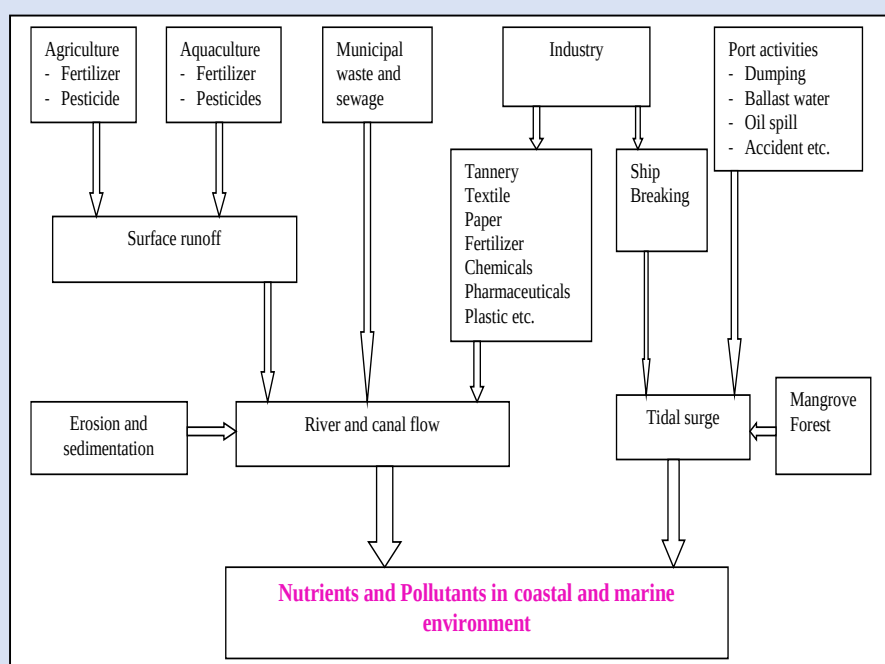


Nutrient Loading in Coastal Waters of the South Asian Seas and its future interventions.

Pulakesh Mondalⁱ

The five South Asian maritime countries namely, Bangladesh, India, Maldives, Pakistan and Sri Lanka are home to about 22% of the global population, with only 4.8% of the world's land mass, 14% of the global arable land, 2.73% of the world forest area and 4% of the world's coastline. For this region like many other regions of the world, availability and use of nutrients is the key to ensure food security, hence it cannot afford to lose precious nutrients required for food production as pollutants to the environment. Notwithstanding the above, the coastal habitats of South Asia are at a high risk of eutrophication from nutrient enrichment due to leakages from agriculture, aquaculture, sewage, industrial effluents, marine trade and transport.

Bangladesh, with a coastline of 734 km generates 600 tons of waste per day from its shrimp culture alone with mean levels of nutrients at 108.78 mg/l for CaCO_3 , 0.526 mg/l for NH_4^+ -N, 3.075 wt% for organic carbon, 7.00 mg/l for $\text{PO}_4\text{-P}$ and 5.57 mg/l for $\text{NO}_3\text{-N}$. In addition, a huge amount of pollutants released from its 8,542 industrial units contains 11-22 $\mu\text{g/kg}$ dissolved or dispersed hydrocarbons or particulate petroleum residues in the



surface water and 14-23 $\mu\text{g/kg}$ in subsurface water. India, with the longest coastline of 5,423 km contributes around 50 billion litres of industrial effluents, 30 billion litres of sewage, 5 million tons of fertilizer residues, 3,500 tons of petroleum hydrocarbons and 0.2 million tons of mining rejects, dredged spoils and sand extractions. In Maldives with 26 coral atolls, contamination from direct disposal of sewage wastes from tourist trade constitutes the major source of pollution, coupled with the global traffic of petroleum transport along the sea routes. Pakistan, with about 990 km long coastline contributes to coastal pollution mostly through direct discharge of industrial effluents and domestic sewage in the ratio of 60:40. In the Karachi coast alone, an estimated BOD load of >1,500 tons/day is added into sea by these industries in addition to inorganic pollutants. Discharges of 130,000 tons of solid nitrogen, 160,000 tons of organic matter, 800 tons of nitrogen compounds, 90 tons of phosphate compounds and 12,000 tons of suspended solid every year, is encountered in Manora Channel in the Karachi coast. Further, being on the gateway of Persian Gulf, transport of crude oil constitutes other major source of coastal pollution in Pakistan. Sri Lanka, an island nation with 1,625 km coastline with agriculture and aquaculture as the cornerstones of the country's economy, pollution of coastal waters from agrochemicals contributes the major share with nitrate-N

reaching 0.11-5.7 mg/l and phosphate at 0.11-0.78 mg/l in coastal aquifers. Shrimp farms also release effluents with high levels of suspended solids (200-600 mg/l) and high BOD levels (60-180 mg/l).

Signs of degradation of aquatic, estuarine, coastal and marine ecosystems due to nutrient loading are evident at various locations in South Asia, with several reports on eutrophic zones due to excessive growth of algae and fish kills due to hypoxia. Estuarine and coastal systems in South Asia are N-limited and N loading through upwelling, sediment transport and sediment release can trigger algal blooms and eutrophication. Some of the estuaries, especially along the Indian east coast, are phosphorus limited and are adversely affected by P loading. The Western side of the Indian peninsula is already prone to seasonal development of natural hypoxic zones, whereas the East coast is relatively less prone to hypoxia. Additionally the hydro-dynamics of the region often makes the situation complex and at times even invisible. Agricultural nutrient loading to coastal waters is primarily during rains/floods, whereas sewage is the single main source of pollution of coastal waters from the land. Nutrient leakage from sediment transport and upwelling, fisheries, aquaculture and livestock farming is also high, especially in areas of intensive aqua-farming.

The South Asia Cooperative Environment Programme (SACEP) together with the United Nations Environment Programme –Global Programme of Action (UNEP-GPA) and the Bay of Bengal Large Marine Ecosystem (BOBLME) Project developed the project concept “Controlling Nutrient Loading and eutrophication of Coastal Waters of the South Asian Seas Region” with the main objective of reducing and controlling nutrient loading into the coastal waters of the South Asian Seas Region through development of a regional action plan and policy forum/framework. A first step in this activity was to understand the spatial and temporal complexity of nutrient loading and coastal eutrophication / hypoxia, including the functioning of ecosystems and socioeconomic systems. In 2013, BOBLME commissioned, through SACEP, the Indian Nitrogen Group (ING), a network of nitrogen researchers and experts, to carry out this scoping study. The desk review seeks to highlight important trends in eutrophication, sources of nutrients and current policy and legislation in various

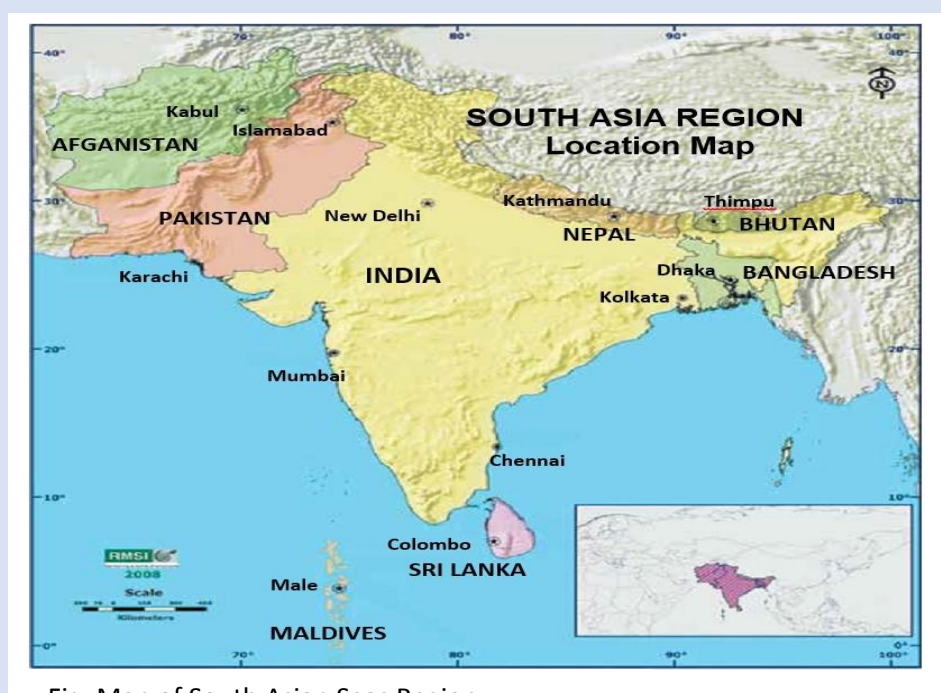


Fig: Map of South Asian Seas Region

South Asian countries. The study covers the maritime countries of Bangladesh, India, Maldives, Pakistan and Sri Lanka and has been submitted to validation by a range of technical experts from the countries at a validation workshop held in Colombo, Sri Lanka in May 2014. Now the study report is final and the desk study examined the problem of eutrophication of

coastal waters for the maritime countries of South Asia. This report has given some directions to tackle the problem of nutrient pollution requires framing specific policies/programs designed to

recover and recycle nutrients as well as enhance nutrient use efficiencies. Such targets need simultaneous consideration of social, economic and environmental concerns, the bedrock of sustainable development. The following policy options could be considered to combat nutrient pollution of aquatic, coastal and marine environment:

1. Strict adherence to laws and policies related to coastal ecology.
2. Effective river conservation program ensuring direct linkage to coastal habitat conservation.
3. Develop quality standards for coastal waters including introduction of uniform standard for primary water quality criteria for the coastal waters.
4. Managing pollution sources on land including capture and recycling of the nutrients emanating from agriculture, aquaculture, poultry and livestock farming etc. to minimize nutrient leakages throughout the food chain. They should be enforced and monitored periodically through a joint task force comprising relevant scientific, administrative and civil society stakeholders.
5. Develop national and sub-regional policies for conservation, protection and sustainable policies for conservation, protection and sustainable development of oceanic and marine resources through a South Asian level intergovernmental working group/task force with governmental and civil society representatives. This may work within, or in consonance with the existing intergovernmental processes, including the UNEP-GPA, SAARC, and SACEP and other ongoing initiatives such as the BOBLME project etc. and build on them for stronger regional cooperation on nutrient management.

The study also provided some important recommendations could be considered to combat nutrient pollution of aquatic, coastal and marine environment:

1. Nutrients such as Nitrogen and Phosphorus that are necessary for food production should be retained or recycled as they become pollutants if lost to the environment. The existing policies and practices of agriculture/aquaculture, sanitation, industry and environment do not sufficiently emphasize nutrient efficiencies and sustainable nutrient management to prevent nutrient pollution and eutrophication of aquatic and coastal ecosystems
2. The available quantitative information on nutrient losses from various human activities and their accumulation in the coastal zones of South Asia is very limited. This calls for detailed studies with actual long term measurements and simulation of nutrient pollution from source to sink (land to sea) for informed decision-making
3. Systematic studies to quantify the sources, flows, fate and extent of current industrial, agricultural and municipal effluents and the nutrients they contribute to water bodies and their impacts on aquatic life, fishing as well as human health.
4. Installation of information technology based effective mechanisms for exchange and sharing of data on the nutrient pollution status in different coastal regions of South Asia between various stakeholders including governments and non-governmental and interregional agencies.
5. Capacity building for sustainable fishing and aquaculture with integrated resource management to protect them from environmental degradation including bottom trawling and dredging and encroachment on the livelihood rights of fishermen.

ⁱ **Pulakesh Mondal, Senior Programme Officer, South Asia Co-operative Environment Programme (SACEP), 69/4, Maya Avenue, Colombo-06, Sri Lanka. Email: Pulakesh.mondal@sacep.org; web: www.sacep.org**