Introduction of Coastal Area Management Program in Other Countries

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Abstract

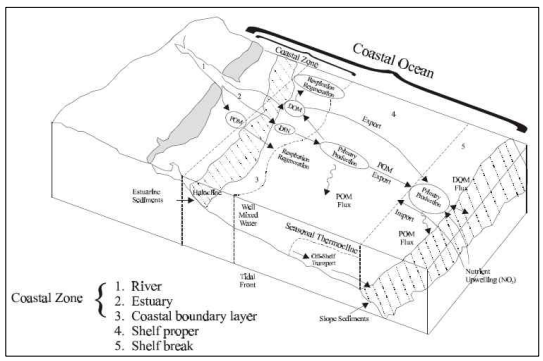
The coastal zone is the transitional area between land and sea. It plays an important role in the land-sea ecosystem. Unfortunately, most of the world's coastal areas are polluted due to the human being activities. Pollution and development are changing coastal habitats, and feeding and nursery areas are being destroyed, reducing fish and wildlife populations. The pollution in coastal areas is becoming a global environmental problem, more and more attention has been paid to coastal areas. America passed the Coastal Zone Management Act (CZMA) in 1972, and from then, CZMA outlined and conducted the National Coastal Zone Management Program and the National Estuarine Research Reserve System which including 34 projects. And England established "the Crouch & Roach Estuary Project" in 2003, and "South East Coastal and Marine Project" was started in 2007 in responding to the non-point pollutants challenge.

1. Coastal Areas and Estuaries

1.1. Definition of coastal areas

The coastal zone is the transitional area between land and sea. The coastal zone is a band rather than a line. The width of the band varies from place to place and is determined by the interaction of marine and terrestrial coastal processes.

The worldwide average width of the coastal zone on the terrestrial side is said to be 60 km. The zone occupies less than 15% of the Earth's land surface, yet it accommodates more than 60% of the world's population. Only 40% of the one million km of coastline is accessible and temperate enough to be habitable. As a result, coastal zones are marked by above-average concentrations of people and economic activity (Fig. 1).



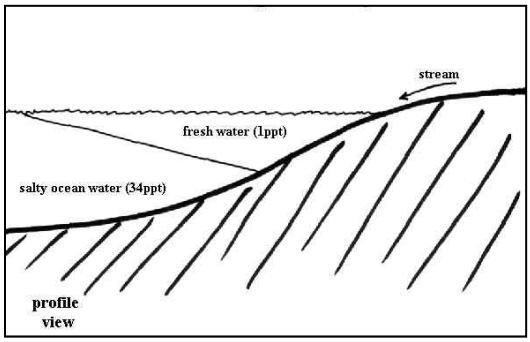
[Fig. 1] Schematic diagram of coastal zone

1.2. Identification of features of coastal area

Coastal waters extend from the coastal baseline at high tide and across the mouths of estuaries to approximately three nautical miles. Coastal waters are relatively deep compared to estuaries with depths ranging from a few meters to several hundred meters, depending on coastal location. Coastal systems tend to be particle-rich compared to the open ocean, but much less so than adjoining estuaries. Coastal systems have a weaker benthic-pelagic coupling than estuaries mainly because they are deeper.

1.3. Estuaries

An estuary is a partially enclosed or semi-enclosed body of water formed where freshwater from rivers, streams, and ground water flows to the ocean, mixing with the salty seawater(Fig. 2).



[Fig. 2] Schematic diagram of estuary

Estuaries are among the most biologically productive ecosystems on the planet. More than two thirds of the fish and shellfish we eat spend some part of their lives in estuaries. These ecosystems also provide many other important ecological functions, and they act as filters for terrestrial pollutants and provide protection from flooding.

1.4. Identification of features of estuaries

Estuaries are located between freshwater ecosystems (lakes, rivers, and streams; freshwater and coastal wetlands; and ground water systems) and coastal shelf systems . These ecological boundary conditions create a transition between contrasting freshwater and open-ocean ecosystems. Estuaries are relatively shallow; often, on average, only a few meters to a few tens of meters deep.

Estuaries are particle-rich relative to coastal systems and have physical mechanisms that tend to retain particles. These suspended particles mediate a number of activities (e.g., absorbing and scattering light, or absorbing hydroscopic materials such as phosphate and toxic contaminants). New particles enter with river flow and may be resuspended from the bottom by tidal currents and wind-wave activity.

Many estuaries are naturally nutrient-rich because of inputs from the land surface and geochemical and biological processes that act as ""filters"" to retain nutrients within estuaries.

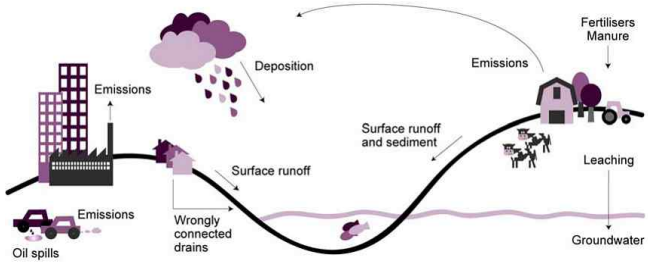
2. Non-point source pollution in coastal area

2.1. Non-point Source (NPS) pollution

NPS pollution occurs when rainfall, snow melting, or irrigation water runs over land, picks up pollutants, and deposits them into rivers, lakes, and coastal waters (Fig. 3).

In coastal areas, non-point source pollution is generated by several major categories of activities:

Agriculture (crops and livestock), forestry (timber harvesting), urban (cities, roads and residential areas), marinas (boat storage and service facilities), hydromodification (shoreline protection and restoration and building dams), Non-point pollutants from these activities include sediment, nutrients (nitrogen and phosphorus), and chemicals (pesticides, oil, salts, and metals) [1].



[Fig. 3] The schematic diagram of common sources of nopoint pollution

2.2. The problems facing to coastal areas and estuaries

Although positive measures have been taken to reduce human impacts on these coastal areas and estuaries, limiting development and use within specific areas, estuarine ecosystems continue to be affected by less noticeable, yet highly detrimental problems of pollution. Pollution of coastal watersheds poses a threat to the estuaries. Some typical impacts on estuarine systems include loss

of habitat due to development, loss of recreational opportunities due to poor water quality, and loss of economic resources due to shellfish bed closures and a reduction in fisheries.

Summarizing the scientific reference, the problems facing coastal areas and estuaries are main followings:

(1) Most of the world's coastal areas and estuaries are polluted; (2) Pollution and development are changing coastal habitats. Feeding and nursery areas are being destroyed, reducing fish and wildlife populations; (3) Along some coasts, runoff enriches the water with too many nutrients, leading to oxygen-depleted water and fish kills; (4) The two most widespread and serious sources of coastal pollution are sewage disposal and sedimentation from land-clearing and erosion; (5) Coastal waters suffer from contamination from non-point source pollution resulting in outbreaks of toxic algal blooms and red tides; (6) Coral bleaching results from warmer surface water temperatures attributed to global warming; (7) Loss of coastal wetlands have been attributed to commercial and residential developments.

2.3 Protection ways of coastal and estuaries environment

The following section outlines some of the management measures for the various types of non-point sources.

(1) Agricultural Runoff
- Erosion and sediment control
- Control of facility wastewater and runoff from confined animal facilities
- Nutrient management planning on cropland
- Grazing management systems
- Irrigation water management

(2) Urban Runoff
- Control of runoff and erosion from existing and developing areas
- Construction site runoff and erosion control
- Construction site chemical control (includes fertilizers)
- Proper design, location, installation, operation, and maintenance of on-site disposal systems
- Pollution prevention education (e.g., household chemicals, lawn and garden activities, golf courses, pet waste, on-site disposal systems, etc.)
- Planning, siting, and developing roads, highways, and bridges (including runoff management)

(3) Silvicultural Runoff
- Streamside management
- Road construction and management
- Forest chemical management (includes fertilizers)
- Revegetation
- Preharvest planning, harvesting management

(4) Marinas and Recreational Boating
- Siting and design
- Operation and maintenance
- Storm water runoff management
- Sewage facility management
- Fish waste management
- Pollution prevention education (e. g. proper boat cleaning, fish waste disposal, and sewage pump out procedures)

(5) Hydromodification
- Minimize changes in sediment supply and pollutant delivery rates through careful planning and design
- Erosion and sediment control
- Chemical and pollutant control (includes nutrients)
- Stabilization and protection of eroding stream banks or shoreline, Wetlands, Riparian Areas, Vegetated Treatment Systems
- Protect the NPS abatement and other functions of wetlands and riparian areas through vegetative composition and cover, hydrology of surface and ground water, geochemistry of the substrate, and species composition

- Promote restoration of preexisting function of damaged and destroyed wetlands and riparian systems
- Promote the use of engineered vegetated treatment systems if they can serve a NPS pollution

3. The projects conducted in the world

3.1. the Coastal Non-point Pollution Control Program, USA[2,3]

The Coastal Non-point Pollution Control Program was established by Congress in 1990 to encourage better coordination between state coastal zone managers and water quality experts to reduce polluted runoff in the coastal zone. This program falls under Section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA), is jointly administered by NOAA and the Environmental Protection Agency (EPA). The Program is unique in that it establishes a set of management measures for states to use in controlling polluted runoff. The measures are designed to control runoff from six main sources: forestry, agriculture, urban areas, marinas, hydromodification (shoreline and stream channel modification), and wetlands and vegetated shorelines, or riparian areas.

The coastal nonpoint program focuses on pollution prevention, minimizing the creation of polluted runoff rather than cleaning up already contaminated water—a very difficult and expensive process. The program encourages pollution prevention efforts at a local level, particularly improvements to land use planning and zoning practices to protect coastal water quality. Some of the land use practices NOAA recommends through the program include: preserving natural vegetation, avoiding development within sensitive habitats and erosion-prone areas, and limiting impervious surfaces such as pavement, decking, and roof tops, to the maximum extent practicable.

3.2. Texas Coastal Management Program, USA[4]

The Texas Coastal Management Program was approved by the National Oceanic and Atmospheric Administration (NOAA) on January 10, 1997. The Texas Coastal Management Program is administered by the Texas Coastal Coordination Council and staff of the Texas General Land Office. The purpose of the Texas Coastal Management Program (CMP) is to improve the management of the state's coastal natural resource area(CNRAs) and to ensure the long-term ecological and economic productivity of the coast.

The CMP supports access to outdoor recreation and the protection of natural habitats and wildlife through:

- the award of federal grant funds to local entities for projects that support access to beaches, bays and other coastal natural resources areas.
- the development and implementation of the Texas Coastal Non-point Source Pollution Cobtrol Program (NPS), which supports the protection of natural habitats and wildlife by identifying sources of coastal NPS pollution and developing recommendations for its prevention;
- the review of proposed federal actions that are in or may affect land and water resources in the Texas coastal zone;
- the work of the Permit Service Center's (PSC) in providing direct access to permitting agency staff and offering project specific technical assistance during the pre-application process;
- the Beach Watch program which provides Texans with baseline data on the health of the Gulf waters by analyzing water samples.

3.3. National Estuary Program, USA[5]

EPA's National Estuary Program was established by Congress in 1987 to improve the quality of estuaries of national importance. The Clean Water Act Section 320 directs EPA to

develop plans for attaining or maintaining water quality in an estuary. This includes protection of public water supplies and the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife, and allows recreational activities, in and on water, requires that control of point and non-point sources of pollution to supplement existing controls of pollution. In several cases, more than one State is participating in a National Estuary Program. Each program establishes a Comprehensive Conservation and Management Plan to meet the goals of Section 320.

Some programs were included in the National Estuary Program:

- Barataria-Terrebonne National Estuary Program
- Barnegat Bay National Estuary Program
- Buzzards Bay National Estuary Program
- Casco Bay Estuary Partnership
- Coastal Bend Bays and Estuaries Program
- Lower Columbia River Estuary Partnership
- Delaware Center for the Inland Bays
- Galveston Bay Estuary Program
- Indian River Lagoon National Estuary Program
- Maryland Coastal Bays Program
- Massachusetts Bays Program
- Mobile Bay National Estuary Program
- Morro Bay National Estuary Program
- New York-New Jersey Harbor Estuary Program
- Peconic Estuary Program
- Piscataqua Region Estuaries Partnership
- Puget Sound Partnership
- Sarasota Bay Estuary Program
- Tampa Bay Estuary Program
- Charlotte Harbor National Estuary Program

3.4. South East Coastal and Marine Project, England[6]

The project started in October 2007 and is due to run until March 2010. An integral part of the project is developing stronger and more productive partnerships with key organizations such as the Environment Agency, ports and fishing industries and major landowners. The project will lead on marine work within the region, providing a focus for new areas of maritime work such as coastal access and marine protected areas.

References

[1] S.R. Carpenter, N.F. Caraco, D.L. Correll, R.W. Howarth, A.N. Sharpley, V.H. Smith. 1998. "Nonpoint pollution of surface waters with phosphorus and nitrogen." *Ecol. Appl.,* 8(3), 559-568.

[2] Coastal Nonpoint Source Pollution Control Program, U.S, Environmental protection agency. http://www.epa.gov/nps/coastnps.html

[3] Coastal non-point source pollution grant program, Massachusetts office of coastal zone management. http://www.mass.gov/czm/coastalnpsgrants.htm

[4] Coastal no-point source pollution control program. Texas state soil and water conservation board. http://www.tsswcb.state.tx.us/coastalnps

[5] National estuary program, U.S, Environmental protection agency. http://www.epa.gov/nep/

[6] South East Coastal and Marine Project, Natural England. http://www.naturalengland.org.uk/regions/south_east/ourwork/marineandcoastalproject/default.aspx