material concentrations from predictions based on these two previous steps are quantitatively attributed to net non-conservative reactions of materials in the system. The non-conservative flux of dissolved P is an approximation of net metabolism (autotrophy, heterotrophy) at the scale of the ecosystem, and the net non-conservative flux of dissolved N can be assigned to other processes (denitrification, N-fixation) in a quantitative manner.

The important sources of N and P into a coastal system may be runoff, groundwater, and anthropogenic inputs. Runoff and groundwater concentrations can be directly measured but this may not be easy for anthropogenic wastes. Estimation of waste load from various human activities was developed (McGlone and Caringal, 1998). This involved the identification of relevant human activities within the coastal area, determination of the activity level at the local level, and approximation of TN and TP from the activity level and discharge coefficient (WHO, 1993). DIN and DIP were approximated using the ratios given in San Diego-McGlone et. al. (2000).

N and P budgets were constructed for 6 bays in the Philippines, these are Lagonoy Gulf, Lingayen Gulf, Manila Bay, San Miguel Bay, Carigara Bay, and Sogod Bay (Dupra, et al., 2000). The major waste load contributor is agriculture (for 5 bays) except for Manila Bay where domestic sewage predominates. Initial P budget results show that Lingayen Gulf, Lagonoy Gulf, San Miguel Bay and Sogod Bay are net autotrophic (p–r>0) while Manila Bay and Carigara Bay are net heterotrophic (p–r<0). Based on the N budgets, Manila Bay, San Miguel Bay, Carigara Bay and Sogod Bay are net denitrifying, while Lingayen Gulf and Lagonoy Gulf are net N-fixing.

Human activities have altered nutrient (N and P) loading to coastal embayments. In the Philippines, high population density and continuing population growth and development in the coastal areas are issues of concern that have ecological implications. The consequences of altering the major inputs by anthropogenic influence are given in Tables 1 and 2. The effect of changing the waste load can be as drastic as a change in ecosystem metabolism. Doubling the current load shifts the system to autotrophy which will eventually affect the assimilative capacity of the bay or its ability to process waste inputs. This on the long run may bring in eutrophication and anoxic conditions, and will eventually affect the fisheries in a bay. Since the budget provides insights on the biogeochemical dynamics of the system, it may find application as a management tool.

Table 1. Effects of changing waste load on (p–r).

Bays	Current load ($mol\ m^{-2}\ yr^{-1}$)	0 load ($mol\ m^{-2}\ yr^{-1}$)	2x load ($mol\ m^{-2}\ yr^{-1}$)	Waste load (P) ($10^6\ mol\ yr^{-1}$)
Lingayen Gulf	+6	−0.5	+11	116
Manila Bay	−2	−6.3	+1.3	61
Lagonoy Gulf	+0.05	−0.73	+0.07	2
San Miguel Bay	+0.37	+0.11	+0.72	5
Carigara Bay	−0.06	−0.25	+0.14	1
Sogod Bay	+1.63	+1.46	+1.66	4

Table 2. Effects of changing waste load on (*nfix–denit*).

Bays	Current load ($mol\ m^{-2}\ yr^{-1}$)	0 load ($mol\ m^{-2}\ yr^{-1}$)	2x load ($mol\ m^{-2}\ yr^{-1}$)	Waste load (N) ($10^6\ mol\ yr^{-1}$)
Lingayen Gulf	+0.3	−0.03	+0.9	874
Manila Bay	−1.13	−1.35	−0.9	600
Lagonoy Gulf	+0.07	+0.073	+0.09	173
San Miguel Bay	−0.13	0	−0.36	199
Carigara Bay	−0.07	−0.037	−0.11	32
Sogod Bay	−0.02	−0.03	+0.26	59

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Nutrient and biotic fluxes in relation to dispersal of pollutants in Ponggol estuary, Singapore

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Ponggol estuary located on the northeastern coast of Singapore is a mangrove fringed habitat, highly impacted by anthropogenic activities such as reclamation, dredging, clearing of mangroves, dumping of dredge spoil, recreational boating from an adjacent marina and shipping in the busy East Johor strait. These impacts have resulted in the input of different kinds of pollutants into the system, resulting in an overall imbalance in the resident biotic communities.

The study is divided into two parts—intensive field monitoring studies and mesocosm studies. The intensive monitoring involved 24 sampling spaced at fortnightly interval over one year. Spatio-temporal variations in 30 parameters were studied, looking into the effect of pollutants such as heavy metals, total petroleum hydrocarbons and organic carbons on biotic components such as plankton, periphyton and heterotrophic bacteria. The results reveal an imbalance resulting in eutrophication due to inhibition of heterotrophic bacteria by high concentrations of petroleum hydrocarbons discharged by the boats and the ships. Besides this, we are looking into the possible effect of dredging and subsequent light reduction on the overall and the size fractionated primary production in the ecosystem. Mesocosm studies would be carried out to 'ground truth' the findings from the monitoring studies. In these studies, concentrations of a particular pollutant would be made up and added into mesocosm set-ups that would be monitored over a period of time to validate the findings from our field observations.

The Change in land-sea silicate fluxes through the Chao Phraya River

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There are several examples of changes in silicate fluxes due to land use changes, for example on the Danube and Nile River System. The Gulf of Thailand and adjacent coastal area also had undergone by changing land use activities such as dam construction for irrigation and production of hydroelectric power and deforestation to make way for agricultural practice. These changes are expected to have impacts on nutrient composition in the gulf, which have a direct impact to captured fisheries, marine biodiversity and carbon cycle. This study focuses on two areas of interest: the seasonal change in silicate and other nutrients in the Chao Phraya River in 1999 and possible historical change in biogenic silica in seven sediment cores and one 40-year-old coral core from the Gulf of Thailand. The main objective is to try to understand the relationship between silicate fluxes in the past with the historical land use changes in the Central Plain of Thailand.

The year-round average of dissolved silicate concentration in the Chao Phraya River in 1999 was 181.58 mM, which was normal in natural freshwater. However, the concentration in the wet season was higher, which was probably due to higher soil erosion by surface runoff. Dissolved silicate concentration in the river water decreased toward the river mouth through a mixing process with low-silicate seawater. In sediment core, we had expected that the biogenic silica concentration accumulated in sediment should be higher in the deeper part before construction of major dams upstream. However, we found no clear systematic change in downcore concentration of biogenic silica in sediments even in the sediment from upper area of the Gulf of Thailand, which is directly influenced by the Chao Phraya River. This was probably due to the fact that fragile siliceous shells are more soluble in the tropical marine environment, thus only a small amount of it remained in sediment. Another possible reason was a disturbance of surface sediment by bottom trawling. Although silicate cannot show a clear relationship with land use in this research, there are still several nutrients that we can use. One of these elements is Aluminium which its flux also has a close relationship with land use. Additionally, we also expected that biogenic silica recorded in coral bands would be able to show historical changes in land use activities as well.

Ecological status survey of the intertidal macrofauna of the Sikka & Vadinar coast off gulf of Kachchh, India

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The intertidal zone is considered as the most productive with the greatest diversity of plant and animal life of any ecological area of the world. The intertidal ecosystem represents rather special type of environment, which contrasts sharply with conditions that prevail elsewhere in the sea. The life in the intertidal zone needs special adaptations that are required by the organisms to inhabit therein which is alternatingly marine and terrestrial.