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Overview of Vol.2, No.3 - Coastal Waters

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The oceans provide us with a seemingly endless bounty. In 1990, commercial fishing off the coasts of the United States brought in 11 billion pounds of fish, worth approximately $4 billion. Recreational marine fishermen spent nearly $7 billion in 1990. Divers spend millions each year to swim along coral reefs. Many countries rely on oceans as their primary food source as well as a tourism revenue source. So it seems apparent that we should have a vested interest in the preservation of productive oceans ecosystems.

In addition to providing food and recreation, coastal waters also serve other purposes. Even prior to the Industrial Revolution, ocean waters were dumping ground for wastes. Coastal cities still continue to haul barge-loads of refuse out to sea for disposal. Sewage is piped off shore. As the world population increases, coastal areas are experiencing higher population densities. Development along coastlines has resulted in the dredging and filling of coastal wetlands, channelization of rivers entering bays and estuaries, and construction of dams for hydroelectric power. All of this development has been for the bettering of human existence. Or has it?

While boosting our civilization, it is possible that we have forgotten our responsibility to the earth, our stewardship? The laws of physics state that for every action there is a reaction. What reactions come from coastal development, over fishing of coastal waters, ocean dumping of wastes? Signs of the strain are becoming clearer - declining fish populations, erosion of tidal marshes, loss of species diversity. This section of Restoration and Reclamation Review covers some of the problems facing coastal waters. The papers presented involve large-scale techniques meant to stop the further degradation of a habitat type and techniques meant to restore habitats to their pre-disturbance condition.

A key problem with coastal development is the inability to see the connectiveness of marine and terrestrial environments. Many of the fish and shellfish that are harvested for commercial purposes have a terrestrial and marine life cycle. Destruction or degradation of one environment affects the other. In the first two papers, Giedd and Lemire address coastal wetlands near the mouth of the Mississippi River. The Mississippi delivers ~300 million tons of sediment to the Gulf of Mexico each year. Prior to the construction of locks and levees, this rich sediment was deposited in the lowlands, providing a land base for wetlands and a nutrient source. Multiple species of birds, fish, shellfish, and invertebrates utilize these areas for nesting, spawning, and feeding. Construction of levees and other flood control structures has restricted the Mississippi and diverted its sediment load. Without input from the terrestrial system, erosion of the wetlands by tidal action dominates. Loss of such productive ecosystems has an decreases the diversity and quantity of species in the region. Giedd and Lemire present techniques designed to reclaim lost wetland habitat.

Giedd addresses reclaiming degraded wetlands using diversion structures to deliver sediment-laden river water to areas cut off from seasonal flooding. Such structures could be large enough to divert up to 30 000 cfs or as small as a channel through an existing levee. Diversion of river water can be an effective tool for re-establishing the sediment input into adjacent wetlands. The technique has merit and has been successful in restoring sediment deposition to some wetlands. Re-introducing flooding to low areas faces some challenges. With the magnitude of recent spring floods in the Mississippi Basin, public acceptance of such measures may be a limiting factor in their success.

Zonal ecosystems abound along the coastal areas of the Gulf of Mexico. Tidal waters from the Gulf mingle with fresh water from the Mississippi and create freshwater wetlands, brackish estuaries, and salt marshes. Lemire specifically addresses wetland decline related to canals excavated in coastal wetlands of Louisiana. Created for the exploitation of oil, these canals provide a direct inland flow route for tidal waters. Salt intrusion into freshwater habitat is devastating on plant and animal communities. Destruction of vegetation results in increased tidal erosion and loss of wetlands. The problems associated with canal activity are numerous. Juvenile fish become easy prey as wetlands subside and the shallow habitat becomes accessible by large predators. Loss of coastal wetlands also subject the mainland to the harsh conditions of ocean storms. Spoils left from canal dredging create barriers and prevent overland flow of water, disrupting nutrient cycling and migration of aquatic organisms. The reclamation technique Lemire discusses as the easiest and most effective method is backfilling the canals and allowing nature and time to comlete the restoration.

Another threatened coastal ecosystem are coral reefs, which are prime commercial and sport fishing destinations. Recreational enthusiasts see these natural formations as a pleasure destination. The reefs are one of the most diverse ecosystems on earth, supporting a wide range of fish and invertebrate populations. Reefs are breeding and feeding grounds for many commercial fish and shellfish. Barrier reefs, like those off the eastern coasts of Australia and the Florida Keys, serve as a buffer, mitigating the effect of tidal forces on the mainland. Such rich ecosystems, which have taken millennia to form, are susceptible to deterioration. Approximately 10 percent of the world's reefs have been degraded beyond recovery with many more seriously threatened. Coral reefs of 93 coastal countries have been degraded. Siltation, nutrient overload, and fuel spills have all contributed to decreased productivity of the reefs. Physical damage occurs with dragging anchors, ship bottoms, and souvenir hunting divers. Continued loss of this resource will result in further decrease of fish production, an impact which will be hard on populations that rely on fish as a life staple. Reef generation has been attempted using various items, including sunken ships, planes, and autos. Such methods have had mixed success and the stability of these artificial reefs are questionable. The paper by Warzecha provides an overview into the problems with artificial reef construction and establishment and highlights one technique which eliminates many of the stability problems. While the technique shows promise as a method of initiating reef formation the causes of deterioration still remain. As with most restoration projects, success will be forthcoming only if the stressors to the system are removed.

Common practice in coastal conservation is to replace disturbed wetlands with equal or larger scale wetlands. Justification for requiring wetland mitigation is to preserve diversity, protect wetland species, and to retain some of the beneficial attributes of wetlands, such as flood storage and nutrient filtering. However, it is becoming clear that replacement wetlands are often lacking the structure and function of wetlands they are replacing. Hydrologic parameters are often dissimilar, and the nutrient cycling that is a key function and structure of wetlands is not established. The southern coast of California is rapidly developing; new highways and housing developments are crowding the shoreline, out competing the natural ecosystems. One threatened ecosystem is the salt marsh, discussed in the paper by Dailey. A habitat for several endangered and threatened species, California salt marshes are being intensively studied. Given that this habitat supports endangered species, time for successful restoration is important. The research reviewed by Dailey shows that restoration of salt marshes is highly dependant on the establishment of nutrient cycling. Use of soil amendments for establishment of proper nutrient cycling is one method being tested . Dailey's conclusions suggest that, even with soil amendments, salt marsh restoration may not be feasible in the required time frame.

Three out of the four techniques presented in this section show some promise in recreating a degraded ecosystem. The disappointing aspect is that these three techniques are large scale with minimal restoration goals. Much time is required before the systems discussed will match their undisturbed counterparts. We humans have a vital need for coastal ecosystems, but do we have the time to wait while nature heals the wounds we have and are making?