ICM Solutions

Visualizing the Health of Coastal and Marine Ecosystems: Systematic Gathering and Use of Data and Information for Effective Planning and Management of Coastal and Marine Areas

- "A picture is worth a thousand words", as the saying goes…PEMSEA's integrated information management system or IIMS helps policymakers, managers, and the general public to visualize the health of coastal and marine areas (fig. 1).
- IIMS provides users with options for analyzing and packaging information into different formats that are more understandable and usable by target groups. For example, the *Manila Bay Area Environmental Atlas* is an innovative product of IIMS that describes the physical, biological and socioeconomic characteristics of the Bay, and the required management interventions, using maps and graphical presentations.
- ICM provides a systematic approach to data gathering, analysis and information sharing, as well as facilitating the effective application of IIMS in support of decision-making for sustainable development of coastal communities, marine and coastal resources and economies.

WORLD BANK GROUP

PEMSEA

Context

Managing coastal and marine areas and resources entails working with many different social and economic sectors and scientific disciplines. Each sector has its own data and information. Integrated coastal management (ICM) requires access to this wide array of data and information. More importantly, understanding and applying socioeconomic, cultural and natural values, and demography and ecological conditions as input to policymaking and planning are key to a successful program.

Unfortunately, access to and use of these data and information are oftentimes limited due to:

- inadequate technical and financial resources to gather and analyze data;
- incomplete policies or mechanisms that facilitate sharing of data and information among data providers and users;
- the large diversity and coverage of data when dealing with coastal and marine areas;
- lack of a standardized system for data gathering, collation, and recording; and
- deficiencies in quality control, data reliability and accuracy.

In many cases, data are collected, stored, analyzed, and used separately by different government agencies and sectors to meet their individual needs and mandates. As a result, information is not fully utilized to provide a comprehensive picture of the ecological and socioeconomic conditions of the area. In addition, because of the lack of an integrated information gathering and utilization approach, there is often duplication of effort and inefficient use of available resources.

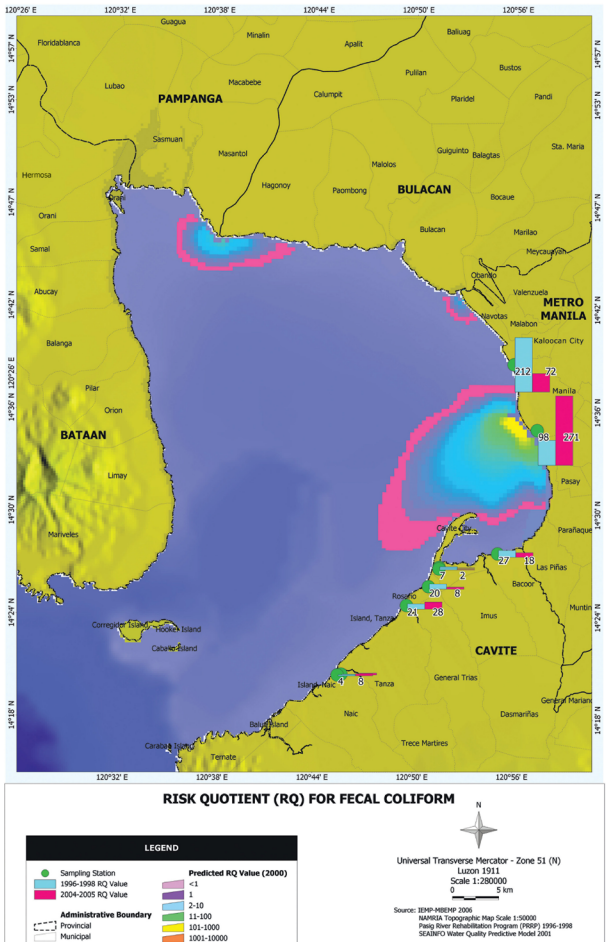

Figure 1. Risk quotient (RQ) for fecal coliform contamination in Manila Bay. RQ > 1 indicates high risk to human health.

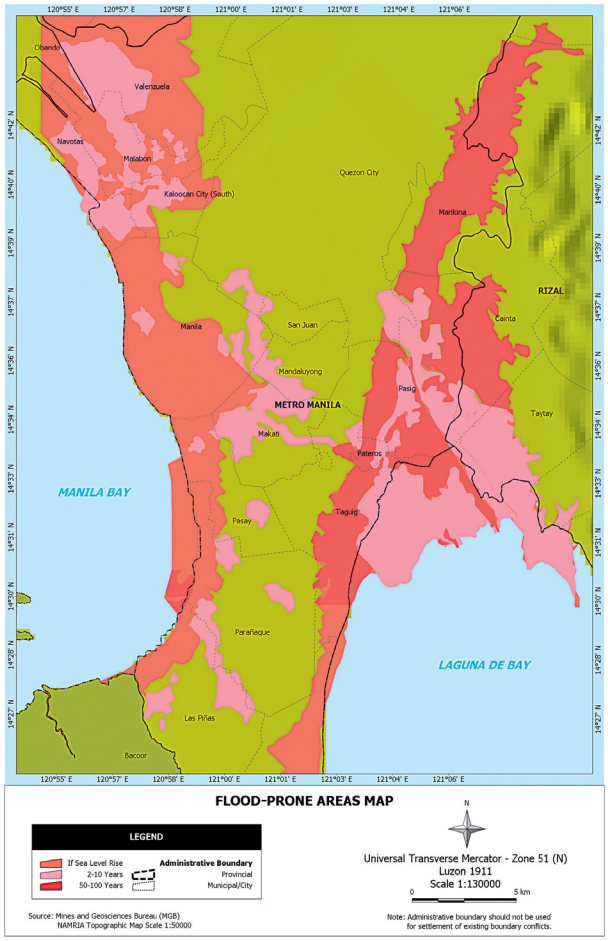

Figure 2. Map of flood-prone areas in the Manila Bay area.

Solutions

PEMSEA has developed the integrated information management system (IIMS) to facilitate integrated data/information gathering, access, and use in ICM programs. The IIMS captures 12 categories of data relevant to marine and coastal areas and river basins. It is a comprehensive relational environmental database that captures data needed for environmental management, planning, and decisionmaking. It standardizes data formats collected from different sites thus facilitating cross-comparison and analysis of data among sites, data providers, and users. The query system of the IIMS is designed to support the retrieval of information in a format required by environmental planners, managers, decisionmakers and policymakers, and other stakeholders (fig. 2). The various steps in developing and IIMS include:

Gather data systematically and with clear goals. With the wide array of data and information requirements, it is important that coastal managers have a clear goal and specific objectives before embarking on the process of data and information gathering. Without a clear goal, the task can be overwhelming and costly, with limited return on the investment.

The ICM programme development and implementation process consists of six stages, namely: preparing, initiating, developing, adopting, implementing, and refining and consolidating. At different stages of the ICM process, specific data inputs are required and various outputs are generated. The IIMS is established in the Initiating Stage of ICM implementation and updated continuously throughout the stages and next cycles of ICM (fig. 3). The stagewise data gathering, analysis, and output-oriented process provides a useful approach to determining what data should be collected and analyzed and when, with direct benefits for improved management, planning, and decisionmaking. PEMSEA has developed an IIMS manual that details the step-by-step process for data gathering and utilization in an ICM context.

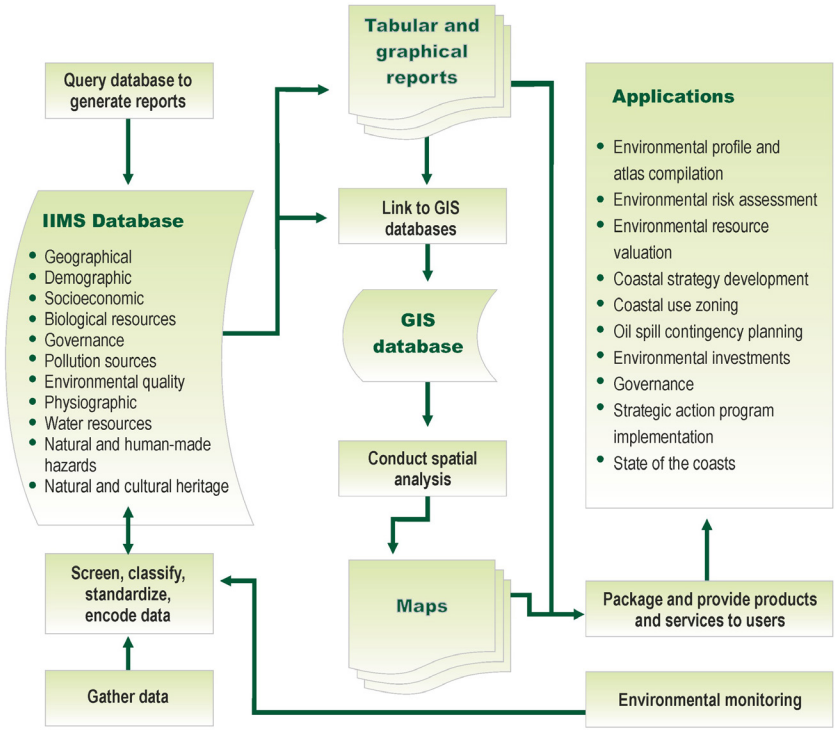

Figure 3. Data categories in IIMS and its applications supporting planning and decision making for integrated coastal and river basin management.

Engage multiple disciplines and sectors. Engaging different government agencies and sectors must be facilitated in order to promote integrated data/information gathering and sharing. It also avoids duplication of effort and inefficient use of resources.

In the case of Manila Bay, the Manila Bay Information Network (MBIN) was established and used the IIMS as a database platform. The MBIN consisted of the Regional Offices of the Department of Environment and Natural Resources (DENR) in the Manila Bay Area (Regions 3, 4A, and NCR), relevant national government agencies, local government units, and academic institutions. The MBIN members worked together to update data

for the Manila Bay area, particularly data from ongoing environmental monitoring programs. One important spinoff from the MBIN was the establishment and operation of the Integrated Environmental Monitoring Network for Manila Bay. In Manila Bay, a number of government agencies were undertaking regular monitoring activities, covering the habitats, biophysical, and ecological conditions of the Bay. However, the monitoring programs were, in some cases, duplicative, while other areas/ concerns in the Bay were not being monitored adequately. Recognizing these gaps, the agencies agreed to adopt a cross-sectoral, integrated monitoring program and to utilize the IIMS as a common and shared database.

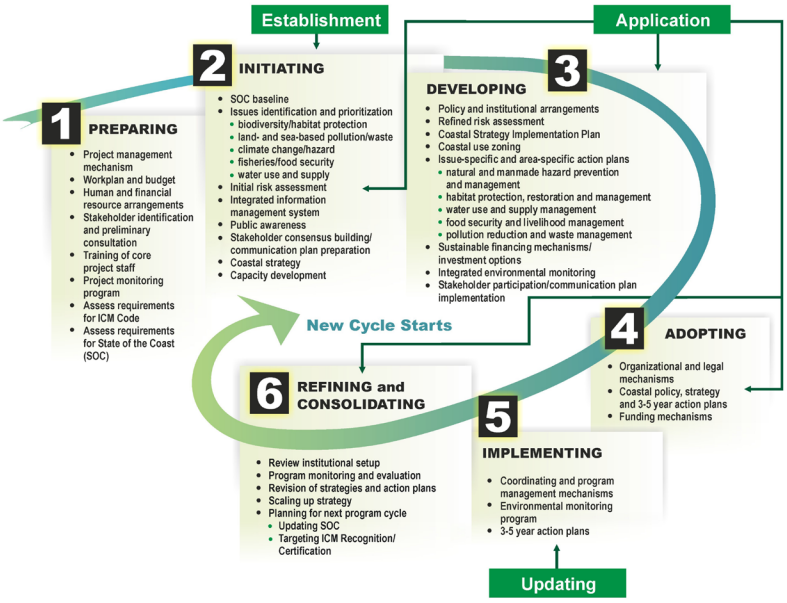

Figure 4. IIMS and the ICM Development and Implementation Cycle.

This approach promoted closer coordination and cooperation, cost sharing, and data and information sharing among the stakeholders. The result, therefore, has been a more complete and comprehensive picture of the physical and ecological conditions of the Bay. (See PEMSEA, 2009).

Use data in different formats to effectively convey information to stakeholders. The goal for data gathering does not end in acquiring the needed data/information, but rather with how these data and information can be utilized fors informed management decision, and disseminated for the use of other stakeholders. Data need to be transformed into context and formats that can be understood by different audiences, including decision makers.

With the diverse data/information collected at various stages of ICM, it is fitting to store the data in a proper database management system that can be updated and retrieved when necessary. Manual retrieval will entail time and effort. A computerized database is important for the storage, retrieval, and management of large and diverse types of data on a continuous basis. At the same time, the data gathered can be readily transformed into useful information for the users.

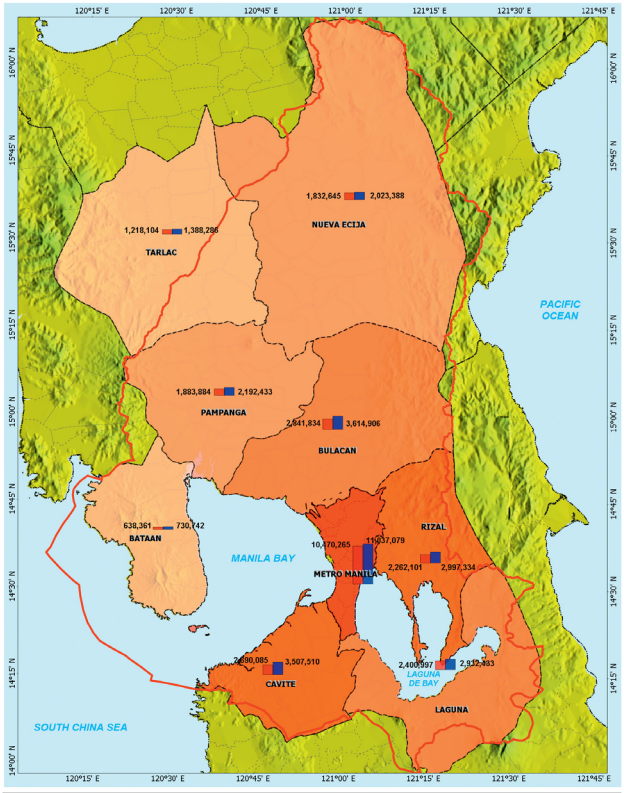

Figure 5. Demographic Map.

The provinces of Bataan and Cavite, which currently are in the process of developing their initial State of the Coasts (SOC) reports, are utilizing their IIMS databases as sources of information for their SOCs, as well as database platform for storing data and information gathered during the process of developing the SOCs (fig. 4, percentage of coral live cover in Bataan).

The integrated IIMS database of Manila Bay, which consolidates the IIMS databases of the DENR Regional Offices in Manila Bay (Regions 3, 4A, and NCR) and the provinces of Bataan and Cavite, is also an important resource for the development of models to estimate the pollutant loadings in Manila Bay, as part of the UNEP Project on Global Nutrient Management. The models are important inputs in developing nutrient management and pollution reduction strategies and policies for the cleanup and rehabilitation of Manila Bay. The accuracy of an output of a particular model greatly depends on the availability and reliability of data to be used. Access to Manila Bay data is facilitated by the IIMS database of Manila Bay. The accuracy of the data inputted in the Manila Bay IIMS is ensured by the protocols and guidelines adopted by IIMS team looking after the operation of the database.

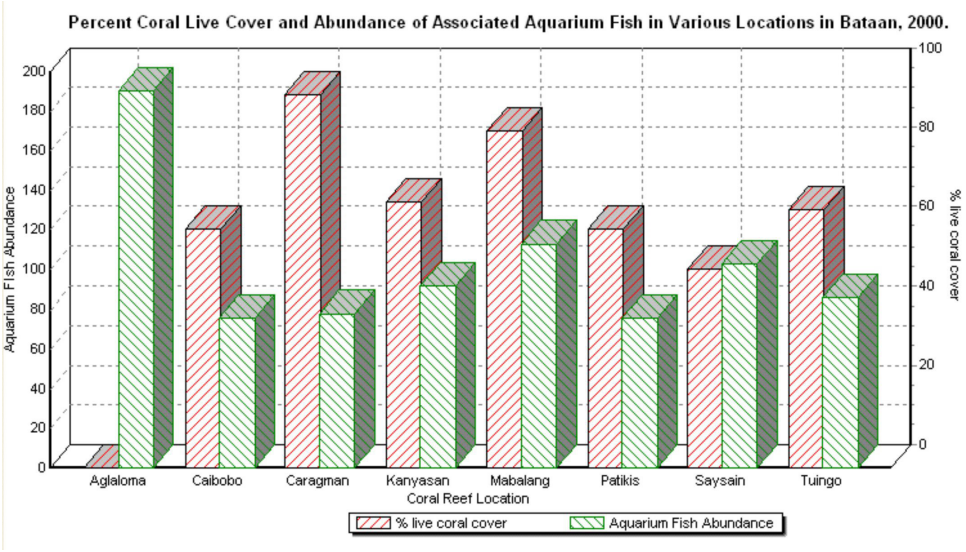

Figure 6. Information on resources and habitats generated from IIMS.

IIMS Module 2 workshop for Manila Bay

Results

The case of Manila Bay, Philippines. In Manila Bay, one of the innovative products of data gathering, analysis, and packaging was the *Manila Bay Environmental Atlas*, published in 2007 (PEMSEA and MBEMP, 2007). The information contained in the Atlas were compiled from the different agencies with mandates and responsibilities in the Manila Bay area and from the different outputs generated during ICM program implementation in the Bay, including environmental risk assessment and integrated environmental monitoring.

The available data were analyzed and transformed into visually relevant formats and utilized in the production of the Atlas. It provides statistical and spatial data to stakeholders in the form of composite maps, graphs, and tables that describe the physical, biological, and socioeconomic characteristics of the area, including issues confronting the sustainable development and use of the Bay; the social, economic, and ecological costs associated with a business as usual scenario; and the actions being undertaken and planned by the various stakeholders.

Maps and annotations identifying the location and health of habitats and resources, economic uses of resources in the Bay such as tourism and recreation (beach resorts), industry, shipping, ports and fisheries, and the water quality conditions of the Bay facilitated the preparation of a zoning plan for the area. Bataan Province, a coastal province in Manila Bay, utilized the *Atlas* as a resource in the formulation of their coastal use zoning scheme, which was then adopted and is currently being implemented in the Province.

Maps presenting the environmental risks and challenges in the Bay, particularly with respect to oil spills, sea level rise, and flooding, are proving to be a useful resource to concerned government agencies in developing oil spill contingency plans, flood mitigation, and climate change adaptation strategies. In terms of pollution reduction, the map of beach resorts in the Bay allowed the identification of priority areas for water quality monitoring particularly levels of bacteriological contamination, and possible management interventions in the form of interceptor sewers and sewage treatment facilities.

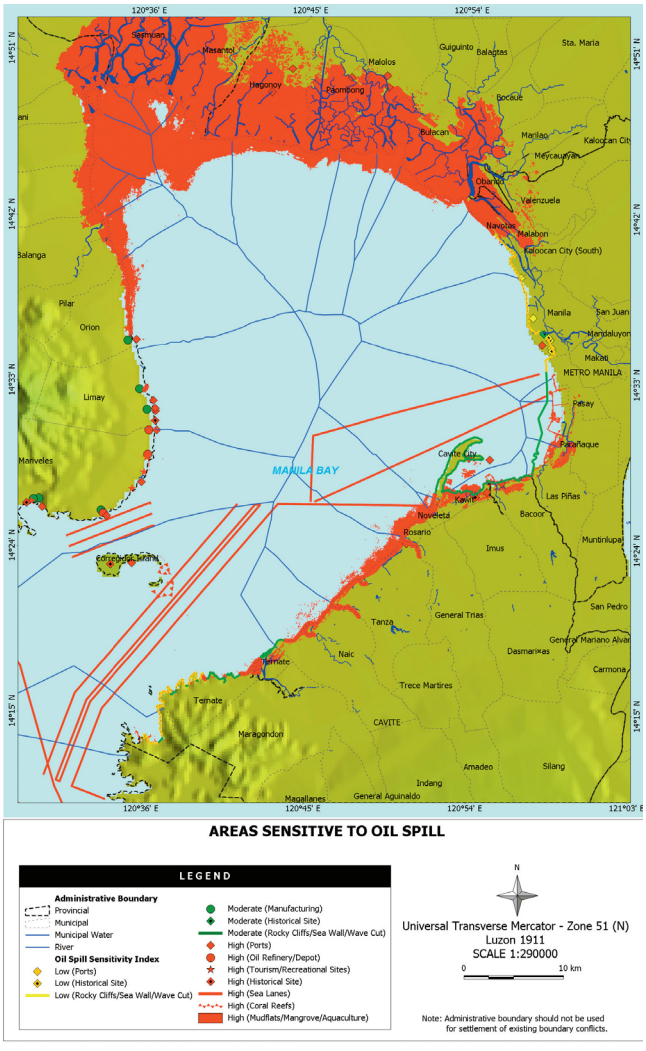

Figure 7. Areas sensitive to oil spill.

One of the most important outcomes of the ICM effort in Manila Bay occurred in December 2008, when the Supreme Court of the Philippines directed 12 national agencies to perform certain functions relating directly or indirectly to the cleanup, rehabilitation, protection, and preservation of Manila Bay. The Supreme Court decision stated that the target classification of the Bay waters was Class SB (i.e., waters fit for swimming and recreation). The Manila Bay Coastal Strategy, operational plan, integrated environmental monitoring program, and the *Manila Bay Environmental Atlas* were recognized as key products employed in the Supreme Court Decision, and in measuring progress toward the identified targets (PEMSEA 2009).

Presently, the Manila Bay Coordinating Office of the DENR is undertaking an initiative to update the Manila Bay Environmental Atlas. The updated Atlas will be able to provide information on changes in socioeconomic and ecological status of the Bay, as well as determine the impacts of the various efforts towards rehabilitating the Bay, in line with the Supreme Court's continuing mandamus.

Moreover, in line with the effort to rehabilitate Manila Bay, pollutant and ecosystem models are being developed as basis for identifying policy options for the management of the Manila Bay watershed. The integrated IIMS database for Manila Bay facilitates the access of data for use in these models.

Lessons Learned

1. Engaging multiple disciplines and sectors helps to address a broad range of governance and management issues being dealt in an ICM program. Such was the case with the MBIN. The network promoted integrated information gathering and sharing for a more cost-effective and comprehensive assessment of the status of Manila Bay.

2. Following the stepwise ICM process provides a systematic approach to data gathering and analysis. This further facilitates the production of information and outputs that can be immediately and effectively utilized to improve understanding and build consensus among stakeholder groups, and serve as inputs to decisionmaking processes. The stagewise process allows efficient and cost-effective data gathering and ensures that required information for the development of specific outputs in each stage of ICM implementation is available.

3. Using a relational environmental database and information management system is critical to systematizing data storage, analysis and retrieval of information coming from a wide variety of sources on an intermittent (e.g., research projects) and regular basis (e.g., environmental monitoring programs). In addition, the database and information management system promotes and facilitates data sharing among different users in the area. This builds relationships among the different government agencies and institutions. The database also standardizes data formats facilitating cross-comparison and analysis of data among sites, data providers and users.

4. Packaging data and information into products that can be understood and used by targeted groups of users contributes to improved policy- and decision-making and builds awareness among the general public. The Manila Bay Environmental Atlas, for example, was an innovative approach in transforming a broad range of multisectoral data into visually relevant information that guided management decisions in the Bay while at the same time informing the public of current conditions in the Bay. The Manila Bay Environmental Atlas has proven to be an important resource document in the coastal use zoning scheme of Bataan Province, as well as in developing oil spill contingency plans, and identifying flood and climate change mitigation strategies and priority areas for pollution reduction and monitoring in the Bay.

For further details

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