

## **MANAGEMENT OF NITROGEN DEPOSITION IN COASTAL BAYS AND ESTUARIES**

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### **ABSTRACT**

Deposition of excessive amounts of nitrate, a relatively non-toxic substance, and other forms of reactive nitrogen species in coastal bays and estuaries has emerged as a major environmental issue that transcends political jurisdictions and involves several economic sectors. The primary effect of nutrient over-enrichment is enhanced algal growth that, in turn, can lead to nuisance algal blooms, hypoxic or anoxic conditions in the water column and on the seabed, altered patterns of primary productivity, changes in species composition and succession, and shading effects on macrophytes and seagrass beds. Of particular concern is the occurrence and magnitude of harmful algal blooms, some of them toxic, and for which enhanced nitrogen availability could be the primary or an important co-factor. Estimates of economic impact of such blooms average \$75 million annually as public health costs, loss of commercial fishing and aquaculture, recreation and tourism. Despite severity of environmental effects in some estuaries and a general lack of improvement in estuarine eutrophication over the past decade, examples of effective nitrogen control measures are few and often controversial. In part this is due to its variety of sources, transport over long distances, complex biogeochemical cycling, and delivery to the estuaries in vastly different amounts and chemical forms. Along its delivery route and following deposition, nitrogen-related effects include unsafe drinking water, soil acidity, smog, ground-level ozone, greenhouse warming, and eutrophication at different concentrations. A singular limitation in this regard is lack of a monitoring program that can provide a continuum of measurements from the watershed to the coastal ocean and offer connectivity with the principal sources of nitrogen input to estuaries, i.e., atmospheric deposition, rivers and streams, groundwater, and inflowing oceanic water. Such measurements are essential for formulating nitrogen control measures as well as evaluating success of those measures.

### **KEYWORDS**

Nitrogen, nitrate, eutrophication, harmful algal blooms, monitoring