maximum yield could have been achieved around 1977 at 51,743.8 metric tons (MT) because after this year the commercial catch has been steadily declining.

On the other hand, the trend for Municipal Marine Fishery production and value from Manila Bay can be observed from Table 10. The trend seems to be the same as that of the Commercial Fishery. From the table it is evident that the highest yield from municipal marine fishery has been achieved in 1987. There has also been a steady decline at a rate of 0.08% per year from 1993 to 1995. Using this information we again extrapolate the share of Manila Bay municipal fishery from the National level (Table 10).

3.1.2 Net Value of Off-Shore Fishery

The trends in production and value of Commercial and Marine Municipal Fishery are gross values. However, the net value or net market value is more relevant for valuation. There are no published aggregate cost data. Therefore, to get the net value for off-shore fishery, it is necessary to assume a value for the cost of off-shore fishery.

Table 11 presents the revenue and cost data for coastal and commercial fishing establishments for the three regions surrounding Manila Bay. There has been a fairly constant cost and revenue in nominal terms. In terms of share, total costs accounts for, on average, 61% of total or gross revenue. We use this assumption in calculating the Net Value of Offshore Fishery. The result of this assumption is shown in Tables 12 and 13. Using this assumption, the **average**

net value of off-shore fishery is 572.6 million pesos. This would amount to **641.3 million pesos** if inflated to 2004.

Table 9. Commercial Fishery Production, Selected Years

Year	Total Production Philippines (MT) (a)	Total Value (in million pesos) (b)	Manila Bay Production (MT) (c)	Manila Bay Value (in million pesos) (d)	% Contribution of Manila Bay to Total National Production [(c)÷(a)] x 100
1971	382276	879.2	15951.48	409.81	4.17
1972	424754	1106	18113.49	418.81	4.26
1973	465442	1261.6	30683.31	647.43	6.59
1974	470675	2389.5	21310.13	444.65	4.53
1975	498617	2549	51743.8	1,019.17	10.38
1977	518165	3543.2	17882	338.93	3.45
1983	519316	4642.7	10271	194.24	1.98
1984	513335	6521.2	10826	207.12	2.11
1985	511987	7857.2	11391	174.81	2.22
1986	546230	9248	14053	237.93	2.57
1987	591,192.00	9,821.00	17,729.00	294.52	3.00
1988	599,995.00	10,272.00	18,053.33	309.08	3.01
1989	637,138.00	11,000.00	19,299.00	333.19	3.03
1990	700,564.00	12,400.00	21,220.00	375.59	3.03
1991	759,815.00	15,425.00	20,298.00	412.07	2.67
1992	759,851.00	16,801.00	19,678.17	435.10	2.59
1993	845,431.00	18,021.00	20,740.00	442.09	2.45
1994	885,446.00	20,714.00	26,222.00	613.43	2.96
1995	926,887.00	23,065.00	25,046.00	623.25	2.70
*1996	879,073.00	24,555.00	23,035.80	643.46	2.62
*1997	884,651.00	27,935.30	22,459.22	709.21	2.54
*1998	940,533.00	29,737.00	23,109.53	730.66	2.46
*1999	948,754.00	32,242.10	22,536.40	765.87	2.38
*2000	946,485.00	33,878.70	21,709.24	777.07	2.29
*2001	976,539.00	36,088.60	21,600.76	798.27	2.21
*2002	1,042,193.00	39,681.00	22,201.55	845.31	2.13

* - projected value
Source: BFAR, Philippine Fisheries Profile, various years

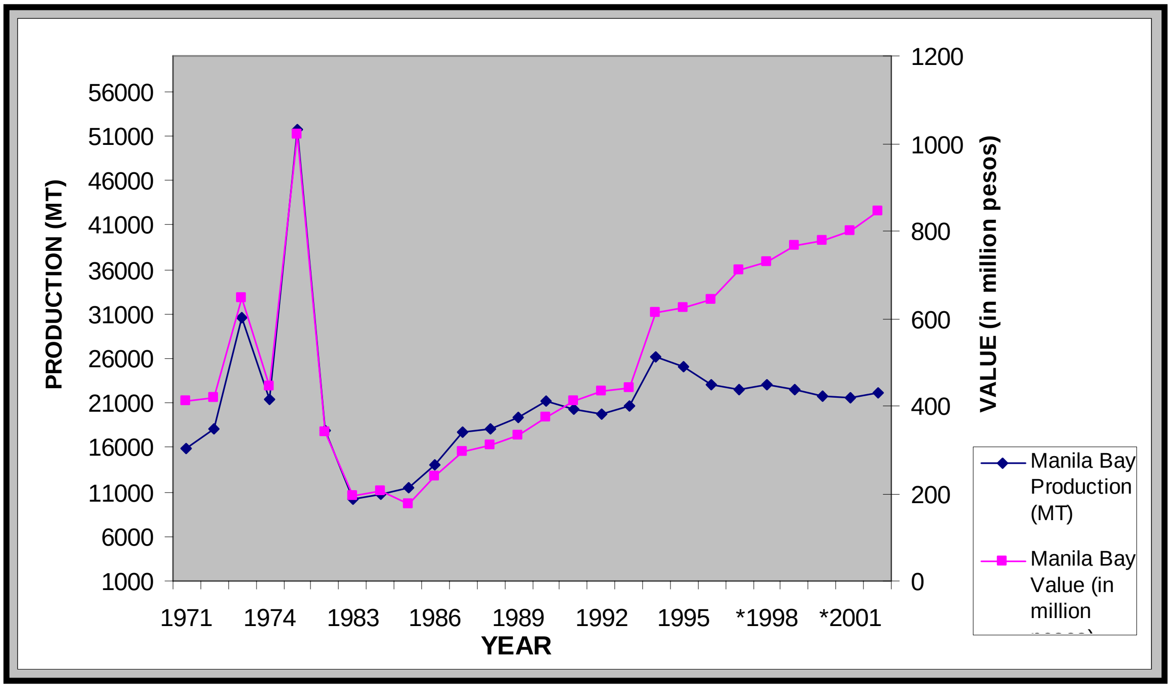


Figure 7. Commercial Fisheries Production and Value, Selected Years.

Table 10. Municipal Fishery Production, Various Years.

Year	Total Production Philippines (MT) (a)	Total Value (in million pesos) (b)	Manila Bay Production (MT) (c)	Manila Bay Value (in million pesos) (d)	% Contribution of Manila Bay to Total National Production [(c)÷(a)] x 100
1979	635,635	4,872.30	17,827	398.73	2.80
1980	647,284	5,410.40	14,588	320.41	2.25
1981	709,989	6,263.40	18,221	364.86	2.57
1982	708,016	6,487.80	18,803	377.57	2.66
1983	770,988	7,463.10	17,404	320.93	2.26
1984	790,157	8,605.85	18,532	333.44	2.35
1985	785,287	11,054.60	19,338	350.10	2.46
1986	807,272	12,986.53	16,534	291.18	2.05
1987	816,247	14,217.00	32,389	564.14	3.97
1988	838,153	13,026.59	32,024	543.20	3.82
1989	882,369	16,182.00	29,856	547.54	3.38
1990	895,040	16,736.00	25,054	468.47	2.80
1991	913,524	19,614.00	20,233	434.41	2.21
1992	854,687	19,444.00	13,934	317.01	1.63
1993	803,194	22,031.00	13,245	363.30	1.65
1994	786,847	24,475.00	12,750	396.59	1.62
1995	785,369	25,373.00	11,649	376.35	1.48
*1996	731,308	23,333.30	10,262	327.42	1.40
*1997	764,727	25,235.60	10,119	333.93	1.32
*1998	744,675	26,634.60	9,258	331.14	1.24
*1999	779,820	28,830.60	9,071	335.37	1.16
*2000	793,824	29,975.80	8,599	324.71	1.08
*2001	833,188	31,314.20	8,359	314.16	1.00

* - projected value
Source: BFAR, Philippine Fisheries Profile, various years

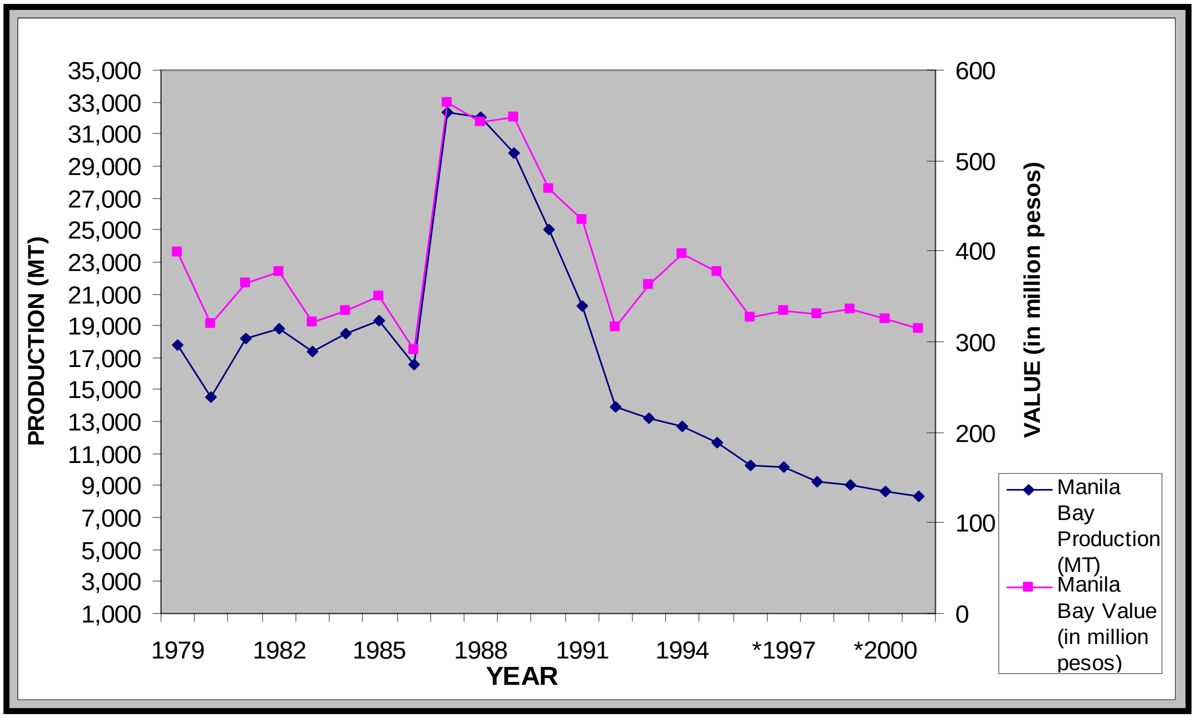


Figure 8. Municipal Fishery Production, Various Years

Table 11. Cost and Returns For Coastal and Ocean Establishments

Region	Total Revenues (a)		Total Cost (b)		% Share of Total Cost (b)/(a)*100		Average
	1994	1998	1994	1998	1994	1998	
NCR	2,910.2	3201.4	1,957.5	2,141.1	67	67	67
Region III	20.3	20.8	12.3	11	61	53	57
Region IV	38.3	437	25.3	241.7	66	55	61
						AVERAGE	61

Source: Census of Establishment (1994), Annual Survey of Establishments (1998)

Table 12. Value of Commercial Fishery Production for Manila Bay

Year	Manila Bay Gross Value (in million pesos)	Manila Bay Net Value (in million pesos)
1963	843.50	324.77
1964	480.52	185.01
1969	605.01	232.94
1971	409.81	157.79
1972	418.81	161.25
1973	647.43	249.28
1974	444.65	171.20
1975	1,019.17	392.41
1977	338.93	130.49
1983	194.24	74.79
1984	207.12	79.75
1985	174.81	67.31
1986	237.93	91.61
1987	294.52	113.40
1988	309.08	119.00
1989	333.19	128.29
1990	375.59	144.61
1991	412.07	158.66
1992	435.10	167.52
1993	442.09	170.21
1994	613.43	236.19
1995	623.25	239.97
1996	643.46	247.75
1997	709.21	273.06
1998	730.66	281.32
1999	765.87	294.88
2000	777.07	299.19
2001	798.27	307.35
2002	845.31	325.47
	AVERAGE	200.88

Source: BFAR. Philippine Fisheries Profile, various years
1990 data based on 1988 percentage distribution
1991 are not estimates
1993 are not estimates
No. of Commercial Vessels by Region
For 1992 onwards NCR not included
For 1995 onwards % share of Manila Bay is assumed to decrease by 8% per year
1992 data also estimated at 8% per year decline
Note: They stopped collecting data on statistical Fishing grounds after 1995

Table 13. Value of Municipal Fishery Production for Manila Bay

Year	Manila Bay Gross Value (in million pesos) (d)	Manila Bay Net Value (in million pesos)
1979	398.73	153.52
1980	320.41	320.41
1981	364.86	364.86
1982	377.57	377.57
1983	320.93	320.93
1984	333.44	333.44
1985	350.10	350.10
1986	291.18	291.18
1987	564.14	564.14
1988	543.20	543.20
1989	547.54	547.54
1990	468.47	468.47
1991	434.41	434.41
1992	317.01	317.01
1993	363.30	363.30
1994	396.59	396.59
1995	376.35	376.35
1996	327.42	327.42
1997	333.93	333.93
1998	331.14	331.14
1999	335.37	335.37
2000	324.71	324.71
2001	314.16	314.16
	AVERAGE	**369.12**

Source: BFAR. Philippine Fisheries Profile, various years
1990 data based on 1988 percentage distribution
1991 are not estimates
1993 are not estimates
No. of municipal Bancas: sum of motorized and non-motorized
1987 based on 1985 census data
Note: They stopped collecting data on statistical Fishing grounds after 1995

3.2 Aquaculture/ Mariculture

3.2.1 *Status and Trend in Production and Value from Aquaculture/ Mariculture*

The provinces around Manila Bay are one of the most productive aquaculture and mariculture areas in the country. Table 14 lists these provinces and the specific aquaculture species that it produces abundantly on average from 1997 to 2001. For some species like Tiger Prawn and Oysters, Manila Bay provinces account for almost an average of 50% of national production.

The trend in value and production of various aquaculture and mariculture species by region are shown in Tables 15, 16, and 17. We have included only production from milkfish, prawns, oysters, mussels and seaweeds. These species are marine or brackish water species and therefore fit to be grown in the aquatic environment of Manila Bay. Notable in the trends is the declining production of all species in the National Capital Region (NCR). The increase is more in terms of the value. This is quite different for both Regions III and IV which are experiencing increasing levels of production and value.

Table 14. Top Aquaculture Producing Provinces by Species, Philippines,1997-2001..

Species/ Province	Average Annual Production (M.T.)	% Share of Manila Bay to National Production
Milkfish		**22**
Bulacan	25,630	14
Pampanga	9,552	5
Bataan	6,887	4
Tiger Prawn		**47**
Pampanga	15,695	40
Bataan	2,571	7
Oyster		**48**
Cavite	3,630	24
Bulacan	3,578	24
Mussel		**31**
Cavite	4,500	31

Source: Fishery Statistics of the Philippines (1997-2001)

3.2.2 Net Value of Aquaculture/ Mariculture

Similarly, the data from the previous section are gross values. Assumptions regarding the costs of operating aquaculture again are needed. Our cost assumptions are based on the Cost and Return Studies on the various species. Table 18 outlines the information from these studies. We use this information to compute for the net value for Aquaculture/Mariculture. The net values for Aquaculture and Mariculture are given in Table 19, 20, and 21. **The average net value from 1995 to 2003 is around 4.7 Billion Pesos**. This value would be around **5.1 Billion pesos** if inflated to the year 2004. Also from the Tables, Region III has the highest average net value for Aquaculture and Mariculture and NCR has the lowest average net value. All values are in nominal terms.

Table 15. Total Value and Production of Selected Aquaculture Species, NCR (1995-2003)

	Tiger Prawn		Milkfish		Mud Crab		Mussel	
Species Cultured	Quantity (M.T.)	Value (000P)	Quantity (M.T.)	Value (000P)	Quantity (M.T.)	Value (000P)	Quantity (M.T.)	Value (000P)
2003			2,910.6	129,164				
2002	37.0	21,360	4,166.0	138,702				
2001			1,301.0	70,614				
2000	1.0	300	1,069.0	57,647				
1999	1.0	280	1,126.0	58,655				
1998	12.0	3,150	4,885.0	340,014				
1997	63.0	19,530	4,000.0	200,406			1	7
1996	73.0	22,320	4,675.0	280,372			5	30
1995	89.0	17,404	7,270.0	401,682	40	2,221	267	4,948

Source: Bureau of Agricultural Statistics

Table 16. Total Value and Production of Selected Aquaculture Species, Region III (1995-2003)

	Tiger Prawn		Milkfish		Mud Crab		Oyster		Mussel	
Species Cultured	Quantity (M.T.)	Value (000P)	Quantity (M.T.)	Value (000P)	Quantity (M.T.)	Value (000P)	Quantity (M.T.)	Value (000P)	Quantity (M.T.)	Value (000P)
2003*	14,806.8	5,108,952	59,599.4	3,427,685	2,617.2	652,600	5,827.0	35,288	390.0	1,828
2002*	15,161.0	5,444,558	66,102.0	3,795,967	2,510.0	564,085	3,765.0	26,489		
2001*	19,758.0	6,563,523	70,466.0	4,386,918	2,235.0	491,800	8,165.0	73,906		
2000*	19,113.0	5,468,287	46,046.0	2,867,945	2,302.0	484,381	2,910.0	18,331		
1999	18,458.0	5,257,909	34,245.0	2,107,342	2,238.0	439,699	1,845.0	11,976		
1998	19,467.0	5,506,097	32,121.0	1,854,522	2,105.0	419,093	2,478.0	6,701		
1997	18,421.0	5,745,809	37,583.0	2,337,169	2,086.0	401,822	2,491.0	12,174		
1996	24,693.0	6,094,685	34,143.0	2,245,466	976.0	178,134	2,162.0	8,252		
1995	25,591.0	6,177,432	37,571.0	2,140,205	1,056.0	221,381	2,115.0	17,007		

Source: Bureau of Agricultural Statistics

Table 17. Total Value and Production of Selected Aquaculture Species, Region IV (1995-2003)

	Tiger Prawn		Milkfish		Mud Crab		Oyster		Mussel		Seaweeds	
Species	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Cultured	(M.T.)	(000P)	(M.T.)	(000P)	(M.T.)	(000P)	(M.T.)	(000P)	(M.T.)	(000P)	(M.T.)	(000P)
2003	1,202.1	434,375	32,250.0	1,586,987	49.7	4,935	322.0	4,965	3,043.0	31,275	293,923.6	1,090,144
2002	1,342.0	439,887	21,780.5	1,220,925	51.0	4,609	164.0	3,906	1,938.0	27,525	217,357.0	897,408
2001	1,521.0	472,245	17,461.0	1,067,080	47.0	5,020	1,722.0	32,675	4,322.0	63,189	171,633.0	784,517
2000	1,587.0	436,882	26,517.0	1,551,368	31.0	4,778	2,737.0	41,938	6,628.0	77,872	168,756.0	659,342
1999*	1,853.0	548,903	28,772.0	1,611,893	33.0	4,260	5,143.0	106,282	5,100.0	71,792	125,685.0	496,597
1998*	1,739.0	584,497	30,467.0	1,882,954	57.0	13,920	4,452.0	89,095	4,430.0	39,702	143,042.0	347,544
1997*	1,828.0	494,287	25,654.0	1,435,250	3.0	261	4,096.0	21,000	2,021.0	17,751	164,997.0	429,332
1996*	1,590.0	359,205	22,803.0	1,453,490			2,398.0	7,138	1,049.0	10,497	180,438.0	488,055
1995*	2,095.0	500,402	21,564.0	1,253,684			563.0	4,492	803.0	9,105	103,925.0	263,439

Source: Bureau of Agricultural Statistics

Table 18. Cost and Returns for Selected Aquaculture Species

Resource	Gross Revenues (a)	Production Cost (b)	Net Income	Percentage [(b)/(a)]*100
MilkFish	74,124	32,202	41,922	43
Prawns	663,605	530,373	133,232	80
Oysters	50,932	17,543	33,389	34
Seaweeds	20,559	14,968	5,591	73

Source: National Statistics Coordination Board, 1999;
BAS, 2003. Costs and Returns for Milkfish Production; BAS, Fisheries Statistics of the Philippines

Table 19. Net Value of Selected Aquaculture Species, NCR (1995-2003)

YEAR	Tiger Prawn		Milkfish		Mud Crab	
	Net Value (Pesos)	Gross Value (000P)	Net Value (Pesos)	Gross Value (000P)	Quantity (M.T.)	Gross Value (000P)
2003	-		90,414.8	129,164		
2002	4,288.4	21,360	97,091.4	138,702		
2001	-		49,429.8	70,614		
2000	60.2	300	40,352.9	57,647		
1999	56.2	280	41,058.5	58,655		
1998	632.4	3,150	238,009.8	340,014		
1997	3,921.0	19,530	140,284.2	200,406		
1996	4,481.2	22,320	196,260.4	280,372		
1995	3,494.2	17,404	281,177.4	401,682	799.6	2,221
AVERAGE	**1,881.5**		**130,453.2**		**799.6**	

Source: Bureau of Agricultural Statistics

Table 20. Net Value of Selected Aquaculture Species, Region III (1995-2003)

YEAR	Tiger Prawn		Milkfish		Mud Crab		Oyster		Mussel	
	Net Value (Pesos)	Gross Value (000P)	Net Value (Pesos)	Gross Value (000P)	Net Value (Pesos)	Gross Value (000P)	Net Value (Pesos)	Gross Value (000P)	Net Value (Pesos)	Gross Value (000P)
2003*	1,025,724.5	5,108,952	2,399,379.5	3,427,685	234,936.0	652,600	23,133.4	35,288	1,198.4	1,828
2002*	1,093,104.1	5,444,558	2,657,176.9	3,795,967	203,070.6	564,085	17,365.1	26,489		
2001*	1,317,758.8	6,563,523	3,070,842.6	4,386,918	177,048.0	491,800	48,449.8	73,906		
2000*	1,097,868.2	5,468,287	2,007,561.5	2,867,945	174,377.2	484,381	12,017.1	18,331		
1999	1,055,630.6	5,257,909	1,475,139.4	2,107,342	158,291.6	439,699	7,851.0	11,976		
1998	1,105,459.3	5,506,097	1,298,165.4	1,854,522	150,873.5	419,093	4,392.9	6,701		
1997	1,153,586.3	5,745,809	1,636,018.3	2,337,169	144,655.9	401,822	7,980.8	12,174		
1996	1,223,630.1	6,094,685	1,571,826.2	2,245,466	64,128.2	178,134	5,409.7	8,252		
1995	1,240,243.2	6,177,432	1,498,143.5	2,140,205	79,697.2	221,381	11,149.1	17,007		
AVERAGE	**1,145,889.5**		**1,957,139.3**		**154,119.8**		**15,305.4**		**1,198.4**	

Source: Bureau of Agricultural Statistics

Table 21. Net Value of Selected Aquaculture Species, Region IV (1995-2003)

YEAR	Tiger Prawn		Milkfish		Mud Crab		Oyster		Mussel		Seaweeds	
	Net Value (Pesos)	Goss Value (000P)	Net Value (Pesos)	Gross Value (000P)	Net Value (Pesos)	Gross Value (000P)	Net Value (Pesos)	Gross Value (000P)	Net Value (Pesos)	Gross Value (000P)	Net Value (Pesos)	Gross Value (000P)
2003	87,209.5	434,375	1,110,890.9	1,586,987	1,776.60	4,935	3,254.9	4,965	20,502.7	31,275	305,240.3	1,090,144
2002	88,316.1	439,887	854,647.5	1,220,925	1,659.2	4,609	2,560.6	3,906	18,044.3	27,525	251,274.2	897,408
2001	94,812.6	472,245	746,956.0	1,067,080	1,807.2	5,020	21,420.4	32,675	41,424.2	63,189	219,664.8	784,517
2000	87,712.8	436,882	1,085,957.6	1,551,368	1,720.1	4,778	27,492.9	41,938	51,049.8	77,872	184,615.8	659,342
1999*	110,203.3	548,903	1,128,325.1	1,611,893	1,533.6	4,260	69,674.3	106,282	47,064.0	71,792	139,047.2	496,597
1998*	117,349.5	584,497	1,318,067.8	1,882,954	5,011.2	13,920	58,407.1	89,095	26,027.1	39,702	97,312.3	347,544
1997*	99,238.0	494,287	1,004,675.0	1,435,250	94.0	261	13,766.8	21,000	11,636.9	17,751	120,213.0	429,332
1996*	72,117.6	359,205	1,017,443.0	1,453,490			4,679.4	7,138	6,881.4	10,497	136,655.4	488,055
1995*	100,465.7	500,402	877,578.8	1,253,684			2,944.8	4,492	5,968.9	9,105	73,762.9	263,439
AVERAGE	**95,269.5**		**1,016,060.2**		**1,943.1**		**22,689.0**		**25,399.9**		**169,754.0**	

Source: Bureau of Agricultural Statistics

3.3 Ports and Harbors

Being in close proximity to Manila, which is the center of economic activity in the country, Manila Bay is one of the busiest shipping routes in the country. Because of this, ports and harbors abound around the coastal area of the Bay. There are four major ports in Manila Bay, most of which are located in the National Capital Region. These ports are the Manila South Harbor, Manila North Harbor, Manila International Container Terminal (MICT), and the Port of Limay in Bataan. Manila South and North Harbors are both passenger and container terminals while the MICT is a container port. These ports are all government owned and operated. Information on private ports is harder to get and thus, are not included in the valuation. The valuation only covered the ports of Limay, Manila South Harbor, and Manila North Harbor.

The gross revenues, total cost, and the net income from operation of these three ports are shown in Table 22 and Table 23. North harbor and Limay port data were added because prior to 1999 data for both ports were aggregated.

Gross revenues mainly come from wharfage dues. For Limay and North Harbor, wharfage dues contribute to roughly 52% of gross revenues or a total of 244 million pesos per year on average. While for the South Harbor, it was only 30% but it is still the biggest source of revenue for this port. In terms of cost, the highest outlay is for the depreciation of operating assets. This item amount to 88 million pesos (or 43.5% of total cost) on average. On average, the North and Limay ports earned a net income of 221 million pesos while for the South Harbor it was higher at 645 million pesos. However, the net income of commuter shipping lines and cargo vessels were not included in the calculation. Furthermore, no information was available for private ports around Manila Bay. The study took the revenues from government controlled ports as a proxy for the value of the use of Manila Bay as a shipping route. In sum the value of Manila Bay as a major port area is on average **865.9 million pesos per year.**

Table 22. Profit and Loss Statement, PMO North Harbor and Limay for the Year 1995 to 2004 (in million pesos)

ITEM	YEAR										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	AVERAGE
REVENUE											
Port Dues	11.13	14.21	18.73	25.44	25.37	32.85	37.80	38.72	44.03	49.54	29.78
Dockage - Berthing	9.41	14.69	17.47	20.29	21.27	28.71	28.79	31.03	29.06	42.41	24.31
Dockage - Anchorage	0.61	0.60	2.47	5.81	3.77	2.48	5.40	7.34	4.99	5.13	3.86
Usage Fees	20.50	24.70	26.00	24.15	23.34	22.30	26.65	34.01	35.99	33.36	27.10
Lay-up Fees	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wharfage Dues	177.45	222.66	235.16	244.90	248.52	252.37	259.04	261.83	256.89	280.48	243.93
Storage Charges	3.26	4.41	5.91	5.47	9.91	8.67	6.21	8.02	7.47	2.10	6.14
Arrastre/Stevedoring	47.98	53.92	64.08	71.44	76.77	85.49	90.79	84.11	74.44	67.10	71.61
Non-Trad. Income	37.81	24.73	47.29	50.77	59.26	62.84	71.43	83.12	87.40	85.52	61.02
Pilotage	0.00	0.10	0.06	0.05	0.12	0.30	1.37	1.71	2.61	2.78	0.91
Gross Revenues	308.15	360.02	417.17	448.32	468.33	496.01	527.48	549.89	542.88	568.42	468.67
OPERATING EXPENSES											
Personal Services	41.47	59.82	77.07	77.35	77.61	77.39	74.61	78.11	90.10	80.19	73.37
R/M - Port Facilities	2.18	4.69	8.66	5.46	19.20	19.05	31.04	7.25	34.77	23.66	15.60
Deprn. - Oprtg. Assets	23.84	62.83	51.07	50.79	78.40	275.53	84.51	102.09	105.02	55.28	88.94
Dredging	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Admin. Costs	11.49	11.55	17.02	14.32	17.95	27.18	25.72	57.04	60.80	52.51	29.56
Total Operating Exp.	78.98	138.89	153.82	147.92	193.16	399.15	215.88	244.49	290.69	211.64	207.46
NET OPERATING INCOME	229.17	221.13	263.35	300.40	275.17	96.87	311.59	305.39	252.19	356.78	261.20
Less: Other Charges											
Interest on Loans	42.06	46.84	44.92	39.34	58.85	41.54	56.69	40.48	19.83	15.67	40.62
Net Income (Loss)	**187.11**	**174.29**	**218.43**	**261.06**	**216.32**	**55.33**	**254.90**	**264.91**	**232.36**	**341.11**	**220.58**

Table 23. Profit and Loss Statement, South Harbor for the year 1995 to 2004 (in million pesos)

ITEM	YEAR										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*	AVERAGE
REVENUE											
Port Dues	-	58.98	60.61	67.49	71.46	73.45	81.10	82.37	82.29	57.73	70.61
Dockage Fees	-	141.61	117.92	96.37	99.04	99.63	99.52	108.80	95.08	60.60	102.06
Usage Fees	-	8.15	8.29	9.37	9.81	11.83	15.30	10.08	19.45	13.83	11.79
Lay-up Fees	-										
Wharfage Dues											
Import	-	366.12	329.31	206.62	247.41	245.09	229.79	231.15	221.48	144.13	246.79
Export	-	6.74	6.86	7.33	7.87	9.03	9.29	12.00	9.87	9.33	8.70
Domestic	-	7.67	7.70	8.06	7.94	7.59	10.63	13.70	15.81	14.79	10.43
Storage Charges	-	21.78	55.00	55.00	55.00	55.00	55.00	55.00	55.00	41.25	49.78
Pilotage	-	0.56	0.35	0.10	0.25	0.11	4.35	3.75	4.03	1.13	1.63
Share in Arr/Stev											
Fixed Fee	-	152.06	164.33	237.35	227.59	248.60	294.42	262.01	247.42	192.92	225.19
Variable Fee	-	189.42	181.89	123.62	159.11	199.60	221.81	26.93	312.81	231.19	182.93
Other Income	-	33.44	34.51	39.70	41.11	49.36	56.61	53.76	38.53	26.00	41.45
Total Port Revenue		986.53	966.76	851.00	926.60	999.29	1077.82	1109.93	1101.76	792.90	881.26
OPERATING EXPENSES											
Personal Services	39.38	52.99	71.01	69.43	68.67	64.41	66.77	61.26	65.85	40.03	59.98
R/M - Port Facilities	5.85	10.01	11.74	6.27	16.09	22.56	9.30	18.02	14.02	5.49	11.93
M.O.O.E.	4.86	6.76	9.47	9.18	10.63	16.19	17.95	19.84	22.75	9.58	12.72
Total Operating Exp.		69.76	92.21	84.88	95.39	103.16	94.02	99.12	102.62	55.09	84.63
NET OPERATING INCOME	-50.08	916.77	874.56	766.12	831.20	896.13	983.80	1010.81	999.14	737.81	796.63
Less: Other Charges											
Bad Debts	0.37		0.07	0.29	0.15	0.43	1.06	7.70	7.77		2.23
Depreciation Expense	78.83	82.69	87.29	86.98	127.38	526.27	155.58	145.08	130.01	75.27	149.54
Total Expense	79.21	82.69	87.36	87.28	127.52	526.69	156.65	152.78	137.78	75.27	151.32
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NET INCOME (LOSS)	**-129.29**	**834.08**	**787.19**	**678.84**	**703.68**	**369.44**	**827.16**	**858.03**	**861.35**	**662.54**	**645.30**

3.4 Tourism

Specific areas around Manila Bay are also prime tourist destinations, as the bay is quite known for its picturesque sunset. In Manila alone, a number of hotels and restaurants along Roxas Boulevard have sprung up to cater to tourists in the area. Another famous destination is the Corregidor Island which is a historical landmark found at the entrance to Manila Bay. Table 24 shows the total revenues and costs, as well as employment of selected resorts and hotels in NCR, Region III and Region IV.

The total revenues for the hotels in NCR are computed as follows. First, occupancy rates were multiplied by the number of rooms times 365 days. This value represents the total number of rooms that were occupied for the whole year. This number was then multiplied by the standard room rates (the cheapest in the price list) under the assumption of single occupancy per room. This is the estimated total revenue for the year. The cost is assumed to be around 30% of Total Revenue. This was based on the Total Cost and Total Revenues of Corregidor Island Resort. Aside from the hotels, there were also some resorts in Cavite. To calculate the net profits, it was assumed that the taxes they pay are 5% of their net profit. With these assumptions **the total net revenue from tourism industry is around 1.97 billion in 2004.** This figure is clearly an underestimate since only a handful of resort and hotels were included. There are many other resorts and recreation sites that were not included. Refinements to these figures should include actual figures on total revenues and total costs as well as a complete listing of all resorts, hotels, and recreation sites around Manila Bay. If possible a contingent valuation study should be conducted for well known recreation activities such as sunset and bird watching.

Table 24. Total Revenues and Costs for Selected Hotels and Resorts in NCR, Region III and Region IV, 2004.

Location	No. of Rooms	Occupancy Rate	Total No. of Visitors	Total Revenues	Total Costs	Net Revenues	Employment
NCR							
Selected Hotels	3,070	613	644,212	5,952,618,150	4,166,832,705	1,846,763,484	2,491
Bataan							
Selected Resorts	-	-	48,301	44,083,663	13,225,099	30,858,564	
Cavite							
Selected Resorts (Kawit)	-	-	135,844	124,453,655	43,918,742	80,534,913	363
Selected Resorts (Cavite City)	-	-	-	709,300	220,056.00	496,510	
Selected Resorts (Naic)	-	-	-	898,505	269,551.43	628,953	
Selected Resorts (Tanza)	-	-	-	1,044,947	313,483.95	731,463	
Selected Resort (Ternate)	-	-	-	13,307,755	3,992,327.00	9,315,428	
TOTAL				6,137,115,974	4,228,771,964	1,969,329,315	

Source: Department of Tourism and Provincial Data from Cavite
Major Hotels around Roxas Boulevard (2004)
Selected Resorts in Cavite (2004)

4.0 HABITAT-SPECIFIC VALUES

4.1 Mangrove Ecosystems of Manila Bay

4.1.1 Total Use Value of Mangrove Ecosystem in Manila Bay

Table 25 shows the value of the various products and services that mangrove ecosystems provide as estimated by various authors. The value of direct uses from mangrove varies by institutional arrangements. If institutions do not promote sustainable use then the value of direct uses decline. Unmanaged stock, which is akin to an open access situation, produces the lowest direct use values while the highest direct value is obtained when mangroves are managed as plantations (sustainable use). The loss in mangrove production due to unsustainable use is on average around 2% (unmanaged vs. natural growth) to 6% (unmanaged vs. plantation). This means that the *institutional loss* to direct use values is around 2 to 6%. Also evident from the table is the fact that indirect uses (or ecological function) accounts for 97% of the total use value of mangroves.

Using the values from Table 25, we can calculate a rough estimate of the *total use value* of the mangrove ecosystem of Manila Bay. Table 26 and Table 27 show the Total Use Value of the mangrove ecosystem for Manila Bay for various assumptions on the institutional structure governing resource use. Then the **current total use value** of mangroves would be **169.1 million pesos.** Ninety five percent (95%) of this total value can be attributed to the ecological functions of the ecosystem. On the other hand, if we assume that the system will be unmanaged or will be under open access pressure then the total use value of mangrove habitats would be **159.3 million pesos** or a 6% decline in the total use value.

Table 25. Direct and Indirect Use Values of Mangroves

	Pagbilao Jansen and Padilla (1996)	ADB values (1990)	Primavera	White and Cruz Trinidad (mangrove plantation)	White and Cruz Trinidad (mangrove natural)	White and Cruz Trinidad (mangrove unmanaged)	Melana et. al. (various citations)	Melana et. al. (various citations)	Preservation option Pagbilao 1998	Subsistence Forestry Pagbilao 1998	Commercial Forestry Pagbilao 1998
	Peso/ ha.	Peso/ ha.	Peso/ ha.	Peso/ ha.	Peso/ ha.	Peso/ ha.	Peso/ ha.		Peso/ ha.	Peso/ ha.	Peso/ ha.
Forestry	3,775	1,081	3,120	3,120	1,800	840	10120 - 55840			125	150
Fisheries	1,490	3,555	10,760	10,760	10,760	10,760			58	57	57
Local uses		2,354									
SUB TOTAL (DIRECT USES)	**5,265**	**4,636**	**13,880**	**13,880**	**12,560**	**11,600**			**58**	**182**	**207**
Purification/ Waste treatment							267,840	267,840			
Nursery Service							6,760	6,760			
Fertilizer/ Fish Food							18,640	18,640			
Disturbance regulation							73,560	73,560			
Raw materials							6,480	6,480			
Recreation							26,320	26,320			
SUB TOTAL (INDIRECT USES)	**0**	**0**	**0**	**0**	**0**	**0**	**399,600**	399,600	**0**	**0**	**0**
TOTAL	**5,265**	**4,636**	**13,880**	**13,880**	**12,560**	**11,600**	**399,600**	399,600	**58**	**182**	**207**

Table 25. (continued)

	Semiintensive Aquaculture Pagbilao 1998	Alan T. White, Michael Ross, Monette Flores		Francisco 1992 Mangrove Plantation	Francisco 1992 Naturally Regenerated	Francisco 1992 Unmanaged understocked stands	AVERAGE	AVERAGE (Unmanaged)	AVERAGE (Natural)	AVERAGE (Plantation)
	Peso/ ha.	Peso/ ha.		Peso/ ha.	Peso/ ha.	Peso/ ha.	Peso/ ha.	Peso/ ha.	Peso/ ha.	Peso/ ha.
Forestry	0	1,440	1,920	3,900	2,250	1,050	1,809.31	863.75	2,025.00	2,980.00
Fisheries	3	19,200	24,000	13,450	13,450	13,450	8,454.29	10,866.75	12,105.00	16,070.00
Local uses							2,354.00			
SUB TOTAL (DIRECT USES)	**3**	**20,640**	**25,920**	**17,350**	**15,700**	**14,500**	**10,263.59**	**11,730.50**	**14,130.00**	**19,050.00**
Purification/ Waste treatment							267,840.00	267,840.00	267,840.00	267,840.00
Nursery Service							6,760.00	6,760.00	6,760.00	6,760.00
Fertilizer/ Fish Food							18,640.00	18,640.00	18,640.00	18,640.00
Disturbance regulation							73,560.00	73,560.00	73,560.00	73,560.00
Raw materials							6,480.00	6,480.00	6,480.00	6,480.00
Recreation		5,616	6,768				12,901.33		5,616.00	16,544.00
SUB TOTAL (INDIRECT USES)	**0**	**5,616**	**6,768**	**0**	**0**	**0**	**386,181.33**	**373,280.00**	**378,896.00**	**389,824.00**
TOTAL	**3**	**26,256**	**32,688**	**17,350**	**15,700**	**14,500**	**396,444.93**	**385,010.50**	**393,026.00**	**408,874.00**

Table 26. Direct and Indirect Use Values of Mangroves, Manila Bay, 2005 (Unmanaged)

Province	Area (ha.)	Direct Use Values (peso)	Indirect Use Values (peso)	Total Use Values (peso)
BATAAN	135.3	1,587,137	50,504,784	52,091,921
PAMPANGA	219.54	2,575,314	81,949,891	84,525,205
BULACAN	10	117,305	3,732,800	3,850,105
METRO MANILA	24	281,532	8,958,720	9,240,252
CAVITE	24.85	291,503	9,276,008	9,567,511
TOTAL	**413.69**	**4,852,791**	**154,104,915**	**159,274,994**

Table 27. Direct and Indirect Use Values of Mangroves, Manila Bay, 2005 (Sustainable Use)

Province	Area (ha.)	Direct Use Values (peso)	Indirect Use Values (peso)	Total Use Values (peso)
BATAAN	135.3	2,577,465	52,743,187	55,320,652
PAMPANGA	219.54	4,182,237	85,581,961	89,764,198
BULACAN	10	190,500	3,898,240	4,088,740
METRO MANILA	24	457,200	9,355,776	9,812,976
CAVITE	24.85	473,393	9,687,126	10,160,519
TOTAL	**413.69**	**7,880,795**	**161,266,291**	**169,147,085**

4.2 Coral Reefs

4.2.1 Background: Status of Coral Reefs in Manila Bay

There has been a general decline in the areal extent of coral reef systems in Manila Bay, but there is no estimated figure for this (PEMSEA and MBEMP TWG RRA, 2004). Most of these systems can be found in some portions of Bataan, Corregidor Island, and Cavite. A resource and ecological assessment (REA) study of Manila Bay between 1992 and 1993 showed that there is 20% live coral cover in Mariveles, Bataan; 40 to 80% live cover in Limbones Cove, Cavite; and 20% live cover in Corregidor Island. Aside from this there are also artificial reefs in the vicinity of Limay, Bataan. These artificial reefs are mostly made out of tires and bamboo.

Another study by Bonga et. al. (1996) [as cited in PEMSEA and MBEMP TWG RRA, 2004] has shown that live coral cover ranged from 10.9 to 70.9%. The coral cover in Corregidor and Cavite has remained roughly the same as the 1993 REA. For Cavite, the Calumpang marine reserve had 82.5% live coral cover, while in Corregidor the live coral cover is around 26.3%.

4.2.2 Coral Reefs Value in the Philippines: A Review of Literature

Aside from the REA studies, no study has looked at the direct and indirect uses of coral reefs in Manila Bay. Furthermore, there has been no actual or estimated areal extent as mentioned in the previous section. This dearth of information poses a big obstacle in the economic valuation of coral reef systems in Manila Bay. However, there have been a number of studies that have valued coral reef systems in the Philippines. Table 28 summarizes the values associated with the direct and indirect uses, as well as non use values of coral reef ecosystems.

The values in Table 28 represent a reef with tourism potentials. The direct use value for fisheries is derived under the assumption that the average production range is around 7 to 18 mt/km^2/yr. This assumption is higher compared to the annual fish production of reefs systems in Manila Bay. The computed annual fish production for Manila Bay reef systems is within the range of 0.99 to 3.77 mt/km^2/yr. Thus, the value of annual fish production in Manila Bay is roughly 14 to 21% of the values in literature. If we assume that the live fish trade is also consistent with these figures then we can have a rough estimate of **the value of annual fish production in reef systems in Manila Bay of around $18 to $64/ha./yr. (or 900 pesos to 3,200 pesos/ha./yr. if $1=50 pesos)**. This is of course under the notion that the estimated annual fish production remains constant every year.

The indirect use of coral reefs that has been analyzed in the Philippines is based largely on its shoreline protection and tourism value. The shoreline protection value is based on Cesar (1996) for Indonesian coral reefs. The actual value for Manila Bay should be adjusted to take into account differences in erosion rate and the development rate of the shoreline. For instance, coral reef systems around Cavite where lots of beaches are located will have a higher value. The tourism values are derived based on the assumption that there is an equal number of tourists (600 to 800) who will reside in the resorts and tourists who simply use the amenities/ facilities of recreation sites near the reef systems. The Manila Bay reef systems have not been known for tourist attractions. Thus, if we base our valuation on current rather than potential use, then the indirect use value for Manila Bay will be solely coming from its protective or wave stabilizing function. Of course, a lot have been left out in the valuation literature. One very important function that is not accounted for in the literature is its refugia or life support function. We cannot estimate this with the current information at hand.

With these assumptions the **annual value for Coral Reef systems in Manila Bay is roughly around 8,410 to 10,685 pesos/ hectare**. This estimate however, is an underestimate because we have not taken into account the other functions of reef systems and we have assumed current rather than potential use.

4.2.3. Valuing Coral Reefs: The Case of Carabao Islands, Maragondon, Cavite

A recent study by BFAR, NGOs and the LGU of Cavite surveyed benthic life forms around Carabao Island Reef Fish Sanctuary in Maragondon, Cavite. Although there were also other sites that were surveyed, there were no area estimates of the coral reef or fish sanctuary in these sites. The results of the survey are shown in the following table

Based on Table 29, the coral cover for the Carabao Island in Maragondon, Cavite is 65.6%. This means that there is still a good coral cover for the fish sanctuary. The fish sanctuary is around 56.8 hectares, while the estimated coral cover in terms of area is around 37.25 hectares. Thus, the total value of this coral reef area is around **398,010 pesos per year** or **0.40 million pesos per year**. This value was obtained by multiplying the assumed high or upper bound value of coral reefs from the previous section with the area estimate.

Table 28. Estimated Total Economic Value of Coral Reefs for Manila Bay

Location	White et. al.(1998) Olango Island, Cebu		White et. al. (2000) Philippines (a)		AVE.	AVE.	AVE	Estimated Value for Manila Bay	
	Low	High	Low	High		Low	High	Low	High
	US $/ ha/ yr	US $/ ha/ yr	US $/ ha/ yr	US $/ ha/ yr	US $/ ha/ yr	US $/ ha/ yr	US $/ ha/ yr	US $/ ha/ yr	US $/ ha/ yr
Direct Use	**60**	**100**	**200**	**550**	**228**	**130**	**325**	**18**	**64**
Fishery	45	70	150	450	179	98	260	14	55
Live fish export	15	30	50	100	49	33	65	5	9
Indirect Use	**280**	**445**	**45**	**250**	**255**	**163**	**348**	**150**	**150**
Tourism on site	40	65	20	200	81	30	133		
Tourism off site	240	380	25	50	174	133	215		
Coastal protection			50/km/yr	250/km/yr	150			150	150
TOTAL USE VALUE	**340**	**545**	**245**	**800**	**482.5**	**293**	**673**	**168**	**214**
Non Use Value			**24**	**80**	**52**	**24**	**80**		
Aesthetic/ biodiversity			24	80	52	24	80		
TOTAL ECONOMIC VALUE	**340**	**545**	**269**	**880**	**535**	**317**	**753**	**168**	**214**

Table 29. Benthic Life Forms in Carabao Island Reef, Maragondon, Cavite

Benthic Life Form	Percent Cover
Hard Corals	
Acropora	2.10
Non-Acropora	55.80
Dead Seleractinia	17.32
Algae	0.00
Other Fauna	
Soft Corals	7.68
Sponge	0.80
Zoanthids	0.00
Others	5.04
Abiotics	11.26

Source: Provincial Government of Cavite

5.0 SUMMARY OF INITIAL VALUATION

The results of the initial valuation of Manila Bay are summarized in Table 30. The partial **Total Use Value for Manila Bay in 2004 is around 8.3 Billion pesos (4.9 Billion pesos, 1994 real prices)**. This value does not include values from seagrass and seaweed beds because there are no studies related to these habitats in Manila Bay. Thus, we do not have any information on the areal extent, and assumptions for valuation. Furthermore, there are no data related to the salt beds (which used to be abundant in Manila Bay) and area of coral reefs, except for those found in Carabao Island in Cavite. Information on migratory birds is available, but there are no available studies on their valuation. The mangroves, mudflats and swamps are key feeding and roosting grounds for these birds. Another limitation of the current study is that option and non-use values were not estimated. Therefore, future refinements could focus on these values.

Table 30. Summary of Initial Use Values for Manila Bay

Valuation Item	Net Value	Units	Assumptions	Remarks
I. Major Bay-wide Use Values				
A. Off Shore Fisheries	641,300,800[a] (360,281,348)	Average Peso/ year	Cost is 61% of Gross Value; Production and value from Manila Bay from 1996 onwards computed from an average decline of 0.08% per year.	over estimate
B. Aquaculture/ Mariculture	5,069,555,488[a] (2,848,064,881)	Average Peso/year	Includes only crabs, milkfish, seaweeds, oysters, and mussels	over/under estimate
C. Ports and Harbors	865,884,407 (486,451,914)	Average peso/ year	Net income from Limay, North Harbor and South Harbos	underestimate
D. Tourism	1,969,329,315[a] (1,106,364,784)	Peso	Total Revenues estimated from occupancy rates, Total cost 30% of Total Revenues. Only a handful of resorts and hotels were included	underestimate
II. Habitat Specific Values				
A. Mangrove Habitats				
Direct Use Value	7,880,794 (4,427,412)	Average Peso/year	Secure Property Rights	underestimate
	4,852,791 (2,726,287)	Average Peso/year	Open Access	underestimate
Indirect Use Value	161,266,291 (90,599,040)	Average Peso/year	Secure Property Rights	underestimate
	154,422,203 (86,754,047)	Average Peso/year	Open Access	underestimate
B. Coral Reefs				
			Low: 8,410 pesos/ha/year	over/under estimate
			High: 10,685 pesos/ha/year	over/under estimate
Carabao Island	398,010 (223,601)	Peso/ year		underestimate
C. Seagrasses and Seaweeds	No data yet		No data yet	
D. Mud Flats	Included in Mangrove valuation			underestimate
Total Use Value	**8,315,251,142 (4,896,412,980)**	**Does not include all coral reefs, seagrasses, seaweeds and salt beds**		

Note: Values in parentheses are at 1994 real/constant prices (in peso).
a - inflated to year 2004

Table 31. Other Components of the Total Economic Value of Manila Bay

Type of Value		Methodology
Direct Use		
Non-Consumptive	Aesthetic Value	Contingent Valuation Method, Choice Modeling
Indirect Use		
Ecological Functions	Life Support/ Habitat	Shadow Cost
	Carbon Storage	Shadow Cost
	Carbon Sequestration	Shadow Cost
Option Value	Biodiversity	Contingent Valuation Method
	Genetic Material	Contingent Valuation Method
	Endangered Species	Contingent Valuation Method
Non Use Values	Existence Value	Contingent Valuation Method
	Bequest for Humanity	Contingent Valuation Method

III. VALUE OF DAMAGES

1.0 INTRODUCTION

The amount of economic activity around Manila Bay has resulted into high levels of water pollution. This has undoubtedly affected the state of well being of the inhabitants and the natural systems around the area. Furthermore, extraction beyond the regenerative capacity of these natural systems has resulted into rapid degradation. This study outlines the compounded effect of these risk factors on natural habitats and on human health. In particular, the study aims to value the health damages from waterborne pollution and the socio-economic impact of the degradation of natural systems, in particular mangroves and mudflats.

Copper and Freeman (1991) identified five costs associated with the health effects of water pollution:

a) foregone earnings or productivity losses due to incapacity to work
b) risk due to premature death
c) medical expenses for the treatment of pollution-induced diseases, including the opportunity cost of time spent in obtaining treatment
d) defensive or averting expenditures to prevent pollution induced diseases.
e) disutility due to discomfort from illness and lost opportunities for leisure activities

This study was able to capture (a) and (b) through the use of the attribution factors and available health and demographic statistics. Items (c) and (d) can be obtained through statistical methods, but these were not estimated in this study due to lack of information/related studies. Item (e) can only be obtained through survey-based methods like CVM, which was not undertaken.

2.0 HEALTH DAMAGES – MORBIDITY

2.1 Incidence of Water Pollution-Related Morbidity Cases

Water pollution reduces both the quality and extent of human life. It reduces the capacity of people to work and earn effectively, while complications from diseases may result to death and thus, permanent reduction in earning capacity. Therefore, pollution affects the health and quality of life of the population. These translate into economic losses in terms of reduced income of the working population.

To quantify these losses, the study focused on the effects of the following waterborne diseases: diarrhea, typhoid, infectious hepatitis, and poliomyelitis. Water pollution is a major factor for the incidence of these diseases. Attribution factors were provided by epidemiologists and health experts from the College of Public Health, at UP Manila (Ebarvia, 1994 and Cortez et. al., 1996).

The incidence of morbidity cases were taken from various Philippine Health Statistics reports which covered the period from 1996 to 2002. Published data from other years were not considered because they were not disaggregated by age groups, sex, and province. Furthermore, only age groups above 15 years old were considered because this is the legal working age in the country. The trend in morbidity incidences are shown in Appendix Tables 1A to 1J.

Diarrhea is the most prevalent waterborne disease in Manila Bay. This is true for the whole study area, which includes Navotas, Las Piñas, Parañaque, Bataan, Bulacan, Pampanga, Nueva Ecija, Rizal, Laguna, and Cavite (or the entire watershed area of Manila Bay). Typhoid and paratyphoid had the next highest incidence. The highest recorded incidence for these two diseases occurred on 1998 and 2001 respectively. For these years, there were a total of 56,390 cases of diarrhea and 517 cases of typhoid and paratyphoid. Pampanga had the highest incidence of diarrhea while Bulacan had the highest incidence of typhoid and paratyphoid.

The demographic trends in the incidence of the diseases are shown in Appendix Tables 2A to 2F. Demographically, in general, the male population was more affected by water borne diseases. However, women were more prone to suffer from diarrhea. For instance, in 1998, 82% of all incidences of this disease were from the women population. In contrast during the same year, incidence of other diseases was mostly from the male population (typhoid and paratyphoid (58%), infectious hepatitis (67%). In terms of age, all diseases occurred for people between the ages of 15 to 49. From the tables it can be gleaned that 70% of incidence of all diseases came from this age group.

2.2 Cost of Morbidity

The previous paragraphs discussed the general trend in the incidence of waterborne diseases around Manila Bay. These cases redound to economic impacts because they reduce the effective working time of the labor force due to absences or reduced quality of work. Furthermore, the cost of treating these diseases is often very high. To quantify the value of work loss days, first the number of employed morbidity cases was estimated using the following formula (ENRAP, 1994):

$$M_p = N_{15 \leq age \leq 65} \times LFPR \times ER \times M_{p\%}$$

where:

M_p	=	estimated no. of morbidity cases attributed to water pollution for employed persons
$N_{15 \leq age \leq 65}$	=	number of morbidity cases for ages between15 and 65 years old
LFPR	=	Labor force participation rate (see Appendix Table 10A for LFPR assumptions)
ER	=	employment rate (see Appendix Table 10B for ER assumptions)
$M_{p\%}$	=	% morbidity cases attributable to pollution

Estimation of the physical effects of pollution usually requires a dose-response function. Since no dose-response function can be found for physical health effects of water pollution, this study used instead the attribution factor approach to adjust the number of cases that can be attributed to water pollution. This approach recognizes the fact that although water pollution is a major cause, not all of the morbidity cases can be attributed solely to it. Table 32 shows the attribution/adjustment factors ($M_{p\%}$) used for the study. The adjusted morbidity cases are outlined in Appendix Tables 3A to 3J.

Table 32. Pollution Attribution Assumptions

DISEASE	FACTOR
Schistosomiasis	100
Diarrhea	60-75
Typhoid and Paratyphoid	60-75
Poliomyelitis	70
Infectious Hepatitis	50

Source: ENRAP-III,1996

An employed person suffering from waterborne disease cannot usually work or experiences a reduction in the quality of his/her work. Thus, each adjusted employed morbidity case means a certain number of days of restricted activity or absence from work. The assumptions on the number of restricted activity days (RAD) per incidence for each waterborne disease are shown in Table 33. Again these assumptions were based on health expert interviews (ENRAP III, 1996)

Table 33. Restricted Activity Days

DISEASE	RAD
Schistosomiasis	49
Diarrhea	3
Typhoid and Paratyphoid	7
Poliomyelitis	7
Infectious Hepatitis	7

Source: ENRAP III, 1996

Multiplying the RAD assumptions with the adjusted employed morbidity cases results into the total excess work loss days for each disease in each province/ municipality (see Appendix Tables 4A to 4J). In equation form, the total excess work loss days can be computed as:

Total Excess Work Loss Days (TWLD) = RAD x M_p

where:

M_p = estimated no. of morbidity cases attributed to water pollution for employed persons

RAD = Restricted Activity Days per incidence

Finally, the cost of morbidity can be computed by multiplying the Total Excess Work Loss Days with the average earnings of an individual. This can be expressed as:

Cost of work loss days = TWLD x (Y_m/ D_w)

where:

TWLD = total excess work loss days

Y_m = average monthly earnings (see Appendix Table 10C for Y_m assumptions)

D_w = no. of working days per month (assumed to be 22 days)

The cost of morbidity in terms of income loss is shown in Table 34 and Table 35. Consistent with the trend in the incidence of morbidity, the highest income loss was due to diarrhea. Although the RAD for diarrhea was the lowest among the diseases, it had the highest incidence among the working population around the Bay. For the years included in the study, income loss due to diarrhea amounted to, on average, 15.2 million pesos per year (96%).

Among the provinces around Manila Bay, NCR had the highest income loss due to water pollution. Within NCR, Manila had the highest income loss at 4.3 million pesos per year. The working population of this province lost a yearly average of 7.1 million pesos. For the whole Bay, the working population lost on average, **15.8 million pesos a year** because of water pollution-related diseases. The highest income loss amounted to 31.1 million pesos in 1998.

Table 34. Morbidity Cost for Working Population Cases (15 – 65 yrs. old), NCR, 1996-2002.

YEAR	DISEASE	NCR					
		Navotas	Las Pinas	Manila	Paranaque	Pasay City	TOTAL
1996							
	Schistosomiasis	0	0	0	0	0	0
	Diarrhea	349,104	1,422,078	6,577,866	1,354,522	1,402,453	11,106,023
	Poliomyelitis	0	0	0	0	0	0
	Typhoid and Paratyphoid	6,164	30,822	378,447	29,941	152,348	597,722
	Infectious Hepatitis	0	9,540	74,119	9,540	11,742	104,941
	TOTAL	**355,268**	**1,462,440**	**7,030,432**	**1,394,003**	**1,566,542**	**11,808,685**
1997							
	Schistosomiasis	0	0	0	0	0	0
	Diarrhea	764,330	1,786,553	8,479,435	1,702,005	1,540,982	14,273,305
	Poliomyelitis	0	0	0	0	0	0
	Typhoid and Paratyphoid	12,888	16,853	61,711	15,862	166,547	273,860
	Infectious Hepatitis	2,478	9,913	56,796	20,653	21,479	111,320
	TOTAL	**779,696**	**1,813,319**	**8,597,943**	**1,738,520**	**1,729,008**	**14,658,486**
1998							
	Schistosomiasis	0	0	0	0	0	0
	Diarrhea	811,850	163,043	9,377,643	0	1,844,940	12,197,476
	Poliomyelitis	0	0	0	0	0	0
	Typhoid and Paratyphoid	0	17,956	119,517	0	155,989	293,462
	Infectious Hepatitis	12,157	32,732	30,394	0	32,732	108,014
	TOTAL	**824,008**	**213,731**	**9,527,553**	**0**	**2,033,661**	**12,598,953**
1999							
	Schistosomiasis	0	0	0	0	0	0
	Diarrhea	64,837	413,204	1,141,843	97,769	192,966	1,910,620
	Poliomyelitis	0	0	0	0	0	0
	Typhoid and Paratyphoid	27,616	3,602	16,809	0	37,221	85,248
	Infectious Hepatitis	1,001	7,004	14,008	2,001	4,002	28,016
	TOTAL	**93,453**	**423,810**	**1,172,661**	**99,771**	**234,189**	**2,023,883**

Table 34. Continued…

YEAR	DISEASE	NCR Navotas	Las Pinas	Manila	Paranaque	Pasay City	TOTAL
2000							
	Schistosomiasis	0	0	0	0	0	0
	Diarrhea	80,681	669,022	1,341,187	104,256	291,289	2,486,435
	Poliomyelitis	0	0	0	0	0	0
	Typhoid and Paratyphoid	4,890	1,222	6,112	0	46,453	58,677
	Infectious Hepatitis	1,019	15,280	0	27,505	18,337	62,140
	TOTAL	**86,589**	**685,525**	**1,347,299**	**131,761**	**356,078**	**2,607,252**
2001							
	Schistosomiasis	0	0	0	0	0	0
	Diarrhea	75,860	411,482	1,318,927	108,043	288,497	2,202,810
	Poliomyelitis	0	0	0	0	0	0
	Typhoid and Paratyphoid	5,364	0	0	13,410	79,116	97,890
	Infectious Hepatitis	2,235	36,876	0	7,822	23,467	70,400
	TOTAL	**83,459**	**448,359**	**1,318,927**	**129,275**	**391,081**	**2,371,100**
2002							
	Schistosomiasis	0	0	0	0	0	0
	Diarrhea	88,976	373,086	1,193,509	127,021	226,429	2,009,022
	Poliomyelitis	0	0	0	0	0	0
	Typhoid and Paratyphoid	1,432	4,295	5,727	5,727	80,181	97,362
	Infectious Hepatitis	1,193	48,920	0	5,966	26,250	82,329
	TOTAL	**91,601**	**426,302**	**1,199,236**	**138,714**	**332,860**	**2,188,713**
AVERAGE		**330,582**	**781,926**	**4,313,436**	**518,863**	**949,060**	**6,893,867**

Source: Philippine Health Statistics, 1996 - 2002

Table 35. Morbidity Cost for Working Population Cases (15 – 65 yrs. old), Region III and IV, 1996-2002.

YEAR	DISEASE	REGION III					REGION IV				
		Bataan	Bulacan	Nueva Ecija	Pampanga	**TOTAL**	Cavite	Cavite City	Laguna	Rizal	**TOTAL**
1996	Schistosomiasis	-	-	-	-	**-**	-	-	-	-	**-**
	Diarrhea	-	1,664,706	-	965,155	**2,629,86**	125,736	17,755	2,442,314	3,500,858	**6,086,662**
	Poliomyelitis	-	-	-	-	**-**	-	-	-	-	**-**
	Typhoid and Paratyphoid	-	39,615	-	535	**40,150**	-	-	1,535	30,692	**32,227**
	Infectious Hepatitis	-	10,252	-	1,018	**11,270**	4,204	445	19,822	-	**24,471**
	TOTAL	**-**	**1,714,573**	**-**	**966,708**	**2,681,28**	**129,940**	**18,200**	**2,463,670**	**3,531,550**	**6,143,360**
1997	Schistosomiasis	-	-	-	-	**-**	-	-	-	-	**-**
	Diarrhea	2,820,981	1,484,509	-	644,623	**4,950,11**	3,235,4	20,153	2,620,096	3,131,274	**9,007,010**
	Poliomyelitis	-	-	-	-	**-**	-	-	-	-	**-**
	Typhoid and Paratyphoid	22,079	23,880	-	-	**45,959**	94,564	-	1,646	25,518	**121,728**
	Infectious Hepatitis	13,599	12,500	-	203	**26,302**	14,479	273	21,265	188,639	**224,656**
	TOTAL	**2,856,659**	**1,520,889**	**-**	**644,826**	**5,022,37**	**3,344,5**	**20,426**	**2,643,007**	**3,345,431**	**9,353,394**
1998	Schistosomiasis	-	-	-	-	**-**	-	-	-	-	**-**
	Diarrhea	3,486,803	2,364,771	1,700,926	2,112,889	**9,665,38**	1,787,8	16,467	2,796,536	3,848,383	**8,449,276**
	Poliomyelitis	-	-	-	-	**-**	-	-	-	-	**-**
	Typhoid and Paratyphoid	82,170	56,204	45,649	350	**184,373**	11,194	-	4,257	23,837	**39,287**
	Infectious Hepatitis	55,986	11,090	3,261	510	**70,847**	19,147	282	29,086	24,120	**72,636**
	TOTAL	**3,624,959**	**2,432,065**	**1,749,835**	**2,113,749**	**9,920,60**	**1,818,2**	**16,749**	**2,829,878**	**3,896,340**	**8,561,199**
1999	Schistosomiasis	-	-	-	-	**-**	-	-	-	-	**-**
	Diarrhea	734,219	320,230	319,436	90,243	**1,464,12**	340,487	1,347	714,063	460,217	**1,516,114**
	Poliomyelitis	-	-	-	-	**-**	-	-	-	-	**-**
	Typhoid and Paratyphoid	38,108	36,989	-	379	**75,476**	7,919	-	1,831	11,901	**21,651**
	Infectious Hepatitis	14,477	9,457	-	316	**24,250**	15,839	342	42,722	5,340	**64,243**
	TOTAL	**786,804**	**366,676**	**319,436**	**90,938**	**1,563,85**	**364,245**	**1,689**	**758,615**	**477,459**	**1,602,008**

Table 35. Continued…

YEAR	DISEASE	REGION III					REGION IV				
		Bataan	Bulacan	Nueva Ecija	Pampanga	TOTAL	Cavite	Cavite City	Laguna	Rizal	TOTAL
2000	Schistosomiasis	-	-	-	-	**-**	-	10,935	-	-	**10,935**
	Diarrhea	638,867	360,149	339,994	125,954	**1,464,964**	467,877	1,839	563,193	473,211	**1,506,120**
	Poliomyelitis	-	-	-	-	**-**	-	0	-	-	**-**
	Typhoid and Paratyphoid	39,652	39,079	34,807	-	**113,538**	8,108	0	2,812	6,561	**17,481**
	Infectious Hepatitis	21,550	10,177	17,525	81	**49,333**	15,946	311	7,030	5,468	**28,755**
	TOTAL	**700,069**	**409,405**	**392,326**	**126,035**	**1,627,835**	**491,931**	**13,085**	**573,035**	**485,240**	**1,563,291**
2001	Schistosomiasis	-	-	-	-	**-**	-	-	-	-	**-**
	Diarrhea	923,279	2,240,847	288,601	94,242	**3,546,969**	260,571	1,707	817,651	417,960	**1,497,888**
	Poliomyelitis	-	-	-	-	**-**	-	-	-	-	**-**
	Typhoid and Paratyphoid	21,600	82,117	4,810	-	**108,527**	8,275	-	1,040	68,620	**77,935**
	Infectious Hepatitis	16,412	15,089	1,336	-	**32,837**	8,095	-	2,599	1,733	**12,427**
	TOTAL	**961,291**	**2,338,053**	**294,747**	**94,242**	**3,688,333**	**276,941**	**1,707**	**821,290**	**488,313**	**1,588,250**
2002	Schistosomiasis	-	-	-	-	**-**	-	-	-	-	**-**
	Diarrhea	720,572	2,171,914	855,419	150,392	**3,898,297**	289,616	1,560	3,943,112	372,413	**4,606,701**
	Poliomyelitis	-	-	-	-	**-**	-	-	-	-	**-**
	Typhoid and Paratyphoid	72,840	35,252	24,454	-	**132,546**	-	-	-	9,975	**9,975**
	Infectious Hepatitis	6,683	14,758	5,622	-	**27,063**	2,237	873	-	7,389	**10,499**
	TOTAL	**800,095**	**2,221,924**	**885,495**	**150,392**	**4,057,906**	**291,853**	**2,433**	**3,943,112**	**389,777**	**4,627,176**
AVERAGE		**1,621,646**	**1,571,941**	**728,368**	**598,127**	**4,080,313**	**959,667**	**10,613**	**2,004,658**	**1,802,016**	**4,776,954**

Table 36. Total and Average Morbidity Cost for Working Population Cases (15 – 65 yrs. old), by Disease and Region, 1996-2002

YEAR	DISEASE	NCR	Region III	Region IV	GRAND TOTAL
1996	Schistosomiasis	-	-	-	**0**
	Diarrhea	11,106,023	2,629,861	6,086,662	**19,822,546**
	Poliomyelitis	-	-	-	**0**
	Typhoid and Paratyphoid	597,722	40,150	32,227	**670,099**
	Infectious Hepatitis	104,941	11,270	24,471	**140,682**
	TOTAL	**11,808,685**	**2,681,281**	**6,143,360**	**20,633,326**
1997	Schistosomiasis	-	-	-	**0**
	Diarrhea	14,273,305	4,950,113	9,007,010	**28,230,428**
	Poliomyelitis	-	-	-	**0**
	Typhoid and Paratyphoid	273,860	45,959	121,728	**441,547**
	Infectious Hepatitis	111,320	26,302	224,656	**362,278**
	TOTAL	**14,658,486**	**5,022,374**	**9,353,394**	**29,034,254**
1998	Schistosomiasis	-	-	-	**0**
	Diarrhea	12,197,476	9,665,389	8,449,276	**30,312,141**
	Poliomyelitis	-	-	-	**0**
	Typhoid and Paratyphoid	293,462	184,373	39,287	**517,122**
	Infectious Hepatitis	108,014	70,847	72,636	**251,497**
	TOTAL	**12,598,953**	**9,920,608**	**8,561,199**	**31,080,760**
1999	Schistosomiasis	-	-	-	**0**
	Diarrhea	1,910,620	1,464,128	1,516,114	**4,890,862**
	Poliomyelitis	-	-	-	**0**
	Typhoid and Paratyphoid	85,248	75,476	21,651	**182,375**
	Infectious Hepatitis	28,016	24,250	64,243	**116,509**
	TOTAL	**2,023,883**	**1,563,854**	**1,602,008**	**5,189,745**

Table 36. Continued…

YEAR	DISEASE	NCR	Region III	Region IV	GRAND TOTAL
2000	Schistosomiasis	-	-	10,935	**10,935**
	Diarrhea	2,486,435	1,464,964	1,506,120	**5457,519**
	Poliomyelitis	-	-	-	**0**
	Typhoid and Paratyphoid	58,677	113,538	17,481	**189,696**
	Infectious Hepatitis	62,140	49,333	28,755	**140,228**
	TOTAL	**2,607,252**	**1,627,835**	**1,563,291**	**5,798,378**
2001	Schistosomiasis	-	-	-	**0**
	Diarrhea	2,202,810	3,546,969	1,497,888	**7,247,667**
	Poliomyelitis	-	-	-	**0**
	Typhoid and Paratyphoid	97,890	108,527	77,935	**284,352**
	Infectious Hepatitis	70,400	32,837	12,427	**115,664**
	TOTAL	**2,371,100**	**3,688,333**	**1,588,250**	**7,647,683**
2002	Schistosomiasis	-	-	-	**0**
	Diarrhea	2,009,022	3,898,297	4,606,701	**10,514,020**
	Poliomyelitis	-	-	-	**0**
	Typhoid and Paratyphoid	97,362	132,546	9,975	**239,883**
	Infectious Hepatitis	82,329	27,063	10,499	**119,891**
	TOTAL	**2,188,713**	**4,057,906**	**4,627,176**	**10,873,795**
					0
	AVERAGE	**6,893,867**	**4,080,313**	**4,776,954**	**15,751,134**

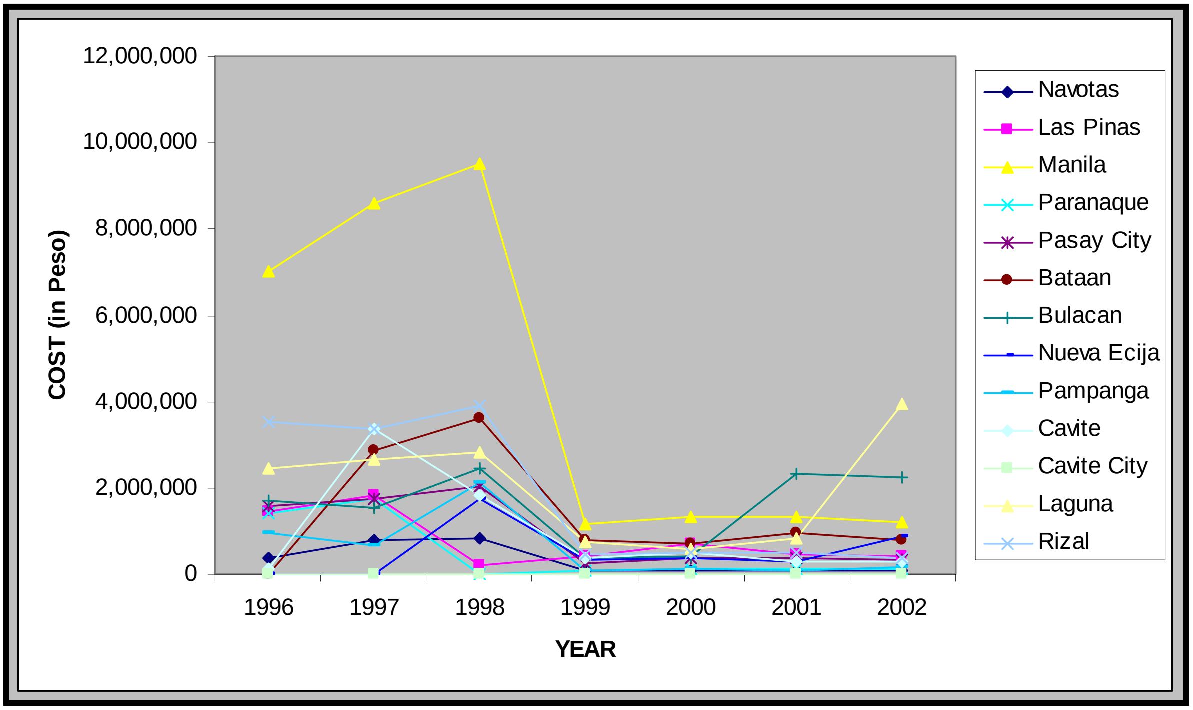


Figure 9. Morbidity Cost by Location, 1996-2002

3.0 HEALTH DAMAGES - MORTALITY

3.1 Methodology

Aside from income losses due to reduced work capacity, it is also possible for death to occur due to exposure to waterborne diseases. To compute the value of income loss arising from premature death due to water pollution the following procedure was followed. First, the present value of foregone earnings of an individual at age *a* who dies prematurely from a waterborne disease was computed using the following formula (Ridker, 1967):

$$V_a = \sum_{n=15}^{LE\text{-}a} \frac{L_n * ER_n * Y_n}{(1+r)^n}$$

Here LE is the life expectancy of an average individual, L_n is the Labor Force Participation Rate, ER_n is the employment rate, Y_n is the average earnings for the age group for each province, and r is the discount rate, which is assumed to be 15%.

The original formula used by ENRAP II (1994) and ENRAP III (1996) computed V_a for each age bracket and gender at the national level. However, at the provincial and city level, the Health Statistics for mortality are not disaggregated by sex and age brackets. The national level data was used to facilitate disaggregation. In particular, the age bracket weights were derived from the national data. These weights were then used to derive the incidence of the disease for a particular age bracket at the provincial/ municipal level. However, if the number of deaths at the provincial level were less than or equal to 10 it was assumed that it occurred at the dominant age bracket. The dominant age bracket is defined as the age bracket that had the highest recorded cases at the national level. There are admittedly two drawbacks from this modification:

a) This procedure assumes implicitly that all deaths from a particular disease at the provincial or municipal level occurred at the dominant age bracket.

b) It also implicitly assumes that people who die beyond the life expectancy are not worth anything.

Finally, the cost of mortality is computed by multiplying the present value of foregone earnings with the number of mortality incidences for each province. In equation form:

$$Cost\ of\ Mortality = V_a * no.of\ deaths$$

3.2 Incidence of Pre-mature Deaths due to Water Pollution

Unlike the analysis of morbidity incidences, the mortality analysis considered the following diseases: diarrhea, typhoid, schistosomiasis, infectious hepatitis, bronchitis, dengue/ h-fever, amoebiasis/ forms of dysentery, and poliomyelitis. Some of these diseases were not accounted in the morbidity calculations because of lack of additional information in particular the number of restricted activity days (RAD). All data were taken from the Philippine Health Statistics of the Department of Health and covered the years from 1995 to 1998. There are no later published statistics on mortality cases that are disaggregated by disease and by province since the advent of the Local Government Code. Unlike the morbidity data, the mortality data were not disaggregated by gender and age brackets. Furthermore, data for the National Capital Region were lumped by districts. Thus, only district 3 and 4 were considered since, these districts covered Navotas for district 3 and Las Piñas and Parañaque for district 4, respectively.

There has been a general uptrend in the number of deaths from waterborne diseases from 1995 to 1998 as seen in Appendix Table 5. The average number of yearly deaths is around 686, with the highest recorded number of deaths at 897 in 1998. From the Table, it is clear that diarrhea is again the primary cause of mortality for all provinces and districts. On average, 71% of yearly deaths are associated with diarrhea. Of all the provinces/regions, the 4th district of Metro Manila had the highest average yearly mortality incidence from diarrhea, averaging 130 deaths per year. The next dominant cause of death is dengue H-fever.

3.3 Cost of Mortality

The results of the calculation of damages due to premature death are shown in Table 37. Mortality costs of waterborne diseases from 1995 to 1998 have been steadily increasing at a rate of 7.3% per year or 79.2 million pesos per year. On average, premature deaths redound to lost income amounting to **309.6 million pesos** a year.

In terms of the specific disease, diarrhea accounted for 37.7% of the total value of damages. 116.6 million pesos of lost income can be attributed to this disease. This is followed by dengue H-fever, accounted for 21.4 % of the total value of damages.

Geographically, 21% of this yearly health damages can be attributed to the 4th District of Metro Manila. Yearly deaths from this district amounted to an average of 64.2 million pesos in lost income.

Demographically, the age bracket of 35 - 44 years old had the highest opportunity cost. Premature deaths from this age group resulted into an average yearly lost income of 65.2 million pesos. This can be explained by the fact that this is the most productive stage of a person’s working life and therefore earnings in this age bracket would be the highest.

Table 37. Mortality Cost for Working Population Cases (15 – 65 yrs. old), By City/Province, 1995-1998.

Province/ Disease	1995	1996	1997	1998	AVERAGE
Manila, 3rd District					
Schistosomiasis*	0	273,737	927,396	747,801	487,234
Diarrhea	9,245,608	13,720,51	14,012,84	34,713,81	17,923,196
Poliomyelitis	422,832	232,752	424,828	283,843	341,064
Typhoid and Paratyphoid	1,479,913	2,094,772	1,792,599	22,628,20	6,998,872
Infectious Hepatitis	6,056,411	4,492,662	6,030,726	6,182,697	5,690,624
Bronchitis/Brochiolitis	2,196,020	2,757,785	12,929,46	4,450,641	5,583,479
Dengue H-fever	2,114,162	9,538,880	2,560,855	16,049,51	7,565,854
Amoebiasis and Other Dysentery All Forms	0	848,601	968,449	2,215,314	1,008,091
TOTAL	21,514,94	33,959,70	39,647,16	87,271,83	45,598,413
Manila, 4th District					
Schistosomiasis*	754,625	547,474	0	747,801	512,475
Diarrhea	21,086,47	23,699,07	23,991,68	34,241,52	25,754,688
Poliomyelitis	0	698,257	0	0	174,564
Typhoid and Paratyphoid	4,010,748	6,582,711	5,135,938	11,100,62	6,707,506
Infectious Hepatitis	6,344,812	8,022,611	6,385,475	4,946,157	6,424,764
Bronchitis/Brochiolitis	1,966,412	0	7,958,764	2,244,585	3,042,440
Dengue H-fever	8,361,366	28,113,80	11,169,21	27,627,42	18,817,952
Amoebiasis and Other Dysentery All Forms	3,512,649	2,545,802	1,452,673	3,876,800	2,846,981
TOTAL	46,037,08	70,209,73	56,093,74	84,784,91	64,281,370
Bataan					
Schistosomiasis	0	0	0	0	0
Diarrhea	1,548,171	1,383,180	2,594,250	3,842,314	2,341,979
Poliomyelitis	0	150,561	0	0	37,640
Typhoid and Paratyphoid	288,269	451,682	0	1,412,317	538,067
Infectious Hepatitis	2,556,052	1,372,338	1,398,194	1,930,974	1,814,389
Bronchitis/Brochiolitis	1,340,618	0	3,375,311	0	1,178,982
Dengue H-fever	864,808	1,707,204	1,408,079	1,649,406	1,407,374
Amoebiasis and Other Dysentery All Forms	798,259	274,468	1,183,331	643,658	724,929
TOTAL	7,396,177	5,339,433	9,959,165	9,478,668	8,043,361
Bulacan					
Schistosomiasis*	514,472	354,145	755,446	434,546	514,652
Diarrhea	10,505,44	13,716,53	11,414,70	20,034,92	13,917,901
Poliomyelitis	144,135	301,122	156,453	494,822	274,133
Typhoid and Paratyphoid	3,515,605	5,272,015	4,930,762	4,713,869	4,608,063
Infectious Hepatitis	4,129,007	4,151,677	4,984,804	3,832,273	4,274,440
Bronchitis/Brochiolitis	2,677,004	3,333,841	12,072,58	4,849,615	5,733,260
Dengue H-fever	720,674	12,315,35	2,211,370	5,467,565	5,178,740
Amoebiasis and Other Dysentery All Forms	532,173	274,468	1,183,331	1,287,316	819,322
TOTAL	22,738,51	39,719,15	37,709,44	41,114,92	35,320,512
Pampanga					
Schistosomiasis*	0	0	188,862	0	47,215
Diarrhea	2,985,758	3,342,686	4,669,650	6,724,049	4,430,536
Poliomyelitis	144,135	150,561	259,545	0	138,560
Typhoid and Paratyphoid	288,269	1,355,047	312,907	1,694,780	912,751
Infectious Hepatitis	2,949,291	2,491,006	2,167,306	3,113,722	2,680,331
Bronchitis/Brochiolitis	0	1,359,206	6,327,731	2,086,524	2,443,365
Dengue H-fever	288,269	4,530,318	2,400,232	4,238,835	2,864,413
Amoebiasis and Other Dysentery All Forms	532,173	1,097,870	1,479,164	1,930,974	1,260,045
TOTAL	7,187,895	14,326,69	17,805,39	19,788,88	14,777,217

Source: Philippine Health Statistics, 1995-1998
* - information on incidence of schistosomiasis needs to be reviewed and validated since the disease is not endemic in these areas.

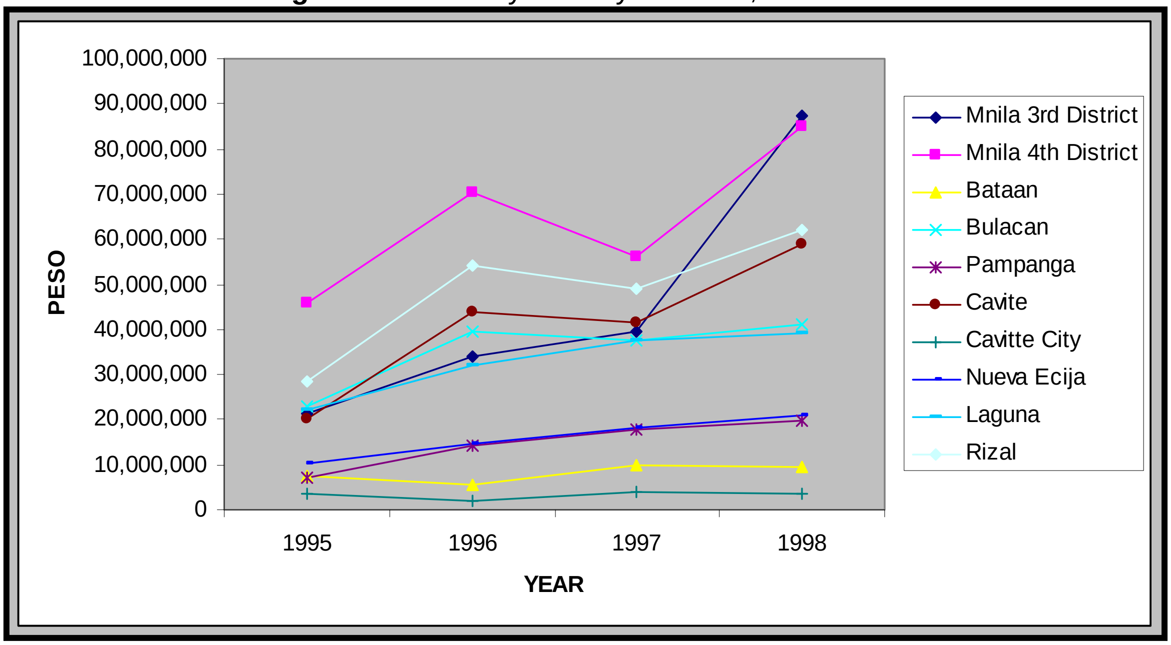
Table 37. Continued…

Province/ Disease	1995	1996	1997	1998	AVERAGE
Cavite					
Schistosomiasis*	0	238,511	513,367	1,134,542	471,605
Diarrhea	8,963,756	13,631,597	13,194,584	22,339,551	14,532,372
Poliomyelitis	0	0	0	0	0
Typhoid and Paratyphoid	3,036,954	6,281,867	4,873,777	4,534,264	4,681,716
Infectious Hepatitis	4,331,165	6,431,007	5,596,650	9,067,536	6,356,590
Bronchitis/Brochiolitis	2,254,798	1,497,226	9,040,812	3,121,784	3,978,655
Dengue H-fever	1,396,088	13,471,037	7,410,855	17,452,875	9,932,714
Amoebiasis and Other Dysentery All Forms	344,788	2,218,196	804,138	1,260,379	1,156,875
TOTAL	20,327,549	43,769,443	41,434,183	58,910,931	41,110,527
Cavite City					
Schistosomiasis*	0	238,511	0	0	59,628
Diarrhea	0	0	0	0	0
Poliomyelitis	0	0	0	0	0
Typhoid and Paratyphoid	560,298	202,801	0	1,106,212	467,328
Infectious Hepatitis	689,576	369,699	0	840,253	474,882
Bronchitis/Brochiolitis	1,259,294	333,582	2,469,249	737,474	1,199,900
Dengue H-fever	186,766	811,203	0	430,638	357,152
Amoebiasis and Other Dysentery All Forms	689,576	0	1,608,276	420,126	679,494
TOTAL	3,385,509	1,955,796	4,077,525	3,534,703	3,238,383
Nueva Ecija					
Schistosomiasis*	171,491	0	0	0	42,873
Diarrhea	3,870,428	6,622,553	3,895,174	8,295,758	5,670,978
Poliomyelitis	0	0	0	0	0
Typhoid and Paratyphoid	1,953,114	903,365	938,720	3,734,816	1,882,504
Infectious Hepatitis	2,752,672	3,044,860	5,417,132	2,845,283	3,514,987
Bronchitis/Brochiolitis	0	1,359,206	4,862,339	1,304,325	1,881,467
Dengue H-fever	864,808	2,550,065	2,339,978	3,665,951	2,355,200
Amoebiasis and Other Dysentery All Forms	532,173	274,468	591,666	965,487	590,948
TOTAL	10,144,684	14,754,517	18,045,008	20,811,619	15,938,957
Laguna					
Schistosomiasis*	0	715,534	0	0	178,883
Diarrhea	8,454,197	11,842,567	10,257,059	10,305,551	10,214,844
Poliomyelitis	0	202,801	0	0	50,700
Typhoid and Paratyphoid	3,796,193	3,532,446	4,079,173	6,094,444	4,375,564
Infectious Hepatitis	4,585,940	5,195,022	3,239,488	5,571,492	4,647,985
Bronchitis/Brochiolitis	3,246,581	2,402,901	13,129,501	4,193,143	5,743,031
Dengue H-fever	1,307,363	6,939,275	5,206,591	11,772,609	6,306,459
Amoebiasis and Other Dysentery All Forms	689,576	1,109,098	1,608,276	1,260,379	1,166,832
TOTAL	22,079,849	31,939,643	37,520,088	39,197,617	32,684,299
Rizal					
Schistosomiasis*	0	0	256,683	0	64,171
Diarrhea	14,042,565	24,607,931	21,837,610	26,899,236	21,846,835
Poliomyelitis	0	0	352,750	215,319	142,017
Typhoid and Paratyphoid	4,302,352	4,619,353	8,741,085	6,399,166	6,015,489
Infectious Hepatitis	4,840,714	4,101,333	6,184,478	6,500,074	5,406,650
Bronchitis/Brochiolitis	0	0	4,587,415	0	1,146,854
Dengue H-fever	1,867,661	19,045,771	5,206,591	19,495,721	11,403,936
Amoebiasis and Other Dysentery All Forms	3,447,878	1,848,497	2,010,345	2,520,758	2,456,870
TOTAL	28,501,171	54,222,884	49,176,957	62,030,274	48,482,822
GRAND TOTAL	189,313,384	310,197,009	311,468,671	426,924,378	309,475,860

Source: Philippine Health Statistics, 1995-1998

* - information on incidence of schistosomiasis needs to be reviewed and validated since the disease is not endemic in these areas.

Figure 10. Mortality Cost by Location, 1995-1998



4.0 DAMAGES ASSOCIATED WITH HARMFUL ALGAL BLOOM (HAB)

Harmful algal bloom (HAB) or red tide has been occurring in the coastal waters of Manila Bay since 1987. The worst occurrence was in 1992. During this year, the whole Bay was closed for almost seven months. It affected all the coastal communities around Manila Bay and a total of 562 cases of red tide poisoning was recorded for this year (see Table 38). The last known occurrence was in 1998. However, sources or causes of the bloom are not yet well established (PEMSEA and MBEMP TWG RRA, 2004). Climatological changes, eutrophication, and even oil spills have been suspected as contributing factors to HAB occurrences. In the Bay *Pyrodinium bahamese var. compressum* has been the dominant dinoflagellate species during red tide incidences. This dinoflagellate is often associated with paralytic shellfish poisoning or PSP.

4.1 Health Costs of HAB in Manila Bay

The immediate effect of HABs is on the health of people who eat red tide contaminated marine life. Table 38 shows that there have been a total of 1008 incidences of red tide poisoning with 11 recorded deaths from 1988 to 1998. To value the mortality costs of the deaths associated with PSP, the present value of earnings for age brackets from 15 to 65 were averaged to get the average PVE for each region. The regional average PVE were then averaged to get the Bay's average PVE. This final value was multiplied with the number of incidences per year. This procedure was adopted because there was no demographic information associated with the recorded deaths. The total income losses due to PSP related deaths between from 1988 to 1998 were around **10.6 million pesos** or on average a loss of **0.82 million pesos per year.** The probability of death, however, is quite low. From Table 38 it can be gleaned that this probability is around 3.7%. Thus, the mortality costs are quite low.

Morbidity costs on the other hand were computed using the same procedure as before. However, the average employment rate, labor force participation rate, and average earnings for Region III, Region IV, and NCR were used. Total morbidity cost from 1988 to 1998 amounted to **1.9 million pesos** or an average of **0.15 million pesos per year**.

Table 38. Damages Associated with Harmful Algal Blooms (PSP) in Manila Bay

Year	Cases	Morbidity Costs	Deaths	Mortality Cost	Amiebi Shrimps	Amiebi Shrimps (kg)	Fresh Shrimps (US$)	Fresh (kg.)
1988	65	95,514	4	1,117,388	n.d.	n.d.	201,108,583	19,067,763
1989	0	-	0	-	n.d.	n.d.	167,714,666	18,832,279
1990	0	-	0	-	n.d.	n.d.	170,940,904	18,701,690
1991	73	128,951	8	2,234,777	904,009	232,478	200,701,662	21,910,443
1992	569	1,061,443	11	3,072,818	402,321	118,680	158,113,729	17,342,424
1993	45	88,400	2	558,694	527,156	108,515	187,571,517	18,469,312
1994	36	67,309	2	558,694	264,713	63,084	192,426,709	16,919,805
1995	110	224,375	8	2,234,777	175,343	35,390	168,695,807	13,486,634
1996	27	59,114	1	279,347	144,993	29,106	117,352,167	9,621,441
1997	0	-	0	-	88,890	21,177	93,318,842	7,204,643
1998	83	210,290	2	558,694	60,485	17,438	96,734,546	7,570,710
1999	0	-	0	-	101,545	12,620	96,685,090	8,221,436
2000	0	-	0	-	128,142	28,131	103,524,181	8,168,000
Total	1008	1,935,397	38	10,615,190				

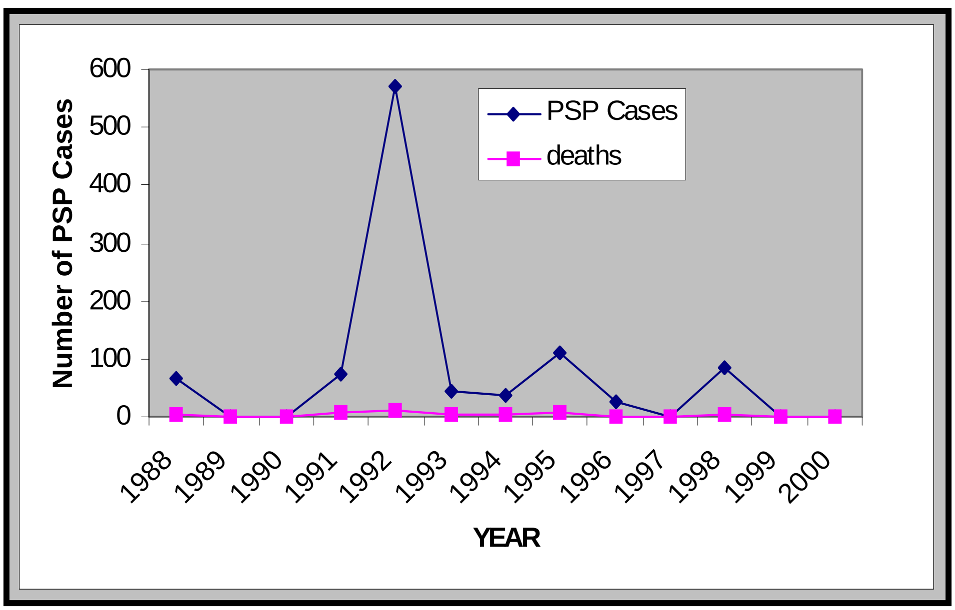


Figure 11. Damages Associated with Harmful Algal Blooms (PSP) in Manila Bay, 1988-2000.

4.2 Export Losses due to HAB

During the 1988, 1992, and 1993 red tide incidents, Japan and Singapore banned their imports of shrimps/prawns from the Philippines (http://www.bfar.da.gov.ph). Thus, a major economic effect of the red tide phenomenon is the loss in exports. The biggest importer of prawns/shrimps from the Philippines is Japan. It imports around $141.8 million worth of shrimps/ prawns every year. The effect of red tide on the exports of shrimps/prawns can be seen in Figures 10 and 11. Figure 11 shows the year-to-year change in recorded cases of PSP and the year-to-year change in exports (Ameibi) while figure 9 shows the same relationship for fresh shrimp exports. It can be seen clearly that there is an inverse relationship between Japan's value of exports and the increase in cases of PSP. The increase in cases of PSP can be treated as a proxy for the severity of the HAB. Thus, the more severe the HAB, the higher are the losses in terms of export reduction. The largest decrease in export occurred in 1992. This is also the year Manila Bay experienced the worst case of HAB. The value of shrimp exports to Japan declined by almost $ 43.1 million. Between 1988 and 1998, total export losses due to HAB amounted to **$176.2 million (or 9.7 billion pesos).** On average, yearly losses amounted to **$29.3 million (or 1.6 billion pesos)**.

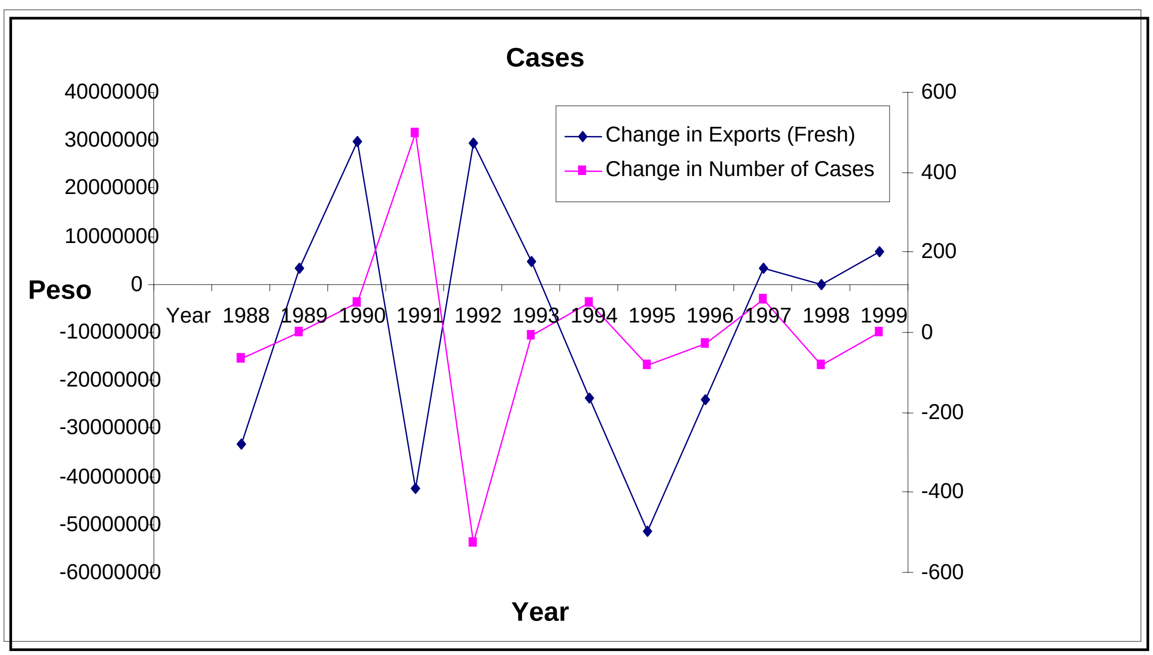


Figure 12. Change in Export of Fresh Shrimps and Change in the Number of PSP Cases

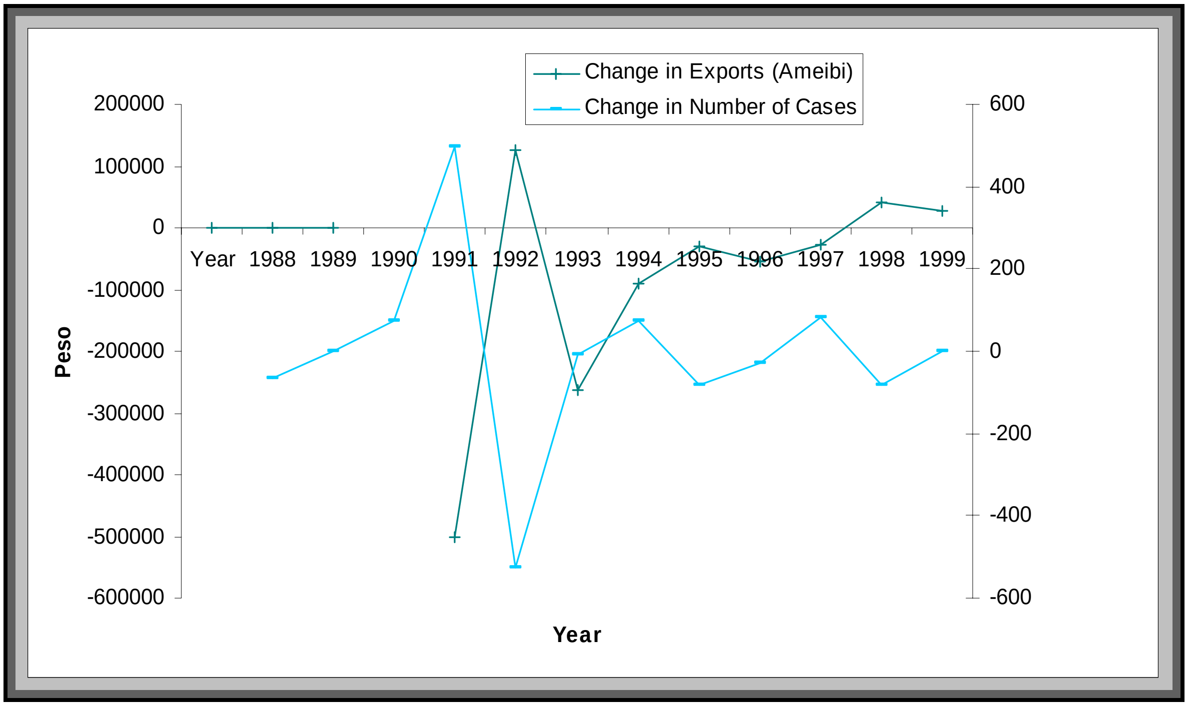


Figure 13. Change in Export of Ameibi Shrimps and Change in the Number of PSP Cases

4.3 Other Damages Associated with Red Tide Occurrences

Aside from the health and loss in exports, HABs also cause displacement of fishermen. Displacement costs of fishermen happen because the common policy response of the government has been to ban the harvesting of selected bivalves and fish. For instance the red tide occurrence in 1992 displaced a total of 6,416 (see Table 39) families[1]. The fisherfolks affected by these bans are usually those who harvest mussel, oyster, sea crab (*alimasag*), small shrimps, and *alamang.* However, because of misinformation about the disease, consumers usually inhibit consuming even other marine products that are not affected by red tide. Fish operators in 1992 claimed that they lose 10 million pesos a day during the 7-month ban (Malaya Journal, July 5, 1992 edition). Assuming that these fisherfolks did not operate on Sundays, there were a total of 186 fishing days during the 7-month ban in 1992. This amounts to roughly 1.9 billion pesos in lost income. Furthermore, the government released 15 million pesos as livelihood support for fishermen affected by the sever HAB incident. This means that the opportunity cost of the 1992 incident is around **1.92 billion pesos.** However, no similar information for the other occurrences was available. Since 1999, there were no reported red tide incidents in Manila Bay. BFAR regularly monitors planktons and toxins in the bay.

Table 39. Damages Caused by Selected Major Natural Disasters in Manila Bay, 1990-2002

Year	Type of Disaster	Date of Occurrence	Areas Affected	Population Affected		Casualties			Houses Damaged		Value of Damages (in million pesos)
				Families	Persons	Dead	Injured	Missing	Total	Partial	
1990	Typhoon	Aug.28-30	Regions I-IV, CAR & NCR	130,219	568,675	50	53	-	684	1,961	1,520.00
		Nov. 10-14	Regions IV-XII	1,010,004	5,498,290	508	1,278	-	22,026	630,885	10,846.00
1992	Flashflood	Jul. 9-12	Region III	144,476	707,807	22	-	-	1,569	3,137	681
	Red Tide	Jun-Dec	Region III-IV & NCR	6,416	38,500	10	67	-	-	-	-
	Typhoon	Jul. 9-12	Region II-III	1,027	5,135	3	-	-	5	15	21
		Jul. 17-21	Region III & NCR	27,902	134,417	36	77	-	478	1,305	471
		Aug. 16-18	Region III-IV & NCR	148,049	725,956	22	-	-	1,428	3,072	1,347.00
		Sept. 18-23	Regions I-III & CAR	113,686	570,136	27	13	-	785	3,272	2,155.00
1997	Typhoon		Bulacan		145,658	4	-	-	-	-	25.3
			Pampanga		115,237	11	1	-	2	2	136.4

Table 39. Continued…

Year	Type of Disaster	Date of Occurrence	Areas Affected	Population Affected		Casualties			Houses Damaged		Value of Damages (in million pesos)
				Families	Persons	Dead	Injured	Missing	Total	Partial	
2000	Typhoon Biring 55 kph	May 18-22	Metro Manila , Pampanga, Bulacan, Bataan, Nueva Ecija	59,404	235,885	12	4	-	-	-	-
	Typhoon Edeng 95 kph	Jul. 3-8	Metro Manila, Tarlac, Bataan, N.Ecija,Bataan, Bulacan, Apayao, Kalinga, Rizal, Batangas, La Union, Ilocos Sur and Norte	320	1,483,310	66	11	9	-	-	-
	Maring	Sept. 2-7	Metro Manila	1,302	6,508	5	-	-	-	-	-
	Reming	Oct. 26-Nov. 01	Metro Manila, La Union, Ilocos Sur and Norte, Pangasinan, Isabela, Quirino, Cagayan, Nueva Vizcaya, Bataan, Bulacan, Tarlac, N. Ecija, Pampanga, Zambales, Batangas, Rizal, Cavite, Laguna, Marinduque, Quezon, Albay, Camarines Norte, Sorsogon, Catanduanes, Iloilo, N. Samar, E. Samar, Benguet, Kalinga, Abra, Apayao, Ifugao	486,416	2,435,942	114	314	40	-	-	-
	Seniang	Nov.15	Metro Manila, Bataan, Bulacan, Tarlac,N. Ecija, Pampanga, Zambales, Batangas, Rizal, Marinduque, Quezon, Mindoro Provinces, Cavite, Laguna, Camarines Provinces, Albay, Catanduanes, Abra, Kalinga	368,552	1,747,872	61	0	33	-	-	-

Table 39. Continued…

Year	Type of Disaster	Date of Occurrence	Areas Affected	Population Affected		Casualties			Houses Damaged		Value of Damages (in million pesos)
				Families	Persons	Dead	Injured	Missing	Total	Partial	
2001	Typhoon Feria	Jul. 2-7	CAR, NCR, Caraga, Regions I,II,II,IV,V,VI,VIII,IX & X	415,436	1,903,113	188	214	44	12,774	39,147	3.586 Billion
	Tropical Depression Jolina	Aug. 17-19	Region III	57,421	295,355				27	45	0.015 Billion
	Tropical Storm Nanang	Nov. 6-10	CAR, NCR, Caraga, Regions IV,V,VII,VIII,IX & X	262,612	1,331,630	236	169	88	1,973	12,763	3.246 Billion
	Tropical Storm Quedan	Dec. 4-8	Regions IV,VI,VII, and VIII	14,961	54,840	5	8	1	121	275	4
2002	Tropical Depression Juan	Jul. 15-23	Regions IV and VI	3,692	19,048	14	3		181	402	1.2
	Tropical Depression Milenyo	Aug. 11-14	Regions III, IV, V, VI, VII,VIII, NCR, X & Caraga	38,634	194,451	35	21	22	2,180	10,998	171.6
	Flashflood/Flooding	Dec. 6-8		272,924	1,268,792	44	27	10	1,032	5,024	1,511.00

Source: National Statistical Coordination Board,2004

5.0 ECONOMIC IMPACT OF MANGROVE DEGRADATION

5.1 Physical Accounting of Mangrove Resources

The current status of the Mangrove areas around Manila Bay in terms of area size is shown in Tables 40 and 41. Currently there are a total of 289 hectares of mangrove around Manila Bay. In 1995, the total mangrove area in the Bay was around 794 hectares. This means that there has been a loss of 505 hectares over the last decade. This amounts to an average loss of 51 hectares per year. The biggest decline in area occurred in Bulacan. For this province there has been on average a yearly decrease of 60 hectares per year for the last decade. In contrast, Pampanga was the only province that had an increase in area. For the last ten years there has been a yearly increase of 17 hectares in this province.

The biggest mangrove area can be found in Pampanga. There are a total of 219 hectares of mangroves in the towns of Macabebe and Sasmuan. In contrast, the smallest mangrove area is in Bulacan. There are only around 10 hectares of mangroves left in this province. This might be attributed to the rampant conversion of these areas to aquaculture farms. However, in terms of tree density Bataan had the highest with an average of 1,464 trees per hectare, while Pampanga had the lowest average number of trees per hectare at 175 trees per hectare. These information are shown in Table 42. These values were derived from the Integrated Environmental Monitoring Program for Manila Bay (IEMP) activities. These activities analyzed a sample of areas around Manila Bay.

Table 40.Unmanaged Mangrove Areas, Resource Rents, Yearly NPV, By Province, 1995 and 2005.

Province	Area (hectares)		Resource Rents		Year to Year NPV		Change in NPV	AVERAGE
	1995	2005	1995	2005	1995	2005		
BATAAN	110.3	135.3	38,773,905	78,248,825	58,115,818	78,248,825	20,133,007	2,013,301
PAMPANGA	45	219	15,818,910	124,250,350	46,531,696	124,250,350	77,718,654	7,771,865
BULACAN	605	10	212,676,452	5,779,086	214,104,954	5,779,086	(208,325,868)	(20,832,587)
METRO MANILA	2.13	24	756,452	14,152,410	4,254,711	14,152,410	9,897,699	989,770
CAVITE	31.8	24.85	11,296,684	14,591,077	14,780,008	14,091,986	(688,022)	(68,802)
TOTAL	**794.23**	**413.69**	**305,786,889**	**159,274,994**	**344,653,789**	**159,274,994**	**(185,882,238)**	**(18,588,224)**

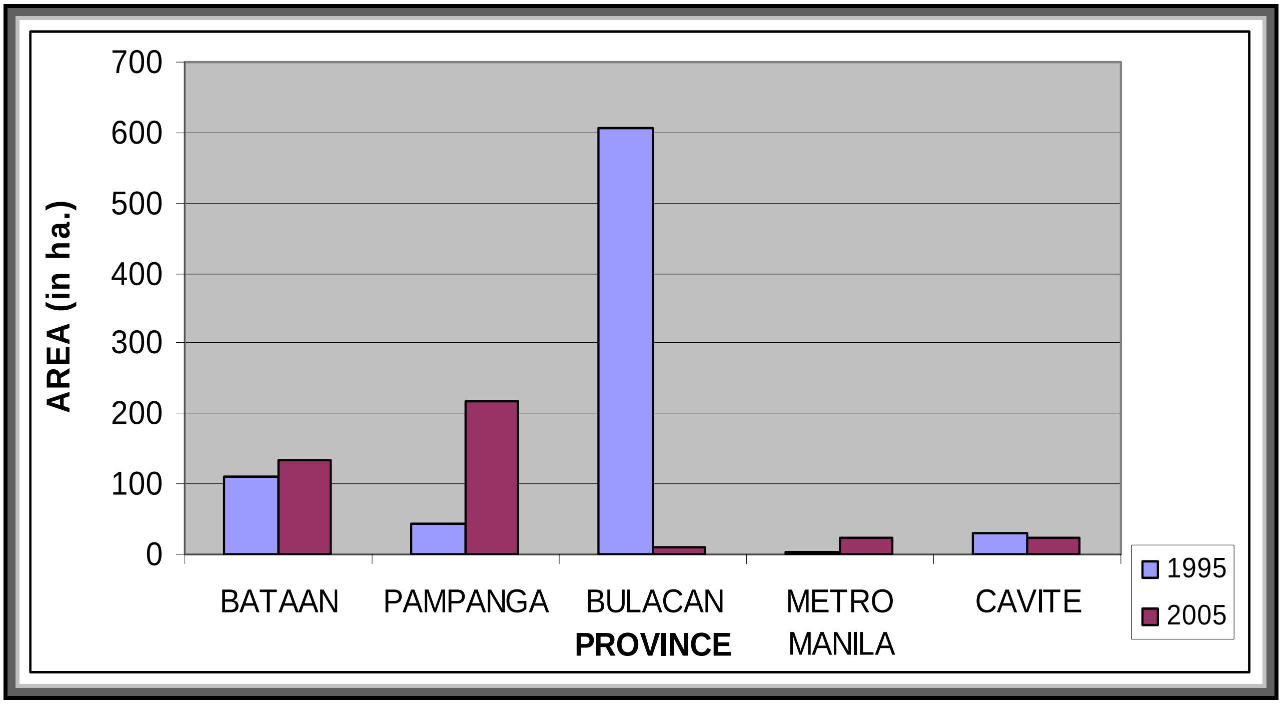


Figure 14. Mangrove Areas, By Province, 1995 and 2005

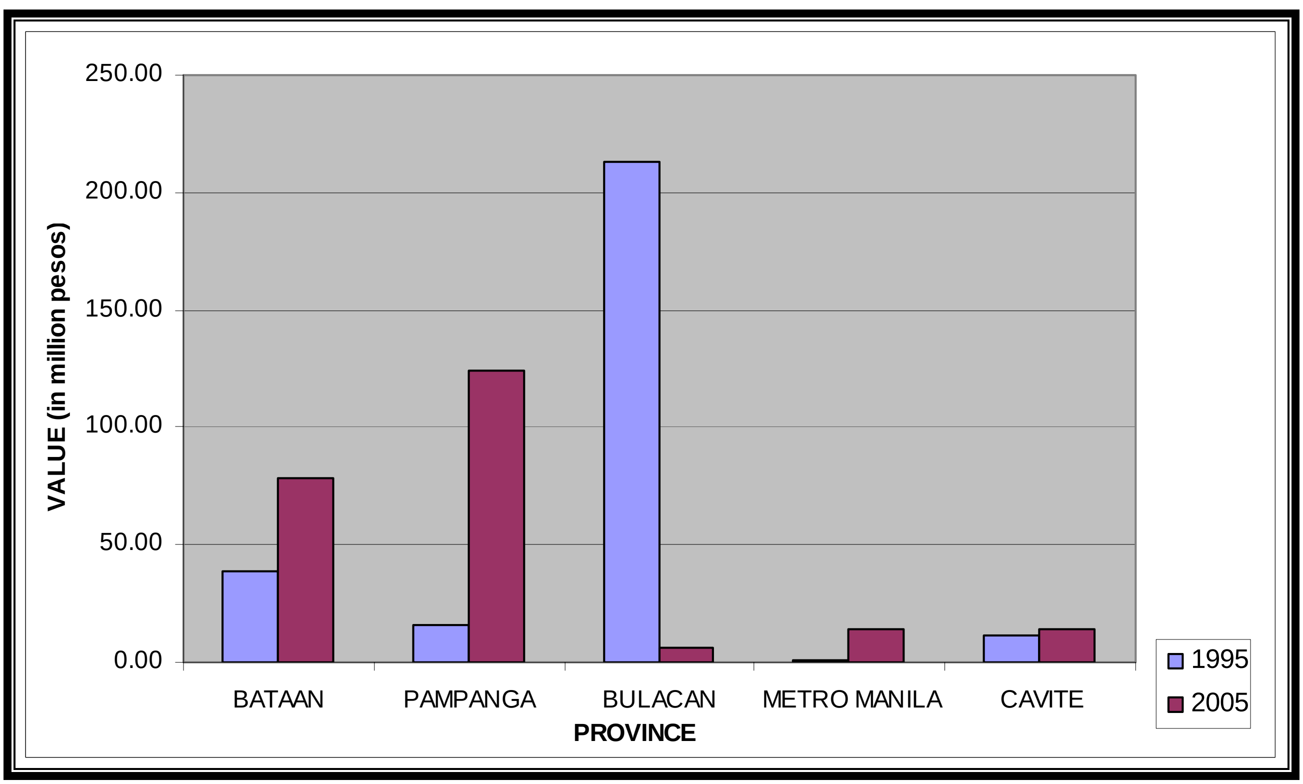


Figure 15. Resource Rents for Unmanaged Mangrove, By Province, 1995 and 2005

Table 41. Managed Mangrove Areas, Resource Rents, Yearly NPV, By Province, 1995 and 2005

Province	Area (hectares)		Resource Rents		Year to Year NPV		Change in NPV	AVERAGE
	1995	2005	1995	2005	1995	2005		
BATAAN	110.3	135.3	41,177,167	83,098,799	61,717,919	83,098,799	21,380,879	2,138,088
PAMPANGA	45	219	16,799,388	131,951,564	49,415,797	131,951,564	82,535,767	8,253,577
BULACAN	605	10	225,858,442	6,137,282	227,375,484	6,137,282	(221,238,202)	(22,123,820)
METRO MANILA	2.13	24	803,338	15,029,597	4,518,425	15,029,597	10,511,172	1,051,117
CAVITE	31.8	24.85	11,996,869	14,965,428	15,696,094	14,965,428	(730,666)	(73,067)
TOTAL	794.23	413.69	324,739,997	169,147,085	366,015,923	169,147,085	(197,403,484)	(19,740,348)

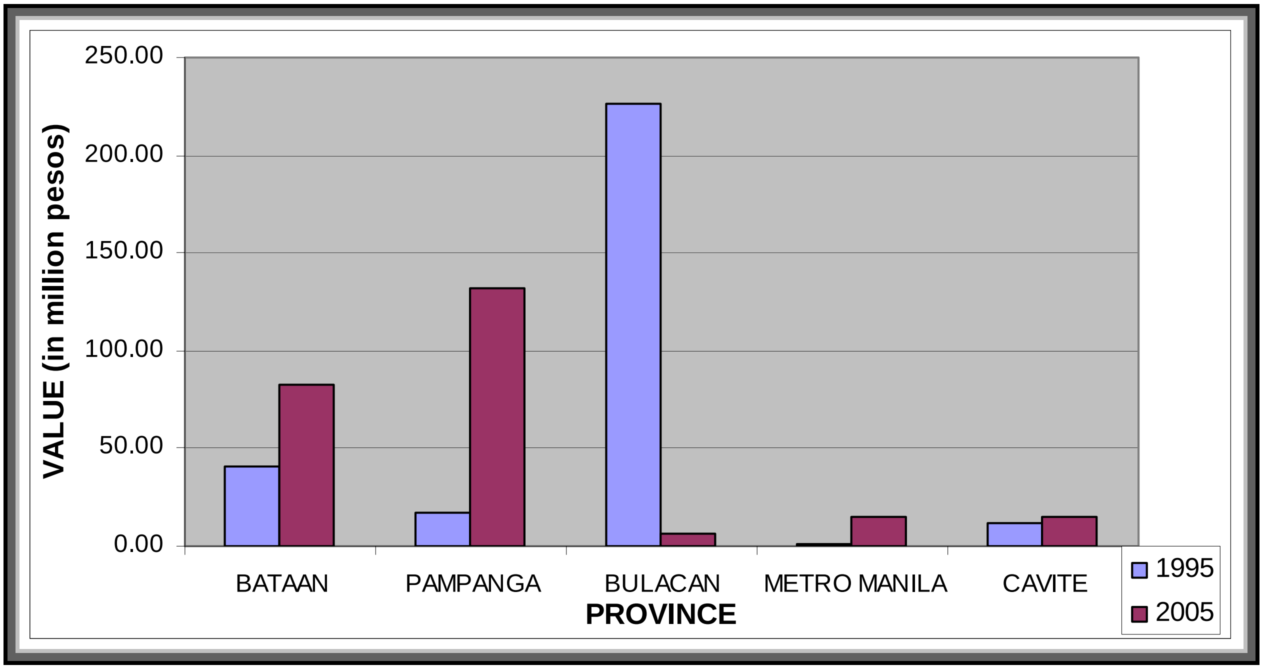


Figure 16. Resource Rents for Managed Mangrove, By Province, 1995 and 2005

Table 42. Total Number of Trees and Area of Mangrove, By Region, 2005

REGION	Total Number of Hectares [a]	Average Number of trees/hectare	Total Number of trees
NCR			
Navotas	5	996	4,830
Las Piñas	19	1,289	24,889
Parañaque		1,379	
Total	**24**	**1,221**	**29,509**
REGION III			
Bataan	16	1,464	23,105
Bulacan	10	613	6,133
Pampanga	215	175	37,625
Total	**241**	**751**	**180,779**
REGION IV			
Cavite	24	978	23,331
Total	**24**	**978**	**23,331**

Source: MBEMP Ground Truthing and IEMP Study.
a – Area represents the sampling area for the IEMP Study and is different from the Total Mangrove Area for the location.

5.2 Economic Accounting of Mangrove Loss Using the Change in Asset Value Approach

To compute the economic value of the loss of mangroves, the Change in Asset Value approach was used. This approach uses the physical information or trends as outlined in the previous section. The physical trends when appropriately valued will represent the flow of rents across time. In equation form the year to year economic depreciation can be written as:

$$\text{Depreciation}_t = PV_t - PV_{t-1}$$

where

Depreciation$_t$: depreciation during the tth year
PV$_t$: present value of mangrove rents at the end of the planning period
PV$_{t-1}$: present value of mangrove rents at the start of the planning period

The present value for the start of the planning period can be computed using the following equation:

$$PV_{t-1} = \sum_{t}^{T=2005} \frac{R_t}{(1+r)^{t-1}}$$

Here we assume that the planning period or the period of analysis starts in 1995 and the interest rate (r) is set at 15%[2]. On the other hand, the present value for the end of the planning period can be computed using the following equation:

$$PV_t = \sum_{t}^{T=2005} \frac{R_t}{(1+r)^{t}}$$

The resource rent (R_t) can be derived by simply multiplying the mangrove area (in hectares) with the net economic benefits per hectare.

5.2.1 Resource Rents from Mangroves

Since, no data or Cost Benefit Study specific to any Manila Bay areas found, the study relied on data from literature to value the rents per hectare per year. Several studies done in the Philippines from 1992 to 1996 were summarized and the potential indirect and direct values were calculated. These values are shown in Table 25. Note that the values vary depending on the

[2] This is the NEDA recommended social discount rate for project analysis.

assumed institutional set-up. The unmanaged mangrove has the lowest total use value.

Using the data in Table 25 and varying assumptions on the institutional set-up, the computed resource rents are shown in Tables 40 and 41. Between 1995 and 2005, there has been a 48% decrease in the resource rents generated by mangroves. This decline is driven primarily by the large decline in the area in Bulacan which was not met by the increases in area in Bataan, Pampanga, and National Capital Region.

5.2.2 Economic Depreciation

As described in the previous section, the undiscounted rents were used to compute for the annual Net Present Value (NPV). The results of this procedure are shown again in Tables 40 and 41. Depending on the assumption of the institutional set-up, the economic depreciation of mangrove resources ranges from **185.8 million pesos** (unmanaged) to **197.4 million pesos** (plantation). On average from 1995 to 2005, mangroves' yearly economic values have been depreciating at a rate of 18.6 million to 19.7 million pesos.

6.0. PHYSICAL AND ECONOMIC VALUATION OF MUDFLATS

Similar to the procedure used earlier for mangroves, economic valuation of damages to mudflats initially entails accounting of the physical changes in mudflat areas across time. The data used for the computation came from the results of the ground truthing activities of the MBEMP in 2005 and the results of an earlier study by BFAR in 1995. Based on the available data, the mudflats of Pampanga have been declining at a rate of 124 hectares per year. (See Appendix Table 6A)

The economic value of mudflats cannot be separated from that of the mangrove resources. This is due to the fact that these two resource systems are ecologically interdependent. Thus, the economic valuation of mudflats is already included in the mangrove valuation.

7.0 EFFECTS OF GROUNDWATER EXTRACTION: SALT WATER INTRUSION IN MANILA BAY

Salt water intrusion (SWI) into the ground water is one of the risks facing inhabitants of the provinces and municipalities around Manila Bay. SWI is caused primarily by excessive groundwater extraction. However, there are also other contributing factors. Lopez (2001), in discussing the effects of salinity in rice farms in Masantol, Pampanga, cites the lack of control dikes, the Pampanga Delta widening program, and the El Nino phenomenon as primary contributing factors. In the same study, the rise of the tide level also contributed to the increased salinity of the soil. Together with the absence of control dikes, rise in the tide level often causes flooding of low lying agricultural lands.

For Manila Bay, there has been a marked increase in the tide levels (PEMSEA and MBEMP TWG RRA, 2004). This has been due to shoreline changes caused by increased sedimentation of rivers, deforestation, and man made activities (such as land reclamation). These factors together with global climatic changes has brought about increased tide levels and therefore increased intrusion of sea water during flooding.

SWI either through groundwater intrusion or through flooding can cause different damages. Two possible quantifiable damages are health costs and productivity loss. Health costs were measured in relation to prevalence of renal disorders. Renal disorders are often associated with heavy intake of salt. The same procedure used in the previous analysis of health costs of water pollution was used for this section.

7.1 Physical Evidence of Decreased Productivity in Palay Farms Due to Salinity

A study by Lopez (2001)[3] documented the decrease in Palay yield during different sowing periods in Baranggay Sua, Masantol, Pampanga. The results of his study are shown in Table 43. From the table it can be gleaned that increased in irrigation salinity by 1.85 dS/m resulted in a decrease of palay yield by 2.13 tons per hectare.

[3] Studies on salt water intrusion are usually associated with ground water use or pricing for industrial purposes in the Philippines

Table 43. Salt Water Conductivity (dS/m)

Sowing Period	Seedling	Tillering	P.I.	Booting	Heading	Maturity	Average	Grain Yield (tons/ha)
First Sowing	2.5	2.5	3.4	3.4	3.1	2.4	2.88	4.64
Second Sowing	2.9	2.9	2.6	2.6	3.1	3.1	2.87	6.21
Third Sowing	2.8	2.8	5.5	5.5	2.1	3.7	3.73	2.66
Fourth Sowing	3.1	3.1	5.9	5.9	7.2	3.2	4.73	2.51

No data on the levels of soil or irrigation salinity in the various municipalities of Manila Bay were found among the government agencies. If this data is available, then we can use the crude relationship Lopez has established to calculate the potential yield and potential income palay farmers would have gotten for a given decrease in irrigation or soil salinity.

7.2 Decline in the Value of Irrigation Water in Palay Farms due to Water Salinity

One of the functions of Mangroves is that it acts as a buffer between the groundwater and the sea. Loss of mangroves would then mean intrusion of sea water into the water table. This is further aggravated by the increased pumping of groundwater for agricultural, domestic, and industrial use. The immediate impact would be that population near coastal areas would experience reduced agricultural productivity because of the high saline content of irrigation water and the reduced water quality for home consumption.

To value the effect of salt water intrusion on agricultural productivity, first consider an agricultural production function (y) that is assumed to be homogeneous of degree 1 or exhibits constant returns to scale.

$$y = f(x_i,..x_n, z)$$

Here y is the amount of agricultural output, x_i is the ith input, and z is the quality adjusted amount of irrigation water. *If all markets are perfect* then, by Euler's theorem we have:

$$\sum_i \frac{\partial f}{\partial x_i} x_i + \frac{\partial f}{\partial z} z = y$$

Multiplying through by the price of agricultural output p_y and noting that we have assumed perfect markets then:

$$\sum_i p_i x_i + p_z z = p_y y$$

where p_i and p_z are the input price of input x_i and quality adjusted irrigation water z, respectively. Rearranging terms we could derive the value of quality adjusted irrigation water as:

$$p_z = \frac{p_y y - \sum_i p_i x_i}{z}$$

This means that the value of the quality of irrigation water can be derived by dividing the net value of agriculture by the amount of irrigation water used. More specifically, we can divide the net value of irrigated crops by the amount of irrigated farm (in hectares). Notice that if salt water intrusion is more pronounced for a certain location then the value of agricultural production would be lower. Thus, for the same area of irrigated land, the value of irrigated land (p_z) would be lower. The change in the value of irrigated land (Δ), and thus the value of salt water damage, can be obtained by either comparing changes in p_z across time or across locations.

$$\Delta = p_z^1 - p_z^0 = \frac{p_y^1 y^1 - \sum_i p_i^1 x_i^1}{z^1} - \frac{p_y^0 y^0 - \sum_i p_i^0 x_i^0}{z^0}$$

The data used for the study came from the Bureau of Agricultural Statistics and the Provincial Profiles of the National Statistics Office (NSO), and data from the Bureau of Soil and Water Management (BSWM). Complete data disaggregated by municipalities are available only for the province of Pampanga for the year 1986. The results of the outlined method applied to this data set are shown in Table 44.

The Net Revenues for Palay were assumed to be 8% of Gross Revenues. This is obtained from the average Net Revenue – Gross Revenue ratio from 1991 to 2004 as published in the BAS statistics for Central Luzon. As seen from the table there is a difference of 8.25 pesos/ha. between coastal and inland municipalities in terms of the value of irrigation water. For Pampanga, the total cost amounts to 365,379.42 pesos, representing the difference between coastal and inland irrigated areas.

Table 44. Value of Irrigation Water in Pampanga, 1986

Market Center	Volume of Palay Production (kg)	Price at Source (Pesos/ kg)	Gross Revenue	Net Revenue	Irrigated Land (ha)	Value of Irrigation Water (pesos/ ha.)
			Coastal Municipalities			
Lubao	162,550	5.36	871,268	69,701	3,508	19.87
Macabebe	16,625	5.72	95,095	7,608	1,987	3.83
Masantol	57,000	5.83	332,310	26,585	2,805	9.48
Sexmoan	8,333	5.25	43,748	3,500		
					Total: 8,300	Ave: 11.06
			Inland Municipalities			
Angeles City	12,273	5.63	69,097	5,528	337	16.40
San Fernando	8,667	5.52	47,842	3,827	458	8.36
Guagua	20,300	5.61	113,883	9,111	1,299	7.01
Apalit	4,425	6.02	26,639	2,131	3,095	0.69
Florida Blanca	133,840	5.80	776,272	62,102	2,809	22.11
Arayat	52,317	5.57	291,406	23,312	3,234	7.21
Mexico	151,859	5.28	801,816	64,145	2,379	26.96
Magalang	327,509	5.45	1,784,924	142,794	3,754	38.04
Candaba	45,548	5.60	255,069	20,406	6,707	3.04
Sta. Rita	12,000	6.02	72,240	5,779	697	8.29
Sta. Ana	194,549	5.37	1,044,728	83,578	1,252	66.76
Bacolor	16,875	5.96	100,575	8,046	1,438	5.60
Porac	86,910	5.54	481,481	38,519	949	40.59
					Total: 28,408	Ave: 19.31
					Difference	8.25

7.3 Health Costs Associated with SWI

As discussed in the previous section, heavy intake of salt often results in renal associated diseases. A related study of Bagarinao (1999), valued the morbidity losses associated with salinization of aquifers in Cebu City. He estimated that morbidity costs amounted to around 91.4 million pesos.

For this study, only the mortality costs of renal associated diseases were valued, since the Philippine Health Statistics does not have morbidity statistics on renal related diseases. The diseases that were included in the analysis are: infections of the kidney, calculus of kidney, ureter & lower urinary tract, and other diseases of the genito-urinary system. The same procedure was used as was outlined in the previous section on the costs of water pollution. As with the previous calculation, mortality cases in the Philippine Health Statistics were at the national level. To get the equivalent incidences for the Manila Bay area the following formula was used:

$$Incidence_i = Nationaldata * \Delta_i$$

$$where$$

$$\Delta_i = \frac{\begin{array}{c}\text{no. of HH in municipality i}\\ \text{who source their water from alternative sources}^1\end{array}}{\begin{array}{c}\text{no. of HH in the Philippines}\\ \text{who source their water from alternative sources}\end{array}}$$

[1] these alternative sources include: springs, lakes, dug wells, tubed pipe/shallow wells shared tube/deep piped wells, own use tubed/piped well

The results of the methodology are presented in Table 45. As seen from the table, the incidence of renal related deaths increases with age. This means that older people are more susceptible to increased salinization. Because older people earn more, higher health costs would be associated with increased salinization. Average loss for people within the 45-54 year old age bracket was around 22.8 million pesos per year. Cavite had the highest mortality costs associated with the three diseases mentioned. For 1995 and 1996, income loss in this province amounted on average to 22.7 million pesos. This could be attributed to the fact that most residents around Manila Bay in Cavite relied on alternative sources of water. For the whole of the Bay, on average, SWI resulted into an income loss of **81.2 million pesos per year**.

Table 45. Mortality Costs of Salt Water Intrusion, 1995-1998.

Province/	1995			1996			1997			1998			
Age Bracket	Incidence	PVE	Cost	Incidence	PVE	Cost	Incidence	PVE	Cost	Incidence	PVE	Cost	AVERAGE
NCR													
15-19 Years	1	211,416	169,133	1	232,752	250,209	1	256,086	236,879	1	283,843	290,939	236,790
20-24 Years	1	356,375	445,469	1	382,848	459,418	1	424,828	488,552	1	486,085	668,367	515,451
25-34 Years	3	378,309	1,267,336	4	413,644	1,499,458	2	466,592	793,207	4	530,363	1,935,823	1,373,956
35-44 Years	4	390,294	1,688,023	5	424,300	1,994,211	2	484,224	774,759	5	553,829	2,713,760	1,792,688
45-54 Years	5	372,270	1,842,735	7	405,181	2,724,841	2	457,718	1,018,422	7	524,613	3,816,562	2,350,640
55-64 Years	7	251,542	1,741,927	10	273,737	2,614,188	3	309,132	819,200	8	373,900	3,103,374	2,069,672
TOTAL	22		7,154,622	27		9,542,325	10		4,131,019	27		12,528,825	8,339,198
Bataan													
15-19 Years	1	144,135	138,369	1	150,561	194,223	1	156,453	173,663	1	164,941	202,877	177,283
20-24 Years	2	242,962	364,442	1	247,654	356,621	1	259,545	358,172	2	282,463	466,065	386,325
25-34 Years	4	257,915	1,036,820	4	267,574	1,163,947	4	285,061	1,128,840	4	308,193	1,349,885	1,169,873
35-44 Years	5	266,086	1,380,988	6	274,468	1,547,997	6	295,833	1,730,622	6	321,829	1,892,354	1,637,990
45-54 Years	6	253,798	1,507,559	8	262,100	2,115,146	7	279,639	1,954,675	9	304,852	2,661,358	2,059,684
55-64 Years	8	171,491	1,425,087	11	177,073	2,029,252	11	188,862	2,011,376	10	217,273	2,164,039	1,907,438
TOTAL	26		5,853,265	32		7,407,186	30		7,357,347	32		8,736,578	7,338,594

Table 45. Continued…

Province/ Age Bracket	1995			1996			1997			1998			
	Incidence	PVE	Cost	Incidence	PVE	Cost	Incidence	PVE	Cost	Incidence	PVE	Cost	AVERAGE
Bulacan													
15-19 Years	2	144,135	230,616	2	150,561	323,706	2	156,453	289,439	2	164,941	338,128	295,472
20-24 Years	3	242,962	607,404	2	247,654	594,368	2	259,545	596,953	3	282,463	776,774	643,875
25-34 Years	7	257,915	1,728,033	7	267,574	1,939,912	7	285,061	1,881,400	7	308,193	2,249,808	1,949,788
35-44 Years	9	266,086	2,301,646	9	274,468	2,579,995	10	295,833	2,884,369	10	321,829	3,153,924	2,729,984
45-54 Years	10	253,798	2,512,598	13	262,100	3,525,243	12	279,639	3,257,791	15	304,852	4,435,597	3,432,807
55-64 Years	14	171,491	2,375,145	19	177,073	3,382,086	18	188,862	3,352,293	17	217,273	3,606,732	3,179,064
TOTAL	43		9,755,442	54		12,345,311	50		12,262,246	53		14,560,963	12,230,990
Pampanga													
15-19 Years	1	144,135	184,492	2	150,561	258,965	1	156,453	231,551	2	164,941	270,503	236,378
20-24 Years	2	242,962	485,923	2	247,654	475,495	2	259,545	477,563	2	282,463	621,419	515,100
25-34 Years	5	257,915	1,382,427	6	267,574	1,551,930	5	285,061	1,505,120	6	308,193	1,799,846	1,559,831
35-44 Years	7	266,086	1,841,317	8	274,468	2,063,996	8	295,833	2,307,495	8	321,829	2,523,139	2,183,987
45-54 Years	8	253,798	2,010,079	11	262,100	2,820,194	9	279,639	2,606,233	12	304,852	3,548,477	2,746,246
55-64 Years	11	171,491	1,900,116	15	177,073	2,705,669	14	188,862	2,681,835	13	217,273	2,885,385	2,543,251
TOTAL	35		7,804,354	43		9,876,248	40		9,809,797	42		11,648,770	9,784,792

Table 45. Continued…

Province/	1995			1996			1997			1998			
Age Bracket	Incidence	PVE	Cost	Incidence	PVE	Cost	Incidence	PVE	Cost	Incidence	PVE	Cost	AVERAGE
Cavite													
15-19 Years	2	186,766	418,356	3	202,801	610,430	3	212,637	550,730	3	215,319	617,966	549,371
20-24 Years	4	314,823	1,101,882	3	333,582	1,120,834	3	352,750	1,135,854	4	368,737	1,419,638	1,194,552
25-34 Years	9	334,200	3,134,798	10	360,414	3,658,203	9	387,428	3,579,839	10	402,325	4,111,765	3,621,151
35-44 Years	12	344,788	4,175,381	13	369,699	4,865,244	14	402,069	5,488,241	14	420,126	5,764,134	5,073,250
45-54 Years	14	328,865	4,558,065	19	353,040	6,647,751	16	380,060	6,198,771	20	397,964	8,106,529	6,377,779
55-64 Years	19	222,213	4,308,714	27	238,511	6,377,791	25	256,683	6,378,585	23	283,636	6,591,690	5,914,195
TOTAL	60		17,697,197	75		23,280,253	70		23,332,020	74		26,611,722	22,730,298
Cavite City													
15-19 Years	2	186,766	418,356	3	202801	610430	3	212,637	550,730	2	215,319	441,404	505,230
20-24 Years	4	314,823	1,101,882	3	333582	1120834	3	352,750	1,135,854	3	368,737	1,014,027	1,093,150
25-34 Years	9	334,200	3,134,798	10	360414	3658203	9	387,428	3,579,839	7	402,325	2,936,975	3,327,454
35-44 Years	12	344,788	4,175,381	13	369699	4865244	14	402,069	5,488,241	10	420,126	4,117,239	4,661,526
45-54 Years	14	328,865	4,558,065	19	353040	6647751	16	380,060	6,198,771	15	397,964	5,790,378	5,798,741
55-64 Years	19	222,213	4,308,714	27	238511	6377791	25	256,683	6,378,585	17	283,636	4,708,350	5,443,360
TOTAL	60		17,697,197	75		23,280,253	70		23,332,020	53		19,008,373	20,829,461
GRAND TOTAL	**246**		**65,962,077**	**306**		**85,731,577**	**270**		**80,224,450**	**281**		**93,095,231**	**81,253,334**

Source of Basic Data: Philippine Health Statistics

8.0 SUMMARY OF DAMAGES

The damages and their corresponding values are shown in Table 46. In summary, the total cost of morbidity and mortality in terms of income is 15.8 million pesos and 309.5 million pesos respectively. While these figures are due to water pollution related diseases, salt water intrusion and the attendant renal related deaths resulted in an income loss of 81.2 million pesos per year. Mangrove depreciation due to degradation is roughly 18.6 to 19.7 million pesos per year in nominal terms.

The highest damage is associated with Harmful Algal Blooms (HAB) or Red Tides. Morbidity and mortality are around 151.6 million pesos per year from 1988 to 1998, the periods where red tide occurred in Manila Bay. A larger portion of the red tide damage can be attributed to income loss from shrimp exports and fishing operations. A further cost is the expenditure of the government in its relief operations. During the 1992 incident, the total cost was around 3.5 billion pesos. If we consider HABs as an indirect effect of water pollution, then the total damages associated with water pollution can reach as high as 3.9 billion pesos.

The damage estimates were obtained through the use of secondary data and in some ways is prone to either undervaluation or overvaluation. As a rule, however, conservative estimates were used to prevent the more glaring problem of overvaluation. Despite, this major limitation the study can be used as a benchmark of the value of damages to health and the mangrove habitats.

Table 46. Summary of Valued Damages

DAMAGES	VALUE	COMMENTS
Morbidity Costs of Water Pollution	15,751,134	Average Yearly Value from 1996 to 2002
Mortality Costs of Water Pollution	309,475,860	Average Yearly Value from 1995 to 1998
Over Extraction of Ground Water		
a. Mortality Costs of SWI	81,253,334	Mortality associated with renal diseases
b. Decline in the Value of Irrigation Water	365,379	Decrease in the Value of Irrigation Water
Mangrove Loss	18,588,244	Average Yearly Depreciation from 1995 to 2005 (Open Access)
	19,740,348	Average Yearly Depreciation from 1995 to 2005 (Secure Property Rights)
Harmful Algal Bloom/ PSP		
a. Morbidity Costs	1,935,397	Average Morbidity Costs from 1988 to 1998
b. Mortality Costs	884,599	Average Mortality Costs from 1988 to 1998
c. Loss in Exports	1,614,319,043	Average Export Losses of Ameibi and Fresh Shrimps from 1988 to 1998
d. Government Costs	15,000,000	Emergency Fund released during 1992 Red Tide Incidence
e. Loss in Income of Fishermen	1,920,000,000	Income Loss during 1992 Red Tide Incidence
TOTAL	**3,977,572,990 to 3,978,725,094**	

IV. LIMITATIONS OF THE STUDY AND RECOMMENDATIONS

1.0 PROBLEMS AND RECOMMENDATIONS FOR CALCULATING THE TOTAL ECONOMIC VALUE OF MANILA BAY

The study mainly estimated the use values of major uses of Manila Bay and its specific habitats. It failed however, to obtain non-use values for these major uses and the specific activities on major habitats. Likewise, non-consumptive direct use values such as aesthetic values were also not calculated.

Non-use values are harder to calculate. Table 31 lists the specific non-use values that were not obtained for Manila Bay. Normally non-use values could be generated either through Choice modeling (CM), Contingent Valuation Method (CVM) or Benefits transfers (BT) techniques. For instance, to implement a BT estimation of values, studies elsewhere in Southeast Asia (SEA) or other countries can be recalibrated to fit Philippine conditions. The problem with the use of BT is that it is hard to recalibrate or account for institutional differences in different locations. As much as values are endogenous and is jointly determined with the institutional environment, it would be hard to determine the plausibility of non-use values obtained in other countries or region. The only recourse then would be to conduct stated preference studies such as CVM or CM to generate non-use and passive values for Manila Bay. However, these kinds of studies are often expensive and time consuming.

The study likewise used extensively available secondary or published data from various government agencies. Thus, the study can also be looked at as an attempt to fins out whether it is possible to calculate the Total Economic Value of Manila Bay through published data. The data used in the study is not free from problems themselves. The following sections outline how the estimates can be improved through utilizing secondary information.

1.1 Valuation for Off-shore Fishery

The valuation based on published data can be extended or refined through the use of other data set on production. The published data used in the valuation maybe an overestimate because it is based on landed data. This is especially true for commercial fishery, since fish landed in Manila Bay, particularly in the Navotas fish port, may come from as far as Palawan and Mindanao. Furthermore, some of the data are extrapolated based on average growth rates. Two possible data sources/ sets are: a). published species specific production and prices, b). recent stock assessment and published price data. Data set (a) may still yield overestimates but it would be minimal. In particular, we would be able to eliminate highly valuable species, like certain types of tuna, that are landed in Manila but comes from other traditional fishing grounds. There are numerous studies that have identified species that are present in Manila Bay (see for instance the extensive data base from (http://www.fishbase.org). Data set (b) is the ideal set for valuation as long as it identifies the quantity of the stock per species. Such information may cover both current and potential values in terms of juveniles that maybe harvested in the future.

1.2 Valuation for Aquaculture/ Mariculture

The initial net values for Aquaculture and Mariculture could either be an underestimate or overestimate of the true current and average value. It is hard to assess the direction of the bias because of geographical coverage and species coverage of the data. Because of limited species coverage it may represent an underestimate. However, since the published data is at the regional level it may cover some provinces that have similar marine environments. For instance, Region IV also includes the provinces of Mindoro and Batangas which have similar marine environments with Manila Bay that can sustain aquaculture and mariculture activities. Production from these provinces is included in the Region IV data. Thus, the use of the regional values may result into an overestimate of the true value of aquaculture and mariculture production from Manila Bay.

The initial estimates can be improved in two ways. First is to increase the species coverage and disaggregate the data by province, species, and aquaculture environment. The second improvement would be to secure more recent cost and returns studies to improve the assumptions that will be used in the valuation. Furthermore, these costs and return studies should be species and province specific if possible.

1.3 Valuation of Mangrove Ecosystems of Manila Bay

The values from Table 25 which is the basis of the valuation for this section came from estimates of other mangrove areas. One has to note that this is an application of direct benefits transfer. The glaring problem however is that no adjustments have been made on the assumed values. Adjustments are necessary to account for the differences between these areas and Manila Bay. In particular, Manila Bay is noted for being one of the most heavily polluted Bays and therefore productivity of mangrove areas maybe lower.

Adjustments can be done through assumptions. One can assume for instance that the Manila Bay area is only 50% productive in terms of its direct and indirect use and therefore, the adjusted total economic value would be 84.3 million pesos. However, we have no current scientific basis for such an assumption. Furthermore, the preference structure of coastal communities maybe different for Manila Bay. Thus, the uses may also differ. Ecologically, the mangrove ecosystems may also be different. For example, different fish species maybe present in Manila Bay but not in the areas were the values were taken. In this aspect, these initial figures are overestimates of the true value of the mangrove ecosystem for Manila Bay. However, the valuation also failed to account for other indirect and non-use values. Thus, in this aspect the values are underestimates.

Refinements for the estimates call for several actions. First, is the completion of the area data of mangrove areas for NCR and Cavite. Second, ground truthing activities should be conducted. Among the needed information from the ground truthing are a). mangrove species distribution, b). uses of each species, c). net income from each type of use. Direct uses are generally forestry and fishery related. Aside from these the indirect use or ecological functions of the mangrove areas should also be quantified. To facilitate this, information should be gathered about: a) spawning and recruitment of fish in the areas (i.e. juvenile fish and shellfish species), b) abundance of spawning species, c) length and value of road networks that are near the mangrove areas, and d) cost of recent major flooding in the areas near the mangrove.

1.4 Valuation of Coral Reefs of Manila Bay

The immediate information needed for refinement of values for Coral Reef Systems is the areal extent and quality of these systems in Manila Bay. Another important information is the identification of fish and other species that use the reefs as sanctuaries. The biomass of these species should also be taken into account. If permitted the potential of having tourist attractions based on the coral reefs should also be assessed.

1.5 Total Economic Valuation: Information Needs and the Work Ahead

Arriving at an accurate and complete Total Economic Valuation, therefore, requires both financial resources and time. Furthermore, the “science” part of the activity should also be developed thoroughly to support the economic side of the valuation. Necessary tasks include a comprehensive on-the-ground Resource and Environmental Assessment (REA) and a series of technical biological studies. The REA will provide an estimate of the remaining area of each of the habitats. As discussed earlier there is no such information for sea grasses and coral reefs. This information can then be multiplied with the per hectare value of direct and indirect uses of these habitats. It will also be important in establishing current and potential uses. Focused group discussion with local users of the resources will identify what uses should be valued in the first place.

Technical biological studies, on the other hand, are needed to establish response of the habitats to disturbances as well as the extent and efficacy of its ecological functions. For example, the ability of mangrove trees to store carbon under polluted environments is useful in establishing the value of mangrove trees in terms of its carbon sequestration function.

To get a sense of the magnitude of the work that might be involved in arriving at an accurate estimate of the Total Economic Value of Manila Bay Appendix Table 12A is provided. This table shows the needed information to calculate the Total Economic Value of the major uses and habitats of Manila Bay. As it is this listing might even be partial because as discussed earlier there is still the need to verify actual uses from personal interviews.

2.0 PROBLEMS AND GENERAL RECOMMENDATIONS FOR DAMAGE VALUATION

2.1 Health Damages

The study calculated the foregone income from morbidity and mortality incidence in provinces/ cities along Manila Bay. The data used were from published health statistics. The first problem with the data is that not all years were considered because the level of disaggregation did not permit analysis. Ideally the data should be disaggregated at least by age, gender, and location.

Furthermore, the mortality data was only up to 1998. After 1998, the operations of rural health centers were devolved to Local Government Units (LGUs) as part of the implementation of the Local Government Code. The collection of information is now being conducted by LGUs. Although, this is acknowledged to be a positive move it also means that a stronger information management system should be in place so that information can be accessed with ease. If the valuation exercise is envisioned as a policy tool that will continuously provide information then, it is imperative to have a strong information management system in place among the LGUs around Manila Bay.

Likewise, there are also some diseases that were covered in the mortality calculation but not in the morbidity calculation. The morbidity calculation was more cumbersome because it needs information on both the RAD and attribution factor. Extensive search for this information was not fruitful. It is recommended that health experts be consulted in the future to get the necessary information. In particular, RAD and attribution factor are needed for other diseases such as dengue/h-fever, leptospirosis, skin diseases (leprosy, psoriasis, etc.), gastroenteritis, and amoebiasis. Air pollution related diseases such as bronchitis and asthma can also be considered in the future. These diseases can be associated with accumulation of solid waste or sewerage. Thus, they are indirectly related to water pollution. The availability of data needed for the calculation of health effects are summarized in Table 47.

Table 47. Summary of Availability of Data Required for Morbidity and Mortality Cost Computation.

DISEASES	DATA REQUIRED			
	Morbidity	Mortality	Attribution Factor	RAD
Schistosomiasis	√	√	√	√
Diarrhea	√	√	√	√
Poliomyelitis	√	√	√	√
Typhoid and Paratyphoid	√	√	√	√
Infectious Hepatitis	√	√	√	√
Bronchitis/Brochiolitis	√	√	X	√
Dengue H-fever	√	√	X	X
Amoebiasis and Other Dysentery All Forms	√	X	X	√
Gastroenteritis [a]	√	X	X	X
Asthma	√	X	X	X
Hypertemsion	√	X	X	X
Leptospirosis	√	X	X	X

NOTE:
√ - Information is available
x – Information is not available
a – Gastroenteritis might have been counted for diarrhea. Data for diarrhea for some years were from “enteritis and other diarrheal diseases”. National data for mortality – “diarrhoeas and gastroenteritis of presumed infectious origin”.

There is also ground for improvement in the methodology used but it would entail more information, particularly more epidemiological studies. The attribution method was used to calculate the damages from morbidity incidences. An alternative method is through the use of dose response functions. However, there were dose-response studies for air pollution and none for water pollution. Once this information is available, then a comparison between the attribution method and the values obtained from the use of the dose-response function can be done.

2.2 Damages to Natural Systems

The study was able to value damages on mangroves but not on mudflats because of limitations with the data. Literature would often analyze mudflats and mangroves together. Thus, it is hard to delineate economic values for mudflats. It is therefore recommended that detailed study on the economic uses of mudflats be conducted.

The physical valuation/accounting of mangrove systems were obtained from two related studies conducted for the Manila Bay Project, namely the ground-truthing activities and the Integrated Environmental Monitoring Program (IEMP) for Manila Bay. The ground-truthing activities resulted in estimates of the current area of the mangroves and mudflats for the whole Bay, while the IEMP studies provided more detailed information, such as relative densities, number of trees per hectare (for selected species), crown cover, dominant species, etc., in selected sampling sites. Both studies identified the dominant species, but the percentage of each of the species was not estimated. The IEMP counted the number of selected trees/species. For instance, the estimates for nipa were not captured. This could have been useful since monetary values are available for nipa.

The mangrove valuation was done through benefits transfers from other mangrove areas in the Philippines because no data is available for the prices of timber and non-timber products from mangroves in Manila Bay. Primarily because cutting and harvesting of mangrove trees are being prohibited and therefore, there is no formal market for it. This is also not a sustainable use, hence, its use for firewood/charcoal cannot be considered part of the total economic value. It is recommended that more detailed studies on the economic use of mangroves specific to the Manila Bay area be conducted to refine the estimates. Future ground-truthing and mangrove monitoring should take into account the application for resource valuation.

3.0 WHERE DO WE GO FROM HERE? SOME FINAL NOTES

Results of this study came generally from secondary data obtained from published government statistics and related studies. Although, the methods used are somewhat rigorous, it is easy to see that the results relied heavily on defensible assumptions. One can say this study has adapted valuation through assumption as a general method. Hence, inaccuracies are undoubtedly present in the calculation. However, care was taken to make sure that estimates were on the more conservative side. Thus, there was intentional bias towards underestimation of values. With these facts in mind, we now need to grapple with the question “Is this study relevant?”. The answer is ”yes”. The results provide warning signs and guideposts, as well as an impetus for further debate and awareness. These two reasons we now elaborate in the succeeding paragraphs.

If 8.3 billion pesos represent a *partial underestimate* of the total economic value of Manila Bay, then the actual total economic value must be in all accounts, larger. This value represents the current value of the Bay. This is enough to assure us that the Bay is still useful, but it is also a warning sign that we stand to loose a larger amount if we do not manage it properly.

Is the actual amount 30% larger, or 20% larger, or 50 % larger? These are questions that can be answered by a more thorough study, akin to the earlier study by BFAR in 1995. But we believe that it is worth investing in this study considering the magnitude of what we might loose in the future.

If sectors do not believe in the results of this study because of some private information, then the study has met one of its purposes – that is to create awareness on the value of the Bay. More debate means increasing awareness and perspectives about the management of the Bay, and initiate the sharing of information. This is good if we consider the alarming rate of the decline in the value of the Bay (for instance the mangrove damage valuation shows a 50% decline in resource rents within the last 10 years). Increasing awareness hopefully will make people come together not only in debates, but also in resolving the impending ecological-economic crisis involving the Bay.

So where do we go from here? The first and obvious direction is towards maintaining/rehabilitating and protecting the habitats (mangroves, mudflats, coral reefs, seagrass beds, etc.) and resources (especially fisheries and water resources), and addressing the deteriorating water quality of the rivers and Manila Bay. Even with limited information, the results of this study can be used in identifying the location and value of key resources, especially those at risk from uncontrolled development, expansion of human settlements, illegal logging and fishing activities and from oil spills.

Secondly, there is a need for studies on the habitats that were not valued (coral reef, seagrass and seaweed beds) and refinement of the values obtained in this study. Experience in conducting this study has shown that there is no replacement for good first hand or primary data. The most difficult part of the study was obtaining information on the physical and scientific aspects of the Bay. One can see that valuation involves both *physical* and *economic* accounting. It is very information intensive. As often repeated in the report, a good database is essential in any refinement endeavor. A step towards this direction is strengthening the IEMP component of the project, and ensuring that the system of monitoring and information gathering and sharing initiated under the ERV, IEMP and IIMS sub-projects of the Manila Bay Environmental Management Project (MBEMP) could be sustained. Representative sites should be selected for major habitats of the Bay. Another possibility is setting up a community-based monitoring system that would complement the IEMP, and assist in constantly updating the IIMS for the economic and ecological management of Manila Bay.The IIMS is a relational database, which could be used in calculating the total value of the Bay. With more information, the valuation study can serve as key inputs to prioritizing and crafting policies that will lead to the optimal combination of uses of the Bay.

Thirdly, another direction that can be pursued in the future is determining the attribution of the damages to specific threats or risks. For instance, the health-related damages due to water pollution can be associated with domestic and industrial wastes, agricultural run-off, aquaculture wastes, etc. How much of the 214.50 million peso damage is due to agricultural run-off as opposed to effluents from aquaculture or from domestic sources? Answers to these questions can be used as basis for market-based or economic instruments, such as charges on specific sectors (e.g., users fee, pollution tax). This is a move towards making the numbers from this study more relevant for policy-making. This is obviously the next and logical step in the analysis.

Fourthly, it is also important to apply other methods such as CVM to capture the non-use values of the Bay. However, this is, as earlier mentioned a time- and money-consuming activity. As in any activity, research is also an optimization problem. One needs to maximize the veracity of its results subject to the budget constraint.

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ANNEX A
Avifauna of Manila Bay

Mangrove areas in Bataan, Navotas, Parañaque City, Las Piñas City, Pampanga and Cavite are frequented by migratory and resident waterfowls. However the threat posed by land conversion for developmental activities including expansion of fishpond operation posed a major threat to the bird population in the area. Thus, the Asian Waterfowl Census (AWC) of resident and migratory birds was undertaken to observe seasonal changes in the occurrence and number of migratory birds. The results of this activity on selected sites on various years are shown in Appendix Tables 7A to 9A.

In Bataan, the total number of waterfowl species reached an average count of 6,226 from 1992-2005. The highest waterfowl population of 13,920 was recorded in 2001, which is comprised of nine types of species. On one hand, the highest number of type of waterfowl species frequenting the area was documented in 2003 (17 species types). Based on the 1992-2003 records, the biggest population among waterfowl species is the common tern (8,216), followed by the kentish plover (7,527) and whiskered tern (4,486). These are all migratory species. Except for the common tern, which is regarded as uncommon species, the other two are quite common in the area. Rare species spotted in Bataan mangroves also include Schrencks Bittern (5) in 1994, little curlew (24) in 1996, little stint (1576) in 1990, ad herring gull (215) in 2003.

Waterfowl species visiting the mangroves observed to decrease by 29% between 1994 and 1998. It further slipped to 60% the following year. However, in 2000, it registered the highest increase of 250%. Nonetheless, it further slipped by 36% and 56%, respectively in 2001 and 2002, but escalated by 325% in 2003.

There were 5,840 birds counted in Barangay Tanza, Navotas. Sitio Pulo of Barangay Tanza is the site of the bird counting activity. It consists of old growth mangroves dominated by Bungalon (*Avicennia marina*) and mudflats stretching around 1½ kms along the coastline. Among the sites covered by this study, this area has the highest number of individuals. It consists of 25 species representing 10 families. More than half (58.17%) of which are Kentish Plovers (*Charadrius alexandrinus*) and around one-fourth (25.19%) are Whiskered Terns (*Chlidonias hybridus*).

As to the distribution by Families, 63.75% belong to Family Charadriidae (Plovers), 25.21% to Family Sternidae (Terns), 8.27% to Family Scolopacidae

(Curlews, Sandpipers & Snipes), 1.95% to Family Ardeidae (Herons, Egrets & Bitterns), and 0.83% to other Families.

Highlight species in Brgy. Tanza, Navotas is the Chinese Egret (*Egretta eulophotes*) which is endangered. During the counting period, 12 Chinese Egrets were counted in contrast to the 17 individuals counted during the 2004 AWC.

The bird sites within Parañaque City and Las Piñas City consists of mudflats and mangroves located in Tambo; along Coastal Road; and within the Freedom Island and Long Island. Mariculture areas for fish and mussels are present in the area.

The area is part of an extensive reclamation within the metropolis and that there is massive development surrounding the observation sites. With such developments and garbage brought about by the wave action, it has been noted that there were so many birds in the area. This is further aggravated by the activities such as construction, gathering of shellfish and people who pass by the area on their way to the beachfront.

Bird habitats in Parañaque-Las Piñas are along the coastal road covering an extensive mudflats of 114 hectares and mangroves of 30 hectares. These areas are under severe development threat for they are planned for further reclamation being parts of the Boulevard 2000 Project.

There were 3,775 birds counted in Parañaque-Las Piñas bird sites. This is a thousand less than the counts gathered during the 2004 AWC. However, there were 65 species identified in the area which is more than double that of the observations during the 2004 AWC counts which was 26. Among the sites sampled in this pilot study, the area is most diverse with such a high species count.

The area is dominated by Common Redshank (*Tringa totanus*) which comprise 20.66% of the total birds counted. This is followed by Whiskered Tern (*Chlidonias hybridus*) with 12.53% and Kentish Plover (*Charadrius alexandrinus*) with 11.05%. Some unidentified Terns comprise 10.99% of the birds counted while 6.01% are Rufous-necked Stints, 5.83% Marsh Sandpipers, 4.45% Asian Golden-plovers, 3.81% unidentified Charadrius, 2.46% Little Egrets 1.91% both Mongolian Plovers & Little-ringed Plovers and 18.40% other species.

In terms of population distribution by Families, Scolopacidae (Curlews, Sandpipers & Snipes) dominates the area with 38.99% followed by Sternidae (Terns) with 23.55%, Charadriidae (Plovers) with 23.50% and Ardeidae (Herons, Egrets and Bitterns) with 7.31% and the rests are 2.01% Estrildidae (Munias), 1.22% Ploceidae (Old World Sparrows), 1.06% Recurvirostridae (Stilts), 0.45%

Rallidae (Rails), 0.45% Laridae (Gulls), 0.32% Alcedinidae (Kingfishers) and 1.22% other species.

The area is famous among birders due to the presence of Siberian Rubythroat (*Luscinia calliope*) which is rare. The Wild Bird Club of the Philippines, Inc. recorded the presence of Chinese Egret (*Egretta eulophotes*) in the area and in the list of the Key Conservation Sites in the Philippines, there are undated records of the presence of such species specifically in Paraňaque which was then a part of the province of Rizal (Mallari, et al. 2001). In 1930s Worcester's Buttonquail (*Turnix worcesteri*), a threatened species, was recorded also in the area.

Numerous nests were found in the mangrove areas within Freedom Island. This is an indication that some migratory species probably had established a colony within the area. However, there are no longer eggs in these nests because people gather them for consumption. With such uncontrolled harvesting, the existence of these birds is threatened.

Bird stations in Candaba, Pampanga are found in Barangays Simang and Paralaya. The area is a complex of freshwater ponds, swamps and marshes with surrounding areas of seasonally flooded grassland, arable land and palm savanna on a vast alluvial flood plain (Mallari, et al, 2001). The bird stations are found in privately owned agricultural and residential lands. Flocks of birds aggregate in these areas.

Most numerous in the area are the Barn Swallow (*Hirundo rustica*) comprising 23.04% of the bird population in the area. This is followed by Black-crowned Night Heron (*Nycticorax nycticorax*) with 16.94%, Grey Heron (*Ardea cinerea*) with 13.71% and Purple Heron (*Ardea purpurea*) with 8.34%. Surprisingly, a considerable number of the endangered Philippine Duck (*Anas luzonica*) was observed in the area and the Siberian Rubythroat (*Luscinia calliope*) is also present.

Most abundant (48.02%) among the birds found in Candaba, Pampanga belong to the Family Ardeidae (Egrets, Herons & Bitterns), 23.04% Hirundinidae (Martins & Swallows), 8.65% Anatidae (Ducks) and 6.52% Estrildidae (Avadavat, Parrotfinches & Munias).

There are species that are in the list of the Key Conservation Sites in the Philippines but were not seen in the area during the conduct of the pilot study. These are: the Spot-billed Pelican (*Pelecanus philippensis*), Wandering Whistling Duck (*Dendrocygna arcuata*), Northern Pintail ((*Anas arcuata*), Eurasian Wigeon (*Anas penelope*), Garganey (*Anas querquedula*), Common Pochard (*Aythya ferina*), Baer's Pochard (*Aythya baeri*), Tufted Duck (*Aythya fuligula*), Purple Swamphen (*Porphyrio phorphyrio*) and Streaked Reed-warbler (*Acrocephalus sorghophilus*).

Furthermore, the Wild Bird Club of the Philippines, Inc. recorded more than 80 species of birds in the area including such rare species like the Chinese Pond Heron (*Ardeola bacchus*), Schrenck's Bittern (*Ixobrychus eurhythmus*) and Common Pochard (*Ayhtya ferina*).

In the case of Cavite, total number of waterfowl species recorded in mangrove areas from 1992-2005 averaged 7,228. This indicates that its mangroves are still highly rich and diverse as mangrove cover only declined by 25% within a span of 10 years (1995 and 2005). Its highest waterfowl population was recorded in 1993 at 26,019, comprising of almost 19 types of waterfowl species. This also corresponds to the highest recorded species diversity from 1992-2003. The largest population per waterfowl species is the kentish plover (3,178), followed by the little tern (1,984) and asiatic golden plover (1,924). These are all migratory species. Except for the kentish plover, which is regarded as a common species, the other two are uncommon in the area. In terms of types of waterfowl found in the area, between 1994 and 1998, types of waterfowl species found in mangroves declined by 81%. Subsequent years showed a remarkable 233% increase, which may be attributed to the seasonality of migration. The figure nonetheless dipped by 46% in 2001, and then climbed by 29% in 2002 and 11% in 2003.

There seem to be no clear pattern that can be seen in the Avifauna count. For instance, though it is tempting to correlate it with mangrove loss, there is no relationship that can be discerned from the data. This is due to the fact that there are many factors that can lead to differences in the bird count. These factors may include: the time of day, the length of time spent counting, the knowledge of the person counting, and the instruments used. Future bird counting activities should insure consistency in the counting methodology to make the data comparable and usable. However, the fact is clear that portions of Manila Bay are frequented by different birds that contribute to the overall level of biodiversity.

Another issue relevant for the calculation of the value of the avifauna resources around the Bay would be the revenues that could be gained from recreational activities such as bird watching. However, this would require asking people their potential willingness to pay for such activity. Methods such as Contingent Valuation would be appropriate. One is also faced with the question of whether such activity would be institutionally feasible. This is because currently potential bird watching sites are owned by private companies or individuals that are not willing to permit access to these sites. Thus, potential revenues from such activity may not be feasible.

ANNEX B
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Mr. Agapito Arrieta	Philippine Ports Authority (PPA)
Mr. Edward Lopes-Dee	National Statistics Census Board (NSCB)
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Appendix Table I A. Number of Morbidity Cases, By Disease, Las Piñas, 1996-2002.

LAS PINAS										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0.00	3,768	32.16	0	0.00	35	46.67	13	8.33
1997	0	0.00	4,205	35.89	0	0.00	17	22.67	12	7.69
1998	0	0.00	339	2.89	0	0.00	16	21.33	35	22.44
1999	0	0.00	803	6.85	0	0.00	3	4.00	7	4.49
2000	0	0.00	1,277	10.90	0	0.00	1	1.33	15	9.62
2001	0	0.00	716	6.11	0	0.00	0	0.00	33	21.15
2002	0	0.00	608	5.19	0	0.00	3	4.00	41	26.28
TOTAL	**0**	**0.00**	**11,716**	**100.00**	**0**	**0.00**	**75**	**100.00**	**156**	**100.00**

Source of Basic Data: Field Health Service Information System, Philippine Health Statistics

Appendix Table I B. Number of Morbidity Cases, By Disease, Navotas, 1996-2002.

NAVOTAS										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0	925	15.24	0	0	7	13.46	0	0.00
1997	0	0	1,799	29.64	0	0	13	25.00	3	14.29
1998	0	0	1,688	27.81	0	0	0	0.00	13	61.90
1999	0	0	126	2.08	0	0	23	44.23	1	4.76
2000	0	0	154	2.54	0	0	4	7.69	1	4.76
2001	0	0	1,232	20.30	0	0	4	7.69	2	9.52
2002	0	0	145	2.39	0	0	1	1.92	1	4.76
TOTAL	**0**	**0.00**	**6,069**	**100.00**	**0**	**0.00**	**52**	**100.00**	**21**	**100.00**

Source of Basic Data: Field Health Service Information System, Philippine Health Statistics

Appendix Table I C. Number of Morbidity Cases, By Disease, Paranaque, 1996-2002.

PARANAQUE										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0	3,589	41.25	0	0	34	42.50	13	11.50
1997	0	0	4,006	46.05	0	0	16	20.00	25	22.12
1998	0	0	321	3.69	0	0	16	20.00	34	30.09
1999	0	0	190	2.18	0	0	0	0.00	2	1.77
2000	0	0	199	2.29	0	0	0	0.00	27	23.89
2001	0	0	188	2.16	0	0	10	12.50	7	6.19
2002	0	0	207	2.38	0	0	4	5.00	5	4.42
TOTAL	**0**	**0.00**	**8,700**	**100.00**	**0**	**0.00**	**80**	**100.00**	**113**	**100.00**

Source of Basic Data: Field Health Service Information System, Philippine Health Statistics

Appendix Table I D. Number of Morbidity Cases, By Disease, Bataan, 1996-2002.

BATAAN										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0.00	0	0.00	0	0	0	0.00	0	0.00
1997	0	0.00	13,714	33.44	0	0	46	9.48	34	12.01
1998	0	0.00	15,743	38.38	0	0	159	32.78	130	45.94
1999	0	0.00	3,057	7.45	0	0	68	14.02	31	10.95
2000	0	0.00	2,594	6.32	0	0	69	14.23	45	15.90
2001	0	0.00	3,391	8.27	0	0	34	7.01	31	10.95
2002	0	0.00	2,516	6.13	0	0	109	22.47	12	4.24
TOTAL	**0**	**0.00**	**41,015**	**100.00**	**0**	**0.00**	**485**	**100.00**	**283**	**100.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table I E. Number of Morbidity Cases, By Disease, Bulacan, 1996-2002.

BULACAN										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0.00	34,416	19.08	0	0	351	15.61	109	13.92
1997	0	0.00	28,866	16.00	0	0	199	8.85	125	15.96
1998	0	0.00	42,706	23.67	0	0	435	19.34	163	20.82
1999	0	0.00	5,333	2.96	0	0	264	11.74	81	10.34
2000	0	0.00	5,849	3.24	0	0	272	12.09	85	10.86
2001	0	0.00	32,919	18.25	0	0	517	22.99	114	14.56
2002	0	0.00	30,333	16.81	0	0	211	9.38	106	13.54
TOTAL	**0**	**0.00**	**180,422**	**100.00**	**0**	**0.00**	**2,249**	**100.00**	**783**	**100.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table I F. Number of Morbidity Cases, By Disease, Pampanga, 1996-2002

PAMPANGA										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0	29,488	25.69	0	0	7	46.67	16	51.61
1997	0	0	18,524	16.14	0	0	0	0.00	3	9.68
1998	0	0	56,390	49.12	0	0	4	26.67	7	22.58
1999	0	0	2,221	1.93	0	0	4	26.67	4	12.90
2000	0	0	3,023	2.63	0	0	0	0.00	1	3.23
2001	0	0	2,046	1.78	0	0	0	0.00	0	0.00
2002	0	0	3,104	2.70	0	0	0	0.00	0	0.00
TOTAL	**0**	**0.00**	**114,796**	**100.00**	**0**	**0.00**	**15**	**100.00**	**31**	**100.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table I G. Number of Morbidity Cases, By Disease, Cavite, 1996-2002.

CAVITE										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0	1,105	2.16	0	0	0	0.00	19	6.11
1997	0	0	26,505	51.87	0	0	332	74.94	61	19.61
1998	0	0	14,162	27.72	0	0	38	8.58	78	25.08
1999	0	0	2,508	4.91	0	0	25	5.64	60	19.29
2000	0	0	3,366	6.59	0	0	25	5.64	59	18.97
2001	0	0	1,690	3.31	0	0	23	5.19	27	8.68
2002	0	0	1,762	3.45	0	0	0	0.00	7	2.25
TOTAL	**0**	**0.00**	**51,098**	**100.00**	**0**	**0.00**	**443**	**100.00**	**311**	**100.00**

Source: Field Health Service Information System, Department of Health, Manila

Appendix Table I H. Number of Morbidity Cases, By Disease, Manila, 1996-2002.

MANILA										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0	17429	26.45	0	0	430	69.16	101	46.70
1997	0	0	19958	30.28	0	0	62	9.97	69	31.91
1998	0	0	19498	29.59	0	0	107	17.21	33	15.26
1999	0	0	2219	3.37	0	0	14	2.25	14	6.47
2000	0	0	2560	3.88	0	0	5	0.80	0	0
2001	0	0	2295	3.48	0	0	0	0	0	0
2002	0	0	1945	2.95	0	0	4	0.64	0	0
TOTAL	**0**	**0.00**	**65,904**	**100.00**	**0**	**0.00**	**622**	**100.00**	**217**	**100.00**

Source: Field Health Service Information System, Department of Health, Manila

Appendix Table I I. Number of Morbidity Cases, By Disease, Pasay City, 1996-2002.

PASAY CITY										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0	3716	28.63	0	0	173	26.05	16	11.27
1997	0	0	3627	27.94	0	0	168	25.30	26	18.31
1998	0	0	3836	29.55	0	0	139	20.93	35	24.65
1999	0	0	375	2.89	0	0	31	4.67	4	2.82
2000	0	0	556	4.28	0	0	38	5.72	18	12.68
2001	0	0	502	3.87	0	0	59	8.89	21	14.79
2002	0	0	369	2.84	0	0	56	8.43	22	15.49
TOTAL	**0**	**0.00**	**12981**	**100.00**	**0**	**0**	**664**	100	**142**	**100.00**

Source: Field Health Service Information System, Department of Health, Manila

Appendix Table I J. Number of Morbidity Cases, By Disease, Cavite City, 1996-2002.

CAVITE CITY										
YEAR	Schistosomiasis		Diarrhea		Poliomyelitis		Typhoid and Paratyphoid		Infectious Hepatitis	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1996	0	0	1,085	31.50	0	0	0	0	14	21.21
1997	0	0	1148	33.33	0	0	0	0	8	12.12
1998	0	0	907	26.34	0	0	0	0	8	12.12
1999	0	0	69	2.00	0	0	0	0	9	13.64
2000	1	100	92	2.67	0	0	0	0	8	12.12
2001	0	0	77	2.24	0	0	0	0	0	0
2002	0	0	66	1.92	0	0	0	0	19	28.79
TOTAL	**0**	**100.00**	**3,444**	**100.00**	**0**	**0**	**0**	**0**	**66**	**100.00**

Source: Field Health Service Information System, Department of Health, Manila

Appendix Table 2 A. Demographic Incidence of Diarrhea, By Region, 1996-1997.

REGION/ AGE GROUP	1996						1997					
	MALE	%	FEMALE	%	BOTH SEX	%	MALE	%	FEMALE	%	BOTH SEX	%
Navotas												
15-49	303	58.49	334	82.06	637	68.86	589	58.49	650	82.07	1,239	68.87
50-64	49	9.46	52	12.78	101	10.92	95	9.43	101	12.75	196	10.89
65 & above	166	32.05	21	5.16	187	20.22	323	32.08	41	5.18	364	20.23
Total	**518**	**56.00**	**407**	**44.00**	**925**	**100.00**	**1,007**	**55.98**	**792**	**44.02**	**1,799**	**100.00**
Las Piñas												
15-49	1,235	58.56	1,361	82.04	2,596	68.90	1,378	58.54	1,519	82.06	2,897	68.89
50-64	198	9.39	212	12.78	410	10.88	221	9.39	236	12.75	457	10.87
65 & above	676	32.05	86	5.18	762	20.22	755	32.07	96	5.19	851	20.24
Total	**2,109**	**55.97**	**1,659**	**44.03**	**3,768**	**100.00**	**2,354**	**55.98**	**1,851**	**44.02**	**4,205**	**100.00**
Parañaque												
15-49	1,176	58.54	1,296	82.03	2,472	68.88	1,313	58.54	1,447	82.08	2,760	68.90
50-64	189	9.41	202	12.78	391	10.89	211	9.41	225	12.76	436	10.88
65 & above	644	32.06	82	5.19	726	20.23	719	32.06	91	5.16	810	20.22
Total	**2,009**	**55.98**	**1,580**	**44.02**	**3,589**	**100.00**	**2,243**	**55.99**	**1,763**	**44.01**	**4,006**	**100.00**
Bataan												
15-49	*	0.00	*	0.00	*	0.00	4,189	78.11	7,047	84.39	11,236	81.93
50-64	*	0.00	*	0.00	*	0.00	831	15.49	785	9.40	1,615	11.78
65 & above	*	0.00	*	0.00	*	0.00	343	6.40	519	6.22	863	6.29
Total	*	**0.00**	*	**0.00**	*	**0.00**	**5,363**	**39.11**	**8,351**	**60.89**	**13,714**	**100.00**
Bulacan												
15-49	11,359	70.59	13,062	71.29	24,421	70.96	9,527	70.59	10,956	71.29	20,483	70.96
50-64	3,202	19.90	3,444	18.79	6,646	19.31	2,686	19.90	2,888	18.79	5,574	19.31
65 & above	1,531	9.51	1,818	9.92	3,349	9.73	1,284	9.51	1,525	9.92	2,809	9.73
Total	**16,092**	**46.76**	**18,324**	**53.24**	**34,416**	**100.00**	**13,497**	**46.76**	**15,369**	**53.24**	**28,866**	**100.00**
Pampanga												
15-49	9,347	60.13	8,572	61.48	17,919	60.77	5,872	60.13	5,385	61.48	11,256	60.77
50-64	4,291	27.60	3,561	25.54	7,852	26.63	2,695	27.60	2,237	25.54	4,932	26.63
65 & above	1,907	12.27	1,811	12.99	3,718	12.61	1,198	12.27	1,137	12.99	2,335	12.61
Total	**15,545**	**52.71**	**13,943**	**47.29**	**29,488**	**100.00**	**9,765**	**52.71**	**8,759**	**47.29**	**18,524**	**100.00**
Cavite												
15-49	301	54.84	407	73.14	708	64.06	3,971	54.84	5,374	73.14	9,345	64.06
50-64	202	36.89	102	18.24	304	27.50	2,671	36.89	1,340	18.24	4,011	27.50
65 & above	45	8.27	48	8.62	93	8.44	599	8.27	633	8.62	1,232	8.44
Total	**548**	**49.64**	**557**	**50.36**	**1,105**	**100.00**	**7,241**	**49.64**	**7,347**	**50.36**	**14,588**	**100.00**

Note: * No report cases
Source of Basic Data: Field Health Service Information System, Philippines Health Statistics

Appendix Table 2 B. Demographic Incidence of Diarrhea, By Region, 1998-1999.

REGION/ AGE GROUP	1998						1999					
	MALE	%	FEMALE	%	BOTH SEX	%	MALE	%	FEMALE	%	BOTH SEX	%
Navotas												
15-49	553	58.52	610	82.10	1,163	68.90	46	85.19	61	84.72	107	84.92
50-64	89	9.42	95	12.79	184	10.90	2	3.70	10	13.89	12	9.52
65 & above	303	32.06	38	5.11	341	20.20	6	11.11	1	1.39	7	5.56
Total	**945**	**55.98**	**743**	**44.02**	**1,688**	**100.00**	**54**	**42.86**	**72**	**57.14**	**126**	**100.00**
Las Piñas												
15-49	111	58.42	122	81.88	233	68.73	267	84.23	424	87.24	691	86.05
50-64	18	9.47	19	12.75	37	10.91	35	11.04	48	9.88	83	10.34
65 & above	61	32.11	8	5.37	69	20.35	15	4.73	14	2.88	29	3.61
Total	**190**	**56.05**	**149**	**43.95**	**339**	**100.00**	**317**	**39.48**	**486**	**60.52**	**803**	**100.00**
Parañaque												
15-49	105	58.33	116	82.27	221	68.85	78	82.98	88	91.67	166	87.37
50-64	17	9.44	18	12.77	35	10.90	11	11.70	7	7.29	18	9.47
65 & above	58	32.22	7	4.96	65	20.25	5	5.32	1	1.04	6	3.16
Total	**180**	**56.07**	**141**	**43.93**	**321**	**100.00**	**94**	**49.47**	**96**	**50.53**	**190**	**100.00**
Bataan												
15-49	4,809	78.11	8,090	84.39	12,899	81.93	754	74.73	1,753	85.60	2,507	82.01
50-64	954	15.49	901	9.40	1,854	11.78	162	16.06	164	8.01	326	10.66
65 & above	394	6.40	596	6.22	990	6.29	93	9.22	131	6.40	224	7.33
Total	**6,157**	**39.11**	**9,586**	**60.89**	**15,743**	**100.00**	**1,009**	**33.01**	**2,048**	**66.99**	**3,057**	**100.00**
Bulacan												
15-49	14,095	70.59	16,208	71.29	30,303	70.96	1,756	68.84	2,034	73.11	3,790	71.07
50-64	3,974	19.90	4,273	18.79	8,247	19.31	553	21.68	491	17.65	1,044	19.58
65 & above	1,900	9.51	2,256	9.92	4,156	9.73	242	9.49	257	9.24	499	9.36
Total	**19,969**	**46.76**	**22,737**	**53.24**	**42,706**	**100.00**	**2,551**	**47.83**	**2,782**	**52.17**	**5,333**	**100.00**
Pampanga												
15-49	6,115	60.13	42,706	92.40	48,821	86.58	677	56.94	686	66.47	1,363	61.37
50-64	2,807	27.60	2,330	5.04	5,137	9.11	392	32.97	217	21.03	609	27.42
65 & above	1,248	12.27	1,185	2.56	2,432	4.31	120	10.09	129	12.50	249	11.21
Total	**10,170**	**18.03**	**46,220**	**81.97**	**56,390**	**100.00**	**1,189**	**53.53**	**1,032**	**46.47**	**2,221**	**100.00**
Cavite												
15-49	3,855	54.84	5,217	73.14	9,072	64.06	695	58.55	888	67.22	1,583	63.12
50-64	2,593	36.89	1,301	18.24	3,894	27.50	349	29.40	314	23.77	663	26.44
65 & above	581	8.27	615	8.62	1,196	8.44	143	12.05	119	9.01	262	10.45
Total	**7,029**	**49.64**	**7,133**	**50.36**	**14,162**	**100.00**	**1,187**	**47.33**	**1,321**	**52.67**	**2,508**	**100.00**

Note: * No report cases
Source of Basic Data: Field Health Service Information System, Philippines Health Statistics

Appendix Table 2 C. Demographic Incidence of Diarrhea, By Region, 2000-2001.

REGION/ AGE GROUP	2000						2001					
	MALE	%	FEMALE	%	BOTH SEX	%	MALE	%	FEMALE	%	BOTH SEX	%
Navotas												
15-49	55	87.30	70	76.92	125	81.17	36	65.45	53	68.83	89	67.42
50-64	6	9.52	13	14.29	19	12.34	16	29.09	18	23.38	34	25.76
65 & above	2	3.17	8	8.79	10	6.49	3	5.45	6	7.79	9	6.82
Total	**63**	**40.91**	**91**	**59.09**	**154**	**100.00**	**55**	**41.67**	**77**	**58.33**	**132**	**100.00**
Las Piñas												
15-49	277	81.71	461	49.15	738	57.79	253	89.40	363	83.83	616	86.03
50-64	49	14.45	456	48.61	505	39.55	23	8.13	45	10.39	68	9.50
65 & above	13	3.83	21	2.24	34	2.66	7	2.47	25	5.77	32	4.47
Total	**339**	**26.55**	**938**	**73.45**	**1,277**	**100.00**	**283**	**39.53**	**433**	**60.47**	**716**	**100.00**
Parañaque												
15-49	60	72.29	109	93.97	169	84.92	56	80.00	101	85.59	157	83.51
50-64	17	20.48	6	5.17	23	11.56	11	15.71	13	11.02	24	12.77
65 & above	6	7.23	1	0.86	7	3.52	3	4.29	4	3.39	7	3.72
Total	**83**	**41.71**	**116**	**58.29**	**199**	**100.00**	**70**	**37.23**	**118**	**62.77**	**188**	**100.00**
Bataan												
15-49	1,109	76.96	807	69.99	1,916	73.86	876	83.91	2,151	91.65	3,027	89.27
50-64	252	17.49	215	18.65	467	18.00	117	11.21	119	5.07	236	6.96
65 & above	80	5.55	131	11.36	211	8.13	51	4.89	77	3.28	128	3.77
Total	**1,441**	**55.55**	**1,153**	**44.45**	**2,594**	**100.00**	**1,044**	**30.79**	**2,347**	**69.21**	**3,391**	**100.00**
Bulacan												
15-49	1,935	72.42	2,209	69.53	4,144	70.85	10,865	70.59	12,494	71.29	23,359	70.96
50-64	482	18.04	632	19.89	1,114	19.05	3,063	19.90	3,294	18.79	6,357	19.31
65 & above	255	9.54	336	10.58	591	10.10	1,464	9.51	1,739	9.92	3,203	9.73
Total	**2,672**	**45.68**	**3,177**	**54.32**	**5,849**	**100.00**	**15,392**	**46.76**	**17,527**	**53.24**	**32,919**	**100.00**
Pampanga												
15-49	923	59.40	919	62.56	1,842	60.93	707	68.24	634	62.77	1,341	65.54
50-64	422	27.16	377	25.66	799	26.43	229	22.10	263	26.04	492	24.05
65 & above	209	13.45	173	11.78	382	12.64	100	9.65	113	11.19	213	10.41
Total	**1,554**	**51.41**	**1,469**	**48.59**	**3,023**	**100.00**	**1,036**	**50.64**	**1,010**	**49.36**	**2,046**	**100.00**
Cavite												
15-49	628	28.94	922	77.09	1,550	46.05	555	75.10	720	75.71	1,275	75.44
50-64	1,475	67.97	196	16.39	1,671	49.64	120	16.24	149	15.67	269	15.92
65 & above	67	3.09	78	6.52	145	4.31	64	8.66	82	8.62	146	8.64
Total	**2,170**	**64.47**	**1,196**	**35.53**	**3,366**	**100.00**	**739**	**43.73**	**951**	**56.27**	**1,690**	**100.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 2 D. Demographic Incidence of Diarrhea, By Region, 2002

REGION/ AGE GROUP	2002					
	MALE	%	FEMALE	%	BOTH SEX	%
Navotas						
15-49	45	78.95	71	80.68	116	80.00
50-64	10	17.54	10	11.36	20	13.79
65 & above	2	3.51	7	7.95	9	6.21
Total	**57**	**39.31**	**88**	**60.69**	**145**	**100.00**
Las Piñas						
15-49	194	81.17	302	81.84	496	81.58
50-64	37	15.48	47	12.74	84	13.82
65 & above	8	3.35	20	5.42	28	4.61
Total	**239**	**39.31**	**369**	**60.69**	**608**	**100.00**
Parañaque						
15-49	68	82.93	106	84.80	174	84.06
50-64	11	13.41	18	14.40	29	14.01
65 & above	3	3.66	1	0.80	4	1.93
Total	**82**	**39.61**	**125**	**60.39**	**207**	**100.00**
Bataan						
15-49	728	78.03	1,350	85.28	2,078	82.59
50-64	145	15.54	144	9.10	289	11.49
65 & above	60	6.43	89	5.62	149	5.92
Total	**933**	**37.08**	**1,583**	**62.92**	**2,516**	**100.00**
Bulacan						
15-49	10,011	70.59	11,512	71.29	21,524	70.96
50-64	2,823	19.90	3,035	18.79	5,858	19.31
65 & above	1,349	9.51	1,602	9.92	2,952	9.73
Total	**14,183**	**46.76**	**16,150**	**53.24**	**30,333**	**100.00**
Pampanga						
15-49	969	56.47	745	53.67	1,714	55.22
50-64	478	27.86	410	29.54	888	28.61
65 & above	269	15.68	233	16.79	502	16.17
Total	**1,716**	**55.28**	**1,388**	**44.72**	**3,104**	**100.00**
Cavite						
15-49	523	69.00	739	73.61	1,262	71.62
50-64	148	19.53	169	16.83	317	17.99
65 & above	87	11.48	96	9.56	183	10.39
Total	**758**	**43.02**	**1,004**	**56.98**	**1,762**	**100.00**

Appendix Table 2 E. Demographic Incidence of Typhoid and Paratyphoid, By Region, 1996-1997.

REGION/ AGE GROUP	1996						1997					
	MALE	%	FEMALE	%	BOTH SEX	%	MALE	%	FEMALE	%	BOTH SEX	%
Navotas												
15-49	3	75.00	3	100.00	6	85.71	4	57.14	5	83.33	9	69.23
50-64	0	0.00	0	0.00	0	0.00	1	14.29	1	16.67	2	15.38
65 & above	1	25.00	0	0.00	1	14.29	2	28.57	0	0.00	2	15.38
Total	**4**	**57.14**	**3**	**42.86**	**7**	**100.00**	**7**	**53.85**	**6**	**46.15**	**13**	**100.00**
Las Piñas												
15-49	11	57.89	13	81.25	24	68.57	6	60.00	6	85.71	12	70.59
50-64	2	10.53	2	12.50	4	11.43	1	10.00	1	14.29	2	11.76
65 & above	6	31.58	1	6.25	7	20.00	3	30.00	0	0.00	3	17.65
Total	**19**	**54.29**	**16**	**45.71**	**35**	**100.00**	**10**	**58.82**	**7**	**41.18**	**17**	**100.00**
Parañaque												
15-49	11	57.89	12	80.00	23	67.65	5	55.56	6	85.71	11	68.75
50-64	2	10.53	2	13.33	4	11.76	1	11.11	1	14.29	2	12.50
65 & above	6	31.58	1	6.67	7	20.59	3	33.33	0	0.00	3	18.75
Total	**19**	**55.88**	**15**	**44.12**	**34**	**100.00**	**9**	**56.25**	**7**	**8.66**	**16**	**64.91**
Bataan												
15-49	*	0.00	*	0.00	*	0.00	24	91.37	18	91.07	42	91.24
50-64	*	0.00	*	0.00	*	0.00	2	6.07	1	7.02	3	6.48
65 & above	*	0.00	*	0.00	*	0.00	1	2.57	0	1.91	1	2.29
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**26**	**57.11**	**20**	**16.22**	**46**	**73.32**
Bulacan												
15-49	161	79.64	115	77.46	276	78.72	91	79.64	65	77.46	157	78.72
50-64	31	15.20	20	13.71	51	14.57	17	15.20	12	13.71	29	14.57
65 & above	10	5.16	13	8.83	24	6.72	6	5.16	7	8.83	13	6.72
Total	**202**	**57.54**	**149**	**42.46**	**351**	**100.00**	**114**	**57.54**	**85**	**42.46**	**199**	**100.00**
Pampanga												
15-49	5	75.00	0	0.00	5	75.00	0	0.00	0	0.00	0	0.00
50-64	2	25.00	0	0.00	2	25.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**7**	**100.00**	**0**	**0.00**	**7**	**100.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Cavite												
15-49	0	0.00	0	0.00	0	0.00	204	93.89	106	92.27	310	93.33
50-64	0	0.00	0	0.00	0	0.00	13	6.11	9	7.73	22	6.67
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**218**	**65.51**	**115**	**34.49**	**332**	**100.00**

Note: * No report cases
Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 2 F. Demographic Incidence of Typhoid and Paratyphoid, By Region, 1998-1999.

REGION/ AGE GROUP	1998						1999					
	MALE	%	FEMALE	%	BOTH SEX	%	MALE	%	FEMALE	%	BOTH SEX	%
Navotas												
15-49	0	0.00	0	0.00	0	0.00	8	80.00	9	69.23	17	73.91
50-64	0	0.00	0	0.00	0	0.00	1	10.00	2	15.38	3	13.04
65 & above	0	0.00	0	0.00	0	0.00	1	10.00	2	15.38	3	13.04
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**10**	**43.48**	**13**	**56.52**	**23**	**100.00**
Las Piñas												
15-49	5	55.56	6	85.71	11	68.75	2	100.00	1	100.00	3	100.00
50-64	1	11.11	1	14.29	2	12.50	0	0.00	0	0.00	0	0.00
65 & above	3	33.33	0	0.00	3	18.75	0	0.00	0	0.00	0	0.00
Total	**9**	**56.25**	**7**	**43.75**	**16**	**100.00**	**2**	**66.67**	**1**	**33.33**	**3**	**100.00**
Parañaque												
15-49	5	55.56	6	85.71	11	68.75	0	0.00	0	0.00	0	0.00
50-64	1	11.11	1	14.29	2	12.50	0	0.00	0	0.00	0	0.00
65 & above	3	33.33	0	0.00	3	18.75	0	0.00	0	0.00	0	0.00
Total	**9**	**56.25**	**7**	**43.75**	**16**	**100.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Bataan												
15-49	83	91.37	62	91.07	145	91.24	40	97.56	24	88.89	64	94.12
50-64	6	6.07	5	7.02	10	6.48	0	0.00	3	11.11	3	4.41
65 & above	2	2.57	1	1.91	4	2.29	1	2.44	0	0.00	1	1.47
Total	**91**	**57.11**	**68**	**42.89**	**159**	**100.00**	**41**	**60.29**	**27**	**39.71**	**68**	**100.00**
Bulacan												
15-49	199	79.64	143	77.46	342	78.72	108	81.82	97	73.48	205	77.65
50-64	38	15.20	25	13.71	63	14.57	19	14.39	22	16.67	41	15.53
65 & above	13	5.16	16	8.83	29	6.72	5	3.79	13	9.85	18	6.82
Total	**250**	**57.54**	**185**	**42.46**	**435**	**100.00**	**132**	**50.00**	**132**	**50.00**	**264**	**100.00**
Pampanga												
15-49	3	75.00	0	0.00	3	75.00	3	75.00	0	0.00	3	75.00
50-64	1	25.00	0	0.00	1	25.00	1	25.00	0	0.00	1	25.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**4**	**100.00**	**0**	**0.00**	**4**	**100.00**	**4**	**100.00**	**0**	**0.00**	**4**	**100.00**
Cavite												
15-49	24	93.89	12	92.27	36	93.33	18	94.74	5	83.33	23	92.00
50-64	2	6.11	1	7.73	3	6.67	1	5.26	1	16.67	2	8.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**25**	**65.51**	**13**	**34.49**	**38**	**100.00**	**19**	**76.00**	**6**	**24.00**	**25**	**100.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 2 G. Demographic Incidence of Typhoid and Paratyphoid, By Region, 2000-2001.

REGION/ AGE GROUP	2000 MALE	%	FEMALE	%	BOTH SEX	%	2001 MALE	%	FEMALE	%	BOTH SEX	%
Navotas												
15-49	2	100.00	2	100.00	4	100.00	3	100.00	1	100.00	4	100.00
50-64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**2**	**50.00**	**2**	**50.00**	**4**	**100.00**	**3**	**75.00**	**1**	**25.00**	**4**	**100.00**
Las Piñas												
15-49	0	0.00	1	100.00	1	100.00	0	0.00	0	0.00	0	0.00
50-64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**	**0.00**	**1**	**100.00**	**1**	**100.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Parañaque												
15-49	0	0.00	0	0.00	0	0.00	4	100.00	6	100.00	10	100.00
50-64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**4**	**40.00**	**6**	**60.00**	**10**	**100.00**
Bataan												
15-49	36	85.71	22	81.48	58	84.06	17	89.47	15	100.00	32	94.12
50-64	5	11.90	4	14.81	9	13.04	1	5.26	0	0.00	1	2.94
65 & above	1	2.38	1	3.70	2	2.90	1	5.26	0	0.00	1	2.94
Total	**42**	**60.87**	**27**	**39.13**	**69**	**100.00**	**19**	**55.88**	**15**	**44.12**	**34**	**100.00**
Bulacan												
15-49	138	77.97	79	83.16	217	79.78	237	79.64	170	77.46	407	78.72
50-64	28	15.82	9	9.47	37	13.60	45	15.20	30	13.71	75	14.57
65 & above	11	6.21	7	7.37	18	6.62	15	5.16	19	8.83	35	6.72
Total	**177**	**65.07**	**95**	**34.93**	**272**	**100.00**	**297**	**57.54**	**220**	**42.46**	**517**	**100.00**
Pampanga												
15-49	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
50-64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Cavite												
15-49	14	87.50	8	88.89	22	88.00	13	100.00	10	100.00	23	100.00
50-64	2	12.50	1	11.11	3	12.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**16**	**64.00**	**9**	**36.00**	**25**	**100.00**	**13**	**56.52**	**10**	**43.48**	**23**	**100.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 2 H. Demographic Incidence of Typhoid and Paratyphoid, By Region, 2002.

REGION/ AGE GROUP	2002 MALE	%	FEMALE	%	BOTH SEX	%
Navotas						
15-49	1	100.00	0	0.00	1	100.00
50-64	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00
Total	**1**	**100.00**	**0**	**0.00**	**1**	**100.00**
Las Piñas						
15-49	1	100.00	2	100.00	3	100.00
50-64	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00
Total	**1**	**33.33**	**2**	**66.67**	**3**	**100.00**
Parañaque						
15-49	1	100.00	3	100.00	4	100.00
50-64	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00
Total	**1**	**25.00**	**3**	**75.00**	**4**	**100.00**
Bataan						
15-49	52	92.86	49	92.45	101	92.66
50-64	4	7.14	2	3.77	6	5.50
65 & above	0	0.00	2	3.77	2	1.83
Total	**56**	**51.38**	**53**	**48.62**	**109**	**100.00**
Bulacan						
15-49	97	79.64	69	77.46	166	78.72
50-64	18	15.20	12	13.71	31	14.57
65 & above	6	5.16	8	8.83	14	6.72
Total	**121**	**57.54**	**90**	**42.46**	**211**	**100.00**
Pampanga						
15-49	0	0.00	0	0.00	0	0.00
50-64	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Cavite						
15-49	0	0.00	0	0.00	0	0.00
50-64	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 2 I. Demographic Incidence of Infectious Hepatitis, By Region, 1996-1997.

REGION/ AGE GROUP	1996						1997					
	MALE	%	FEMALE	%	BOTH SEX	%	MALE	%	FEMALE	%	BOTH SEX	%
Navotas												
15-49	0	0.00	0	0.00	0	0.00	1	50.00	1	100.00	2	66.67
50-64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	1	50.00	0	0.00	1	33.33
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**2**	**66.67**	**1**	**33.33**	**3**	**100.00**
Las Piñas												
15-49	4	57.14	5	83.33	9	69.23	4	57.14	4	80.00	8	66.67
50-64	1	14.29	1	16.67	2	15.38	1	14.29	1	20.00	2	16.67
65 & above	2	28.57	0	0.00	2	15.38	2	28.57	0	0.00	2	16.67
Total	**7**	**53.85**	**6**	**46.15**	**13**	**100.00**	**7**	**58.33**	**5**	**41.67**	**12**	**100.00**
Parañaque												
15-49	4	57.14	5	83.33	9	69.23	4	57.14	4	22.22	8	32.00
50-64	1	14.29	1	16.67	2	15.38	1	14.29	14	77.78	15	60.00
65 & above	2	28.57	0	0.00	2	15.38	2	28.57	0	0.00	2	8.00
Total	**7**	**53.85**	**6**	**46.15**	**13**	**100.00**	**7**	**28.00**	**18**	**72.00**	**25**	**100.00**
Bataan												
15-49	*	0.00	*	0.00	*	0.00	21	82.31	6	70.25	27	79.16
50-64	*	0.00	*	0.00	*	0.00	2	9.74	2	17.54	4	11.78
65 & above	*	0.00	*	0.00	*	0.00	2	7.94	1	12.21	3	9.06
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**25**	**73.84**	**9**	**26.16**	**34**	**100.00**
Bulacan												
15-49	66	90.08	34	94.57	100	91.56	75	90.08	39	94.57	114	91.56
50-64	5	6.28	2	5.43	7	6.00	5	6.28	2	5.43	7	6.00
65 & above	3	3.64	0	0.00	3	2.44	3	3.64	0	0.00	3	2.44
Total	**73**	**66.98**	**36**	**33.02**	**109**	**100.00**	**84**	**66.98**	**41**	**33.02**	**125**	**100.00**
Pampanga												
15-49	14	100.00	2	100.00	16	100.00	2	100.00	0	100.00	3	100.00
50-64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**14**	**87.50**	**2**	**12.50**	**16**	**100.00**	**2**	**87.50**	**0**	**12.50**	**3**	**100.00**
Cavite												
15-49	10	84.93	6	91.08	17	87.08	34	84.93	19	91.08	53	87.08
50-64	1	10.94	1	8.92	2	10.23	4	10.94	2	8.92	6	10.23
65 & above	1	4.13	0	0.00	1	2.69	2	4.13	0	0.00	2	2.69
Total	**12**	**65.05**	**7**	**34.95**	**19**	**100.00**	**40**	**65.05**	**21**	**34.95**	**61**	**100.00**

Note: * No report cases
Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 2 J. Demographic Incidence of Infectious Hepatitis, By Region, 1998-1999.

REGION/ AGE GROUP	1998						1999					
	MALE	%	FEMALE	%	BOTH SEX	%	MALE	%	FEMALE	%	BOTH SEX	%
Navotas												
15-49	4	57.14	5	83.33	9	69.23	1	100.00	0	0.00	1	100.00
50-64	1	14.29	1	16.67	2	15.38	0	0.00	0	0.00	0	0.00
65 & above	2	28.57	0	0.00	2	15.38	0	0.00	0	0.00	0	0.00
Total	**7**	**53.85**	**6**	**46.15**	**13**	**100.00**	**1**	**100.00**	**0**	**0.00**	**1**	**100.00**
Las Piñas												
15-49	11	57.89	13	81.25	24	68.57	5	100.00	2	100.00	7	100.00
50-64	2	10.53	2	12.50	4	11.43	0	0.00	0	0.00	0	0.00
65 & above	6	31.58	1	6.25	7	20.00	0	0.00	0	0.00	0	0.00
Total	**19**	**54.29**	**16**	**45.71**	**35**	**100.00**	**5**	**71.43**	**2**	**28.57**	**7**	**100.00**
Parañaque												
15-49	11	57.89	12	80.00	23	67.65	2	100.00	0	0.00	2	100.00
50-64	2	10.53	2	13.33	4	11.76	0	0.00	0	0.00	0	0.00
65 & above	6	31.58	1	6.67	7	20.59	0	0.00	0	0.00	0	0.00
Total	**19**	**55.88**	**15**	**44.12**	**34**	**100.00**	**2**	**100.00**	**0**	**0.00**	**2**	**100.00**
Bataan												
15-49	79	82.31	24	70.25	103	79.16	18	81.82	7	77.78	25	80.65
50-64	9	9.74	6	17.54	15	11.78	0	0.00	2	22.22	2	6.45
65 & above	8	7.94	4	12.21	12	9.06	4	18.18	0	0.00	4	12.90
Total	**96**	**73.84**	**34**	**26.16**	**130**	**100.00**	**22**	**70.97**	**9**	**29.03**	**31**	**100.00**
Bulacan												
15-49	98	90.08	51	94.57	149	91.56	52	89.66	22	95.65	74	91.36
50-64	7	6.28	3	5.43	10	6.00	3	5.17	1	4.35	4	4.94
65 & above	4	3.64	0	0.00	4	2.44	3	5.17	0	0.00	3	3.70
Total	**109**	**66.98**	**54**	**33.02**	**163**	**100.00**	**58**	**71.60**	**23**	**28.40**	**81**	**100.00**
Pampanga												
15-49	6	100.00	1	100.00	7	100.00	3	100.00	1	100.00	4	100.00
50-64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**6**	**87.50**	**1**	**12.50**	**7**	**100.00**	**3**	**75.00**	**1**	**25.00**	**4**	**100.00**
Cavite												
15-49	43	84.93	25	91.08	68	87.08	33	94.29	24	96.00	57	95.00
50-64	6	10.94	2	8.92	8	10.23	0	0.00	1	4.00	1	1.67
65 & above	2	4.13	0	0.00	2	2.69	2	5.71	0	0.00	2	3.33
Total	**51**	**65.05**	**27**	**34.95**	**78**	**100.00**	**35**	**58.33**	**25**	**41.67**	**60**	**100.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 2 K. Demographic Incidence of Infectious Hepatitis, By Region, 2000-2001**.**

REGION/ AGE GROUP	2000						2001					
	MALE	%	FEMALE	%	BOTH SEX	%	MALE	%	FEMALE	%	BOTH SEX	%
Navotas												
15-49	0	0.00	0	0.00	0	0.00	1	100.00	1	100.00	2	100.00
50-64	0	0.00	1	100.00	1	100.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**	**0.00**	**1**	**100.00**	**1**	**100.00**	**1**	**50.00**	**1**	**50.00**	**2**	**100.00**
Las Piñas												
15-49	5	83.33	8	88.89	13	86.67	21	100.00	12	100.00	33	100.00
50-64	1	16.67	1	11.11	2	13.33	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**6**	**40.00**	**9**	**60.00**	**15**	**100.00**	**21**	**63.64**	**12**	**36.36**	**33**	**100.00**
Parañaque												
15-49	6	46.15	9	64.29	15	55.56	2	100.00	5	100.00	7	100.00
50-64	6	46.15	4	28.57	10	37.04	0	0.00	0	0.00	0	0.00
65 & above	1	7.69	1	7.14	2	7.41	0	0.00	0	0.00	0	0.00
Total	**13**	**48.15**	**14**	**51.85**	**27**	**100.00**	**2**	**28.57**	**5**	**71.43**	**7**	**100.00**
Bataan												
15-49	28	84.85	9	75.00	37	82.22	20	95.24	7	70.00	27	87.10
50-64	4	12.12	1	8.33	5	11.11	1	4.76	3	30.00	4	12.90
65 & above	1	3.03	2	16.67	3	6.67	0	0.00	0	0.00	0	0.00
Total	**33**	**73.33**	**12**	**26.67**	**45**	**100.00**	**21**	**67.74**	**10**	**32.26**	**31**	**100.00**
Bulacan												
15-49	48	90.57	30	93.75	78	91.76	69	90.08	36	94.57	104	91.56
50-64	4	7.55	2	6.25	6	7.06	5	6.28	2	5.43	7	6.00
65 & above	1	1.89	0	0.00	1	1.18	3	3.64	0	0.00	3	2.44
Total	**53**	**62.35**	**32**	**37.65**	**85**	**100.00**	**76**	**66.98**	**38**	**33.02**	**114**	**100.00**
Pampanga												
15-49	1	100.00	0	0.00	1	100.00	0	0.00	0	0.00	0	0.00
50-64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**1**	**100.00**	**0**	**0.00**	**1**	**100.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Cavite												
15-49	38	90.48	15	88.24	53	89.83	12	75.00	9	81.82	21	77.78
50-64	4	9.52	2	11.76	6	10.17	2	12.50	2	18.18	4	14.81
65 & above	0	0.00	0	0.00	0	0.00	2	12.50	0	0.00	2	7.41
Total	**42**	**71.19**	**17**	**28.81**	**59**	**100.00**	**16**	**59.26**	**11**	**40.74**	**27**	**100.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 2 L. Demographic Incidence of Infectious Hepatitis, By Region, 2002.

REGION/ AGE GROUP	2002					
	MALE	%	FEMALE	%	BOTH SEX	%
Navotas						
15-49	1	100.00	0	0.00	1	100.00
50-64	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00
Total	**1**	**100.00**	**0**	**0.00**	**1**	**100.00**
Las Piñas						
15-49	27	93.10	12	100.00	39	95.12
50-64	2	6.90	0	0.00	2	4.88
65 & above	0	0.00	0	0.00	0	0.00
Total	**29**	**70.73**	**12**	**29.27**	**41**	**100.00**
Parañaque						
15-49	4	100.00	1	100.00	5	100.00
50-64	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00
Total	**4**	**80.00**	**1**	**20.00**	**5**	**100.00**
Bataan						
15-49	7	70.00	1	50.00	8	66.67
50-64	2	20.00	0	0.00	2	16.67
65 & above	1	10.00	1	50.00	2	16.67
Total	**10**	**83.33**	**2**	**16.67**	**12**	**100.00**
Bulacan						
15-49	64	90.08	33	94.57	97	91.56
50-64	4	6.28	2	5.43	6	6.00
65 & above	3	3.64	0	0.00	3	2.44
Total	**71**	**66.98**	**35**	**33.02**	**106**	**100.00**
Pampanga						
15-49	0	0.00	0	0.00	0	0.00
50-64	0	0.00	0	0.00	0	0.00
65 & above	0	0.00	0	0.00	0	0.00
Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Cavite						
15-49	4	80.00	2	100.00	6	85.71
50-64	1	20.00	0	0.00	1	14.29
65 & above	0	0.00	0	0.00	0	0.00
Total	**5**	**71.43**	**2**	**28.57**	**7**	**100.00**

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 3 A. Estimated Morbidity Cases for the Employed Population, Navotas, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	300	593	552	41	48	42	47
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	2	4	0	7	1	1	0
Infectious Hepatitis	0	1	4	0	0	1	0

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 3 B. Estimated Morbidity Cases for the Employed Population, Las Piñas, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	1,222	1,385	111	261	397	230	196
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	11	6	5	1	0	0	1
Infectious Hepatitis	4	3	10	2	4	9	11

Source of Basic Data : Field Health Service Information System, Department of Health, Manila

Appendix Table 3 C. Estimated Employed Morbidity Cases, Paranaque, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	1,164	1,320	105	62	62	60	67
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	11	5	5	0	0	3	1
Infectious Hepatitis	4	7	9	1	7	2	1

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 3 D. Estimated Morbidity Cases for the Employed Population, Pasay City, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	1	0	0
Diarrhea	1206	1195	1255	122	173	161	119
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	56	55	45	10	12	19	18
Infectious Hepatitis	4	7	10	1	5	6	6

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 3 E. Estimated Morbidity Cases for the Employed Population, Manila, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	5,654	6,575	6,380	721	797	737	627
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	139	21	35	5	2	0	1
Infectious Hepatitis	27	19	9	4	0	0	0

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 3 F. Estimated Morbidity Cases for the Employed Population, Bataan, 1996-2002

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	0	4,545	5,228	1,036	848	1,153	846
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	0	15	53	23	23	12	37
Infectious Hepatitis	0	9	36	9	12	9	3

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 3 G. Estimated Morbidity Cases for the Employed Population, Bulacan, 1996-2002

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	11,571	9,566	14,181	1,808	1,912	11,190	10,200
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	118	66	144	89	89	176	71
Infectious Hepatitis	31	35	29	23	23	32	30

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 3 H. Estimated Employed Morbidity Cases, Pampanga, 1996-2002

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	9,914	6,139	18,725	753	988	695	1,044
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	2	0	1	1	0	0	0
Infectious Hepatitis	4	1	2	1	0	0	0

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 3 I. Estimated Morbidity Cases for the Employed Population, Cavite, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	399	5,223	4,945	881	1,139	597	624
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	0	119	13	9	8	8	0
Infectious Hepatitis	6	18	23	18	17	8	2

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 3 J. Estimated Employed Morbidity Cases, Cavite City, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	1	0	0
Diarrhea	392	411	317	24	31	27	23
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	0	0	0	0	0	0	0
Infectious Hepatitis	4	2	2	3	2	0	6

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 4 A. Total Excess Work Loss Days, Navotas, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	900	1,778	1,657	123	144	127	140
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	16	30	0	52	9	9	2
Infectious Hepatitis	0	6	25	2	2	4	2

Appendix Table 4 B. Total Excess Work Loss Days, Las Piñas, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	3,667	4,156	333	783	1,192	690	588
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	79	39	37	7	2	0	7
Infectious Hepatitis	25	23	67	13	27	62	77

Appendix Table 4 C. Total Excess Work Loss Days, Parañaque, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	3,493	3,959	315	185	186	181	200
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	77	37	37	0	0	22	9
Infectious Hepatitis	25	48	65	4	49	13	9

Appendix Table 4 D. Total Excess Work Loss Days, Pasay City, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	3,617	3,585	37,665	366	519	484	357
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	393	387	318	71	83	133	126
Infectious Hepatitis	30	50	67	8	33	39	41

Appendix Table 4 E. Total Excess Work Loss Days, Manila, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	16,963	19,726	1,9140	2,164	2,390	2,211	1,882
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	976	144	244	32	11	0	9
Infectious Hepatitis	191	132	62	27	0	0	0

Appendix Table 4 F. Total Excess Work Loss Days, Bataan, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	0	13,634	15,683	3,109	2,544	3,458	2,538
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	0	107	370	161	158	81	257
Infectious Hepatitis	0	66	252	61	86	61	24

Appendix Table 4 G. Total Excess Work Loss Days, Bulacan, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	34,713	28,698	42,544	5,424	5,737	33,570	30,601
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	826	462	1,011	626	622	1,230	497
Infectious Hepatitis	214	242	200	160	162	226	208

Appendix Table 4 H. Total Excess Work Loss Days, Pampanga, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	29,743	18,416	56,176	2,259	2,965	2,086	3,131
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	16	0	9	9	0	0	0
Infectious Hepatitis	31	6	14	8	2	0	0

Appendix Table 4 I. Total Excess Work Loss Days, Cavite, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	1,197	15,668	14,834	2,644	3,418	1,790	1,871
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	0	832	93	62	59	57	0
Infectious Hepatitis	40	127	159	123	116	56	14

Appendix Table 4 J. Total Excess Work Loss Days, Cavite City, 1996-2002.

DISEASE	YEAR						
	1996	1997	1998	1999	2000	2001	2002
Schistosomiasis	0	0	0	0	0	0	0
Diarrhea	16,963	19,726	19,140	2,164	2,390	2,211	1,882
Poliomyelitis	0	0	0	0	0	0	0
Typhoid and Paratyphoid	976	144	244	32	11	0	9
Infectious Hepatitis	191	132	62	27	0	0	0

Appendix Table 5 A. Number of Mortality Incidence, by Province, 1995-1998.

DISEASE	PROVINCE	YEAR			
		1995	1996	1997	1998
Schistosomiasis	M. Manila, 3rd District	0	1	3	2
	M. Manila, 4th District	3	2	0	2
	Bataan	0	0	0	0
	Bulacan	3	2	4	2
	Pampanga	0	0	1	0
	Cavite	0	1	2	4
	Cavite City	0	1	0	0
	Nueva Ecija	1	0	0	0
	Laguna	0	3	0	0
	Rizal	0	0	0	0
Diarrhea	M. Manila, 3rd District	57	77	66	147
	M. Manila, 4th District	130	133	113	145
	Bataan	14	12	20	28
	Bulacan	95	119	88	146
	Pampanga	27	29	36	49
	Cavite	73	102	86	142
	Cavite City	5	9	2	7
	Nueva Ecija	35	57	30	62
	Laguna	59	77	62	59
	Rizal	98	159	132	154
Poliomyelitis	M. Manila, 3rd District	2	1	1	1
	M. Manila, 4th District	0	3	0	0
	Bataan	0	1	0	0
	Bulacan	1	2	1	3
	Pampanga	1	1	1	0
	Cavite	0	0	0	0
	Cavite City	0	0	0	0
	Nueva Ecija	0	0	0	0
	Laguna	0	1	0	0
	Rizal	0	0	1	1
Typhoid and Paratyphoid	M. Manila, 3rd District	7	9	7	53
	M. Manila, 4th District	14	21	14	26
	Bataan	2	3	0	5
	Bulacan	18	26	22	19
	Pampanga	2	9	2	6
	Cavite	12	23	16	14
	Cavite City	3	1	0	3
	Nueva Ecija	10	6	6	16
	Laguna	15	13	14	20
	Rizal	17	17	30	21
Infectious Hepatitis	M.Manila, 3rd District	21	14	17	15
	M.Manila, 4th District	22	25	18	12
	Bataan	13	5	5	6
	Bulacan	21	20	23	16
	Pampanga	15	12	10	13
	Cavite	17	23	19	29
	Cavite City	2	1	0	2
	Nueva Ecija	14	15	25	12
	Laguna	18	19	11	18
	Rizal	19	15	15	21

Appendix Table 5A. Continued …

DISEASE	PROVINCE	YEAR			
		1995	1996	1997	1998
Bronchitis/Brochiolitis	M.Manila, 3rd District	13	15	58	18
	M.Manila, 4th District	11	8	37	12
	Bataan	11	2	26	9
	Bulacan	24	27	95	32
	Pampanga	9	13	44	15
	Cavite	15	12	51	17
	Cavite City	4	1	7	2
	Nueva Ecija	8	13	36	12
	Laguna	21	15	65	22
	Rizal	5	10	26	9
Dengue H-fever	M.Manila, 3rd District	10	38	10	48
	M.Manila, 4th District	37	114	40	84
	Bataan	6	14	9	10
	Bulacan	5	69	17	31
	Pampanga	2	29	18	25
	Cavite	11	56	33	66
	Cavite City	1	4	0	2
	Nueva Ecija	6	16	13	19
	Laguna	7	33	24	47
	Rizal	10	87	24	82
Amoebiasis and Other Dysentery All Froms	M.Manila, 3rd District	0	2	2	4
	M.Manila, 4th District	9	6	3	7
	Bataan	3	1	4	2
	Bulacan	2	1	4	4
	Pampanga	2	4	5	6
	Cavite	1	6	2	3
	Cavite City	1	4	0	2
	Nueva Ecija	2	1	2	3
	Laguna	2	3	4	3
	Rizal	10	5	5	6

Source of Basic Data: Field Health Service Information System, Department of Health, Manila

Appendix Table 6 A. Mudflats Area, By Province, 1995-2005

REGION	1995	2005
NCR		
Navotas		19.20
Parañaque - Las Piñas		68.10
Total Area		**87.30**
Region III		
Bataan	803	137.4*
Bulacan	2,457	
Pampanga	1,340	100*
Total Area	**4,600**	**237.4**
Region IV		
Cavite		3.2750
Total Area		**3.2750**

Note:
a) 1995 data from Risk Assessment Study.
b) 2005 data from IEMP pilot phase (*partial).

Appendix Table 7 A. Waterfowl Count in Puerto Rivas, Balanga, Bataan, 1990-1997.

Waterfowl Counts	1990	1991	1992	1993	1994	1996	1997
A. Herons and Egrets							
Little Egret *Egretta garzetta*			78	2	430		254
Intermediate Egret *E. intermedia*		1		10	250	885	253
Great Egret *E. Alba*		3	112	218	155		180
Cattle Egret *Bubulcus ibis*							
Grey Heron *Ardea cinera*							
Black-Crowned Night Heron *Nyticorax nycticorax*				1			
Purple Heron *Ardea purpurea*							
Striated(Little Green) Heron *Butorides striatus*							
Schrenck's Bittern *Ixobrychus eurythmus*					5		
Cinnamon Bittern *I. cinnamomeus*							
Unidentified Herons and Egrets	1000	2					
B. Geese and Ducks							
Wandering Whistling Duck *Dendrocygna arcerata*							
C. Shorebirds - Waders							
Black-winged Stilt *Himantopus himantopus*	450	4			1		63
Oriental Pranticole *Glareola maldivarum*							
Asiatic (Pacific) Golden Plover *Pluvialis (dominica) fulva*	141	75			65		
Long-billed Plover *Charadrius placidus*							
Little Ringed Plover *C. dubius*		8					48
Kentish Plover *C. alexandrinus*		362			174	203	1,398
Mongolian Plover *C. mongolus*	783	1	160		3	321	188
Greater Sand Plover *C. leschenaultii*	2464	6	221				
Bat-tailed Godwit *Limosa lapponica*							
Little Curlew *Numenius minutus*						24	
Whimbrel *N. phaepus*							
Redshank *Tringa totanus*	1369	8				60	12
Marsh Sandpiper *T. stagnatilis*	168	9	205				15
Greenshark *T. nebularia*							
Green Sandpipper *T. ochropus*	307	1					
Wood Sandpiper T. glareola		2					
Terek Sandpiper *Xenus cinereus*							
Common Sandpiper *Actitis hypoleucos*		5	186		35		30
Grey-tailed (Grey-rumped) Tattler *Hetroscelus brevipes*		15					
Ruddy Turnstone *Arenaria interpres*							
Common Snipe *Gallinago gallinago*			46		15		
Asiatic Dowitcher *Limnodromus semipalmatus*							
Great Knot *Calidris tenuirostris*							
Red-necked (rufous-necked) Stint *C. Rubicollis*	792	1325	77		350		
Little Stint *C. minuta*	1576						
Curlew Sandpiper *Eurynorhynchus pygmeus*			13				
Unidentified shorebirds		1000			300		

Appendix Table 7 A. Continued…

Waterfowl Counts	1990	1991	1992	1993	1994	1996	1997
D. Gulls,Terns and Schimmers							
Herring Gull *Larus Argentatus*							
Black-headed Gull *L. Ridibundus*							
Whiskered Tern *Chlidonias hybrida*		9			600	1200	1,048
White-winged Blacj Tern *C. leuoptera*							
Caspian Tern *Hydroprogne caspia*							
Common Tern *Sterna aurantia*		125	1595		1007	200	1,668
Black-bellied Tern *S. melanogaster*							
Little Tern *S. albifrons*			650			37	
Great Crested Tern *S. bergii*							
Unidentified terns	540						
E. Rails, Gallinules and Coots							
Banded Rail *Rallus philippensis*				3			
Moorhen *Gallinula chloropus*							
Additional Specie							
Kingfisher			8		5		14
Total number of species	**9,590**	**2,961**	**3,351**	**234**	**3,395**	**2,930**	**5,177**

Appendix Table 7 B. Waterfowl Count in Puerto Rivas, Balanga, Bataan, 1998-2005.

Waterfowl Counts	1998	1999	2000	2001	2002	2003	2005
A. Herons and Egrets							
Little Egret *Egretta garzetta*	32	32	32		26	48	
Intermediate Egret *E. intermedia*	51	59	4	150	380	190	
Great Egret *E. Alba*		254	116	20	3	380	
Cattle Egret *Bubulcus ibis*	48	11	8		4		
Grey Heron *Ardea cinera*							
Black-Crowned Night Heron							
Purple Heron *Ardea purpurea*							
Striated(Little Green) Heron							
Schrenck's Bittern *Ixobrychus*							
Cinnamon Bittern *I. cinnamomeus*							
Unidentified Herons and Egrets	6000			4			
B. Geese and Ducks							
Wandering Whistling Duck							
C. Shorebirds - Waders							
Black-winged Stilt *Himantopus*			5			250	
Oriental Pranticole *Glareola*							
Asiatic (Pacific) Golden Plover				27			1375
Long-billed Plover *Charadrius*						36	
Little Ringed Plover *C. dubius*				159		285	
Kentish Plover *C. alexandrinus*	60		356	5000		42	1871
Mongolian Plover *C. mongolus*	35		53	2000		185	
Greater Sand Plover *C.*	24						
Bat-tailed Godwit *Limosa*							
Little Curlew *Numenius minutus*						18	
Whimbrel *N. phaepus*							
Redshank *Tringa totanus*							
Marsh Sandpiper *T. stagnatilis*							723
Greenshark *T. nebularia*			2				
Green Sandpipper *T. ochropus*							
Wood Sandpiper T. glareola							
Terek Sandpiper *Xenus cinereus*							
Common Sandpiper *Actitis*			6			1180	
Grey-tailed (Grey-rumped) Tattler							
Ruddy Turnstone *Arenaria*							
Common Snipe *Gallinago*							
Asiatic Dowitcher *Limnodromus*							
Great Knot *Calidris tenuirostris*						385	
Red-necked (rufous-necked) Stint			110				360
Little Stint *C. minuta*							
Curlew Sandpiper *Eurynorhynchus*			1			14	
Unidentified shorebirds			75	100			

Appendix Table 7 B. Continued…

Waterfowl Counts	1998	1999	2000	2001	2002	2003	2005
D. Gulls,Terns and Schimmers							
Herring Gull *Larus Argentatus*						215	
Black-headed Gull *L. Ridibundus*				58		58	
Whiskered Tern *Chlidonias hybrida*	105		1352			340	
White-winged Blacj Tern *C. leuoptera*							230
Caspian Tern *Hydroprogne caspia*							
Common Tern *Sterna aurantia*	85		2156			1850	
Black-bellied Tern *S. melanogaster*							
Little Tern *S. albifrons*						56	
Great Crested Tern *S. bergii*							
Unidentified terns	600		6500	6400			
E. Rails, Gallinules and Coots							
Banded Rail *Rallus philippensis*							
Moorhen *Gallinula chloropus*				2			
Additional Species							
Kingfisher	4						
Total number of species	**7,044**	**356**	**10,776**	**13,920**	**413**	**5,532**	**5,543**

Appendix Table 8 A. Waterfowl Count in Cavite, 1992-2005.

Waterfowl Counts	1992	1993	1994	1998	1999	2000	2001	2002	2003	2005
A. Herons and Egrets										55
Little Egret *Egretta garzetta*	11	3	9	23		27	52	25	300	
Intermediate Egret *E. intermedia*	80	24	136	93		108	80		30	
Great Egret *E. Alba*		3	4	14		35	210	12	35	
Cattle Egret *Bubulcus ibis*			3							
Grey Heron *Ardea cinera*	3	1	11				8			
Black-Crowned Night Heron *Nyticorax*										
Purple Heron *Ardea purpurea*		1				2	12	2		
Striated(Little Green) Heron *Butorides*							3			
Schrenck's Bittern *Ixobrychus eurythmus*										
Cinnamon Bittern *I. cinnamomeus*							2			
Unidentified Herons and Egrets							40			
B. Geese and Ducks										
Wandering Whistling Duck *Dendrocygna*	8									
C. Shorebirds - Waders										
Black-winged Stilt *Himantopus himantopus*									6	
Oriental Pranticole *Glareola maldivarum*			1380							
Asiatic (Pacific) Golden Plover *Pluvialis*	267	7	1650							
Long-billed Plover *Charadrius placidus*										
Little Ringed Plover *C. dubius*	27	25	300		8	14			5	
Kentish Plover *C. alexandrinus*	150	28	3000							
Mongolian Plover *C. mongolus*	601									
Greater Sand Plover *C. leschenaultii*		33								
Bat-tailed Godwit *Limosa lapponica*			15							
Little Curlew *Numenius minutus*										
Whimbrel *N. phaepus*	1		5							
Redshank *Tringa totanus*										
Marsh Sandpiper *T. stagnatilis*	2	10								
Greenshark *T. nebularia*	10		110			43				
Green Sandpipper *T. ochropus*					20					
Wood Sandpiper T. glareola										
Terek Sandpiper *Xenus cinereus*	10	15				2				
Common Sandpiper *Actitis hypoleucos*		186	58		20	66				
Grey-tailed (Grey-rumped) Tattler	324		500							
Ruddy Turnstone *Arenaria interpres*	2									
Common Snipe *Gallinago gallinago*	22					58				
Asiatic Dowitcher *Limnodromus*					150	21			7	
Great Knot *Calidris tenuirostris*	8	13	1671		42					
Red-necked (rufous-necked) Stint *C.*	440									
Little Stint *C. minuta*										
Curlew Sandpiper *Eurynorhynchus pygmeus*	50	1	300		63					
Unidentified shorebirds	100		10000			38				

Appendix Table 8. Continued…

Waterfowl Counts	1992	1993	1994	1998	1999	2000	2001	2002	2003	2005
D. Gulls,Terns and Schimmers										
Herring Gull *Larus Argentatus*								150	6	
Black-headed Gull *L. Ridibundus*		50			557	240		25	500	
Whiskered Tern *Chlidonias hybrida*	10	823			8					
White-winged Blacj Tern *C. leuoptera*								35		
Caspian Tern *Hydroprogne caspia*					63	58		15		
Common Tern *Sterna aurantia*					128	186		152	35	
Black-bellied Tern *S. melanogaster*		7								
Little Tern *S. albifrons*		1784						200		
Great Crested Tern *S. bergii*										
Unidentified terns	20000	23005			58	47			700	
E. Rails, Gallinules and Coots										
Banded Rail *Rallus philippensis*										
Moorhen *Gallinula chloropus*										
F. Ploceidae (Old World Sparrow and Weavers)										40
G. Silviidae (Old World Warblers)										13
H. Estrldidaem (Avadavat, Parrotfinches and										10
Additional Species										
Kingfisher										
Other Species										
Total number of species	**22,126**	**26,019**	**19,152**	**130**	**1,117**	**945**	**407**	**616**	**1,624**	**145**

Appendix Table 9 A. Waterfowl Census for the Year 2004 and 2005**.**

Waterfowl Counts	Paranaque	Las Pinas	Navotas	Pampanga	Parañaque-Las Piñas
	2004	2004	2005	2005	2005
A. Herons and Egrets					
Egret sp.					
Little Egret *Egretta garzetta*	93	54	73	49	93
Intermediate Egret *E. intermedia*		2	26	89	
Great Egret *E. Alba*	51	13	3	83	
Cattle Egret *Bubulcus ibis*				28	
Grey Heron *Ardea cinera*	30	60		526	
Black-Crowned Night Heron *Nyticorax nycticorax*	28	2		650	
Purple Heron *Ardea purpurea*	1			320	
Striated(Little Green) Heron *Butorides striatus*		5			
Schrenck's Bittern *Ixobrychus eurythmus*					
Cinnamon Bittern *I. cinnamomeus*				3	
Little Heron	7	7			
Rufuos Night Heron	1			22	
White Egret sp.		14			
Chinese Egret			12		
Yellow Bittern				72	
Unidentified Herons and Egrets					
B. Geese and Ducks					
Wandering Whistling Duck *Dendrocygna arcerata*					
Philippine Duck				264	
C. Shorebirds - Waders					
Black-winged Stilt *Himantopus himantopus*	11				
Oriental Pranticole *Glareola maldivarum*				71	
Asiatic (Pacific) Golden Plover *Pluvialis (dominica) fulva*	168	77	268		168
Unidentified Charadrius					144
Long-billed Plover *Charadrius placidus*					
Little Ringed Plover *C. dubius*	65	49		1	72
Kentish Plover *C. alexandrinus*	98	417	3397		417
Mongolian Plover *C. mongolus*					72
Greater Sand Plover *C. leschenaultii*					
Ringed Plover sp.					
Lesser Sand Plover	7				
Bat-tailed Godwit *Limosa lapponica*					
Little Curlew *Numenius minutus*					
Whimbrel *N. phaepus*					
Redshank *Tringa totanus*			35		
Common Red Shank	83	780			
Marsh Sandpiper *T. stagnatilis*	342	164	31		220
Greenshark *T. nebularia*			55		
Common Green Shank	27	104	6		
Green Sandpipper *T. ochropus*					
Wood Sandpiper T. glareola	2			3	

Appendix Table 9A. Continued…

Waterfowl Counts	Paranaque	Las	Navotas	Pampanga	Parañaque-
	2004	2004	2005	2005	2005
C. Shorebirds - Waders					
Terek Sandpiper *Xenus cinereus*					
Common Sandpiper *Actitis hypoleucos*	11	57	5	7	
Grey-tailed (Grey-rumped) Tattler *Hetroscelus brevipes*					
Ruddy Turnstone *Arenaria interpres*					
Common Snipe *Gallinago gallinago*					
Asiatic Dowitcher *Limnodromus semipalmatus*					
Great Knot *Calidris tenuirostris*					
Red-necked (rufous-necked) Stint *C. Rubicollis*					227
Little Stint *C. minuta*					
Sanderling					
Long-toed Stint	17	26			
Rufous-necked Stint	112	227	146		
Curlew Sandpiper *Eurynorhynchus pygmeus*		1	113		
Sharp-tailed Sandpiper		1	213		
Grey Plover			58		
Unidentified shorebirds					
D. Gulls,Terns and Schimmers					
Tern sp.		415			415
Herring Gull *Larus Argentatus*					
Black-headed Gull *L. Ridibundus*			12		
Whiskered Tern *Chlidonias hybrida*	220		1471	110	473
White-winged Blacj Tern *C. leuoptera*					
Caspian Tern *Hydroprogne caspia*					
Common Tern *Sterna aurantia*			1		
Black-bellied Tern *S. melanogaster*					
Little Tern *S. albifrons*					
Great Crested Tern *S. bergii*					
Gull sp.		14			
Unidentified terns					
E. Rails, Gallinules and Coots					
Banded Rail *Rallus philippensis*					
Moorhen *Gallinula chloropus*					
Common Moorhen				96	

Appendix Table 9A. Continued…

Waterfowl Counts	Paranaque	Las Pinas	Navotas	Pampanga	Parañaque-Las Piñas
	2004	2004	2005	2005	2005
Additional Species					
Kingfisher					
Common Kingfisher	4	6	1		
White-collared Kingfisher	3	5	14		
Collared Kingfisher		3	2	1	
Zebra Dove		1	1	6	
Brown Shrike		3		6	
Brahminy Kite					
Barred Rail	6	8		8	
Lesser Coucal	1			1	
Philippine Coucal				4	
Cuckoo-shrike sp.					
Yellow-vented Bulbul		4		13	
Golden-bellied Flyeater					
Striated Grassbird	1			52	
White-shouldered Starling					
Chestnut-cheeked Starling					
Osprey	1				
Chinese Goshawk	1				
Grey-faced Buzzard	1				
Yellow Bittern	2				
Eurasian Kestrel	2	1			
Buff-banded Rail	2	2			
White-brested Waterhen	1	1		2	
Watercock	2				
Spotted Dove	2				
Siberian Rubythroat	3			1	
Grey Wagtail	1				
Yellow Wagtail	4	1		8	
Long-tailed Shrike	1				
Crested Mynah	2				
Scaly-breated Munia	35			100	
Waterhen		2			
Common Woodhen		1			
Chestnut Munias		8		150	
Charadrious sp.		144			
Munias		21			
Bright-capped Cistocola		1			
Barn Swallow (Hirundo rustico)				884	
Tringa sp.			1		780
White-brested Wood Swallow					
Island-collared Dove				1	

Appendix Table 9A Continued...

Waterfowl Counts	Paranaque	Las Pinas	Navotas	Pampanga	Parañaque-Las Piñas
	2004	2004	2005	2005	2005
Additional Species					
Pacific Swallow					
Artic Wabbler					
Sparrow					
Little Grebe				32	
Pied Fantail				4	
Yellow-bellied Flyeater			1		
Red Knot			95		
Bar-tailed Godwit			16		
Gray-tailed Tatler			1		
Jacana				18	
Shoveler				68	
Quail sp.				2	
White Browed Crake				3	
Pheasant Tailed Jacana				1	
Greater Painted Snipe				12	
Snipe sp.				1	
Blue-tailed Bee Eater				1	
Pied Bushchat				13	
Grass Owl (heard only)					
Warbler sp.				1	
Clamorous Reed Warbler				40	
Middendorf's Grasshopper Warbler				1	
Zitting Cisticola				7	
Richard's Pipit				1	
Eurasian Tree Sparrow					
Other species not specified					
Total number of species	7,461	8,713	12,072	9,851	3,775

Appendix Table 10 A. Labor Force Participation Rate, by Region, 1996-2002.

REGION	YEAR						
	1996	1997	1998	1999	2000	2001	2002
NCR	0.628	0.637	0.65	0.648	0.628	0.644	0.653
Region III	0.624	0.613	0.617	0.632	0.615	0.638	0.642
Region IV	0.655	0.650	0.643	0.648	0.641	0.668	0.672

Source: National Statistics Office

Appendix Table 10 B. Employment Rate, by Region, 1996-2002.

REGION	YEAR						
	1996	1997	1998	1999	2000	2001	2002
NCR	0.861	0.862	0.839	0.836	0.826	0.831	0.823
Region III	0.898	0.901	0.897	0.894	0.886	0.888	0.873
Region IV	0.919	0.918	0.905	0.904	0.880	0.881	0.878

Source: National Statistics Office

Appendix Table 10 C. Average Monthly Earnings, by Region, 1996-2002.

REGION	YEAR						
	1996	1997	1998	1999	2000	2001	2002
NCR	8,531	9,457	10,779	11,610	12,344	13,125	13,955
Region III	5,325	5,744	6,172	6,556	6,971	7,412	7,881
Region IV	6,677	7,226	7,663	8,186	8,704	9,254	9,840

Source: National Statistics Office

Appendix Table 11. Coastal Population Statistics around Manila Bay, By Location, 1980-2000.

LOCATION	YEAR			
	1980	1990	1995	2000
Las Piñas	136,514	297,102	413,086	472,780
Navotas	126,146	187,479	229,039	230,403
Parañaque	208,552	308,236	391,296	449,811
Manila	1,280,537	1,552,166	1,654,761	1,581,082
Pasay	235,265	299,793	408,610	354,908
Bataan	253,827	334,351	385,906	437,888
Bulacan	217,632	298,877	354,320	443,602
Pampanga	138,428	180,702	195,458	262,524
Cavite	300,940	449,675	628,287	804,967

Source: National Statistics Office

Appendix Table 12A. Valuation Status of Major Habitats and Uses of Manila Bay [1]

VALUATION ITEM		VALUATION STATUS	DATA NEEDED AND OTHER REMARKS
MANGROVE HABITATS			Estimated by various authors
Direct Use			
Consumptive	Fish	√	
	Shellfish	√	Included in mangrove fishery valuation
	Charcoal	NDA	Volume of harvest, Price per unit of harvest, Cost of harvesting
	Forestry	√	
	Local Use	√	
Non-Consumptive	Aesthetic	NDA	Willingness to Pay
	Recreation (not specified)	√	
	Tourism	NDA	Willingness to Pay
	Scientific study/research	NDA	Investment/ Expenditure for Research and Development
Indirect Use	Shoreline protection	NDA	Identification of Appropriate Technology, Construction cost per type of technology
	Wind break	NDA	Identification of Appropriate Technology, Construction cost per type of technology
	Disturbance regulation	√	
	Carbon sequestration	NDA	Carbon Storage Ability per tree specie, Identification of Appropriate Technology, Cost of storing similar volume per technology
	Water purification	√	
	Oxygen release	NDA	Identification of Appropriate Technology, Construction cost per type of technology
	Nursery service	√	
	Flood Control	NDA	Identification of Appropriate Technology, Construction cost per type of technology
	Fertilizer/Fish Food	√	
	Raw Materials	√	
Option Value	Biodiversity	**X**	Willingness to Pay
	Medicine	**X**	Willingness to Pay
	Endangered species	**X**	Willingness to Pay
	Genetic material	**X**	Willingness to Pay
Non-Use	Existence	**X**	Willingness to Pay
	Bequest for humanity	**X**	Willingness to Pay
MUDFLATS/TIDAL SWAMP HABITAT			Included in mangrove valuation
Direct Use			
Consumptive	Shellfish	√	Included in mangrove valuation
	Fish	√	Included in mangrove valuation
	Salt production	NDA	Volume produced, Price per unit produced, Cost of production
Non-Consumptive	Recreation/Tourism	NDA	Willingness to Pay
	Scientific study/research	NDA	Investment/ Expenditure for Research and Development
	Aesthetic	NDA	Willingness to Pay
Indirect Use	Life support for fish and birds	√	Included in mangrove valuation
	Water purification	√	Included in mangrove valuation
	Carbon storage	NDA	Carbon Storage Ability per tree specie, Identification of Appropriate Technology, Cost of Storing similar volume per technology
	Flood control	NDA	Identification of Appropriate Technology, Construction cost per type of technology
	Shoreline protection	NDA	Identification of Appropriate Technology, Construction cost per type of technology
Option Value	Biodiversity	**X**	Willingness to Pay
	Place for migratory species	**X**	Willingness to Pay
	Endangered species	**X**	Willingness to Pay
	Genetic material	**X**	Willingness to Pay
Non-Use	Existence	**X**	Willingness to Pay
	Bequest for humanity	**X**	Willingness to Pay

Appendix Table 12 A Continued…

Valuation Item		Valuation Status	Remarks
BEACH/SANDY SHORE HABITATS			
Direct Use			
Consumptive	Raw Materials	NDA	Volume of harvest, Price per unit of harvest, Cost of harvesting
	Ports and harbors	√	
Non-Consumptive	Aesthetic	NDA	Willingness to Pay
	Recreation/Tourism (hotels and resorts)	√	
Indirect Use	Feeding ground for sea birds	NDA	Fauna species in the area, Change in volume or growth of species, Price of species
	Habitats for crabs, shellfish	NDA	Fauna species in the area, Change in volume or growth of species, Price of species
	Climate condition	NDA	
	Sanctuary for sea turtle	NDA	Fauna species in the area, Change in volume or growth of species, Price of species
Option Value	Biodiversity	**X**	Willingness to Pay
	Place for migratory species	**X**	Willingness to Pay
	Endangered species	**X**	Willingness to Pay
	Genetic material	**X**	Willingness to Pay
Non-Use	Existence	**X**	Willingness to Pay
	Bequest for humanity	**X**	Willingness to Pay
CORAL REEF HABITATS			
Direct Use			
Consumptive	Fisheries	√	
	Live Fish Export	√	
Non-consumptive	Scientific study/research	NDA	Investment/ Expenditure for Research and Development
Indirect Use	Shoreline Protection	NDA	Identification of Appropriate Technology, Construction cost per type of technology
	Coastal protection	√	
	Carbon Sequestration	NDA	Carbon Storage Ability per tree specie, Identification of Appropriate Technology, Cost of Storing similar volume per technology
	Tourism on site	NDA	Willingness to Pay
	Tourism off site	NDA	Willingness to Pay
Option value	Biodiversity	**X**	Willingness to Pay
	Endangered species	**X**	Willingness to Pay
	Existence	**X**	Willingness to Pay
	Bequest for Humanity	**X**	Willingness to Pay
Non-Use	Aesthetic/biodiversity	√	
Carabao Island, Maragondon, Cavite, Coral Reefs			
	Hard corals	√	
	Dead Seleractinia	√	
	Algae	√	
	Other Fauna	√	
	Abiotics	√	
SEAGRASS BED HABITATS			
Direct Use			
Consumptive	Food	NDA	
Non-consumptive	Scientific study/research	NDA	Investment/ Expenditure for Research and Development
Non-Use	Existence	NDA	Willingness to Pay
	Bequest for humanity	NDA	Willingness to Pay
BAY WATER HABITATS			
Direct Use			
Consumptive	Shipping Lanes	√	Included in Ports and Sea Lanes valuation
	Fishery	√	Included in Fisheries valuation

Appendix Table 12A Continued…

Valuation Item		Valuation Status	Remarks
SEAWEEDS			
Direct Use			
Consumptive	Food	√	Included in Aquaculture Valuation
Non-consumptive	Scientific study/research	NDA	Investment/ Expenditure for Research and Development
Non-Use	Existence	**X**	Willingness to Pay
	Bequest for humanity	**X**	Willingness to Pay
PORTS AND SEA LANES			
Direct Use			
Consumptive	Ports/Harbor	√	
	Settlement Area	NDA	
	Fish	√	
Non-consumptive	Scientific study/research	NDA	Investment/ Expenditure for Research and Development
FORESHORE AREA HABITATS			
Direct Use			
Consumptive	Ports/Harbor	√	
	Settlement Area	NDA	
FISHERIES			
Aquaculture, Mariculture			
Direct Use			
Consumptive	Food/Livelihood	√	
	Seaweeds	√	
Non-consumptive	Scientific study/research	NDA	Investment/ Expenditure for Research and Development
Off Shore Fisheries			
Direct Use			
Consumptive	Food/Livelihood	√	
	Coastal and ocean establishments	√	
Commercial Fishery Production			
Direct Use			
Consumptive	Food/Livelihood	√	
SMALL ISLAND ECOSYSTEMS			
Direct Use			
Consumptive	Ports/Harbor	NDA	
	Settlement Area	NDA	
	Fish	√	Included in Fishery and Mangrove Valuation
Non-consumptive	Scientific study/research	NDA	Investment/ Expenditure for Research and Development
	Recreation/Tourism	√	

[1] This table was prepared from the Inception Report for the ERV for Manila Bay.
√ - Valued
X - not valued because it requires primary data
NDA - valuation was attempted but no data was available