CoE in Action

Southeast Asian Centre of Excellence

Milkfish are fed around the clock to maximise yield.

Bolinao, 2002. High nutrient levels in the water from excessive feeding can lead to major fish kills.

Fish farming provides income and food security.

Promoting sustainable mariculture

Aquaculture is a booming industry in the Philippines, a nation ranked within the 14 most influential fisheries countries globally.

With the continuously declining production from capture fisheries due to overfishing, aquaculture is viewed as the means to increase fisheries production and address food security concerns. It can increase income and employment. From 2000 to 2005, aquaculture contributed an annual average of 1.4 million tons or 40% of the Philippines' total fishery production.

The Province of Pangasinan is one of the main centres of aquaculture production in the Philippines. Aquaculture in marine areas (known as mariculture), is particularly extensive in the coastal waters of Western Pangasinan where the largest areas of coral reefs and seagrasses in Western Luzon are found.

Although it is a major industry, mariculture is still largely unregulated. Where local policies and regulations do exist, they are often poorly enforced. Unconsumed feed and fecal material dissolve in the water column and accumulate as sediments. This high level of nutrients reduces water quality, placing biodiversity and productivity of coral reefs and seagrass meadows under threat. Capture fisheries, which provide the major source of livelihood for poor coastal households, experience further pressure.

Fish farming and environmental impacts

The farming of *Chanos chanos* (milkfish) began in Bolinao in the 1970s in brackish water ponds. By 1995, milkfish culture was also occurring in fish pens and cages along coastal areas and channels.

From this time, several local and international projects began examining fish farming and its impact on the environment. The University of the Philippines Marine Science Institute (UPMSI) began regular monitoring from its Bolinao Marine Laboratory, to gauge water quality.

These projects produced a 10-year data set on nutrients, chlorophyll-a, and dissolved oxygen that was used to examine the link between the expansion of fish farming and environmental changes, particularly with regards to water quality, algal blooms and a massive fish kill that occurred in Bolinao in 2002.

This fish kill coincided with the first reported bloom of the dinoflagellate *Prorocentrum minimum* in the Philippines. Days before the bloom, dissolved oxygen was measured at <2 mg/L, much lower than the allowable limit of 5 mg/L.

These conditions could be linked to the uncontrolled proliferation of fish pens and cages in the area to more than double the allowable limit of 554 units.

In over ten years, the water has become eutrophic, with ammonia increasing by 56%, nitrite by 35%, nitrate by 90%, and phosphate by 67%.

The Coral Reef Targeted Research & Capacity Building for Management Program (CRTR) is a leading international coral reef research initiative that provides a coordinated approach to credible, factual and scientifically-proven knowledge for improved coral reef management.

The CRTR Program is a proactive research and capacity building partnership that aims to lay the foundation in filling crucial knowledge gaps in the core research areas of Coral Bleaching, Connectivity, Coral Diseases, Coral Restoration and Remediation, Remote Sensing and Modeling and Decision Support.

Each of these research areas are facilitated by Working Groups underpinned by the skills of many of the world's leading coral reef researchers.The CRTR also supports four Centres of Excellence in priority regions, serving as important regional centres for building confidence and skills in research, training and capacity building.

The CRTR Program is a partnership between the Global Environment Facility, the World Bank, The University of Queensland (Australia), the United States National Oceanic and Atmospheric Administration (NOAA) and approximately 50 research institutes & other third parties around the world.

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Using science in management planning

The UPMSI operates as the Southeast Asian Centre of Excellence (CoE) for the Coral Reef Targeted Research & Capacity Building for Management Program (CRTR). The CoE has conducted seminars and workshops to facilitate the exchange of knowledge and information amongst LGUs, managers, stakeholders and scientists on key marine and coastal resource issues.

These forums were designed to engage stakeholders to work towards common goals, and to enhance local experiences and knowledge with science-based information derived from research to the resource managers and other stakeholders to improve local resource management programs.

In 2008, the CRTR Program's Local Government Initiative (LGI), collaborated with the District Office of Congressman Arthur F. Celeste of Pangasinan, to conduct a Coastal Resources Management Forum for LGUs, resource users and scientists.

The deterioration of water quality due to intensive mariculture was identified as a key management issue.

Subsequently, the CoE supported an action-planning workshop on "Reducing Environmental Impacts of Marine Fish Cage/ Pen Culture" in January 2009 to:

- Enhance local knowledge with science-based information that will help mitigate the negative impacts of intensive mariculture; and
- Discuss with LGUs and direct stakeholders the importance of integrating sustainable mariculture as a major part of fisheries and coastal resources management programs.

Bolinao 2008. CoE Chair, Professor Ed Gomez, talks with local government representatives and others at the Coastal Resources Management Forum.

The Forum had two major outputs. Firstly, general action plans that could assist in the development of sustainable mariculture practices in participants' municipalities and cities, and at the inter-LGU level were identified. Secondly, practical ways and means to keep fish farming profitable and sustainable and to minimise negative impacts on human health, the local economy and environment were shared.

Mariculture management in the Philippines

The work undertaken in the CRTR LGI project supported previous work undertaken through PHILMINAQ (Mitigating impact from aquaculture in the Philippines) – an EU-funded and joint project of UPMSI, Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR), Scottish Association for Marine Science (SAMS), and Akvaplan-Niva (APN), which has resulted in improved monitoring and modelling of aquaculture impacts on the environment.

The project introduced three levels of monitoring surveys (low-cost local, medium, and comprehensive surveys) depending on the resources available and results required. It also developed tools and models to help locate mariculture sites and optimise production.

The PHILMINAQ project has helped government agencies manage sustainable aquaculture development. This has been achieved by encouraging inter-government agency discussions; developing a Joint Administrative Order clarifying roles and jurisdiction of agencies for the environmental management of aquaculture; developing a handbook on Guidelines for Local Government Units (LGUs) for planning, managing, and controlling aquaculture development; developing a Geographic Information System (GIS) database of aquatic ecosystems and sensitive habitats; and training university research staff in aquaculture impacts, monitoring methodology and modelling.

Better management principles for aquaculture

As a result of the PHILMINAQ project, a series of management principles for aquaculture planning has been developed:

- **Zoning.** Aquaculture should be zoned so that it is not in conflict with other users of the coastline and located in an area with sufficient depth and currents.
- **Environmental considerations.** There is a need to consider the environmental consequences in aquaculture planning and licensing, with the goal of production within carrying capacity.
- **Sustainable production.** With increasing production, there are increasing impacts on the environment. The environment is able to assimilate certain impacts such as organic sedimentation or dissolved nutrients but if the impact is greater than the assimilative capacity, eventually there may be consequences such as fish kills.
- **Carrying capacity.** An assessment of carrying capacity of zones allocated to aquaculture should be developed and validated for aquaculture in the different aquatic environments (fresh, brackish, marine) for the Philippines. This needs to consider inputs by aquaculture and other human activities. Planning and management should set production below the estimated carrying capacity.
- **Ecosystem management approach.** Planning of aquaculture development should take an ecosystems approach, where the ecosystem as a whole is considered, rather than individual zones.
- **Co-management.** The management of aquaculture is undertaken by individual LGUs but co-management of the whole ecosystem in cooperation with bordering LGUs should be considered.

Further information

For more detail on what has been done by UP MSI on sustainable mariculture in The Philippines, please visit www.gefcoral.org, see 'Where we work'.

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