

Bolinao Fish Kill: A Case Study on the Need for Sustainable Mariculture

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From 1995 to 2005, the coastal waters of Bolinao, Pangasinan, Philippines experienced environmental changes linked to the uncontrolled proliferation of fish pens and cages to more than double the allowable limit for Bolinao waters. Growth in the mariculture of *Chanos chanos* (milkfish) in Bolinao has resulted in eutrophic conditions due to the release of organic matter from unconsumed feed and fecal material accumulating in the water column and sediments. Eutrophic waters where nutrients have increased (in Bolinao ammonia increased by 56%, nitrite by 35%, nitrate by 90%, and phosphate by 67%) favor algal blooms and the onset of hypoxic or anoxic conditions. The major fish kill event in Bolinao in 2002 coincided with the first reported bloom of a dinoflagellate *Prorocentrum minimum* in the country. A high density of *P. minimum* cells was found in the water column as well as in the gills of the dead fish. Days before and during the bloom dissolved oxygen (DO) levels were low (<2.0 mg/L). Low DO caused the suffocation of fish, and eventually the fish kills. The addition of more fish pens and cages also placed additional stress to the poorly flushed, shallow areas in Bolinao waters that affected water quality due to changes in the water residence time.

The fish kill that happened in Bolinao illustrates that mariculture should not be pursued at the expense of the marine environment. Measures that can be taken to mitigate the problem and prevent similar occurrences in other parts of the country include proper siting of fish pens and cages, regular monitoring of water quality conditions and microalgal species, compliance with allowable limits and following proper fish farming practices.



23-27 November • Manila, Philippines