



Part 1: Overviews

Marine and Oceanic Biomes

Coastal Seas

Coastal seas are extremely important for biodiversity and ecosystems. Coastal seas can be defined in terms of the continental shelves, as understood geologically, and by reference to international conventions. In geological terms, the continental shelf is the extended perimeter of the continent and the associated coastal plain. The continental margin, which is located between the continental shelf and the abyssal plain, consists of a steep continental slope, followed by a flatter continental rise. Sediment from the continent descends down the slope, and accumulates at the continental rise located at the base of the slope.

Under the United Nations Convention for the Law of the Sea (UNCLOS), the continental shelf is the seabed adjacent to the shores of a country. The waters are also known as territorial waters. UNCLOS states that a country's continental shelf extends to the limit of the continental margin, but no less than 200 nautical miles (370 kilometers) from the baseline. The waters above the continental shelf are also known as territorial waters, and are subject to the sovereignty and control of coastal nations. The legal definition of a continental shelf under UNCLOS differs significantly

from the geological definition. Inhabited volcanic islands, such as the Azores and the Canaries, which have no continental shelf geologically, have a legal continental shelf.

Understanding Types of Coastal Seas

Some coastal seas are pelagic seas that are located along an open ocean. Examples of pelagic seas include the North Sea and the South China Sea. Coastal seas may be enclosed seas or semi-enclosed seas. Examples of enclosed seas include the Black, Baltic, and Mediterranean Seas, while the Gulf of Mexico, Gulf of Carpentaria, and Hudson Bay are semi-closed seas. Some seas may have multiple characteristics over time, such as the Wadden Sea, which was a pelagic sea that became enclosed over time through human action. Some coastal seas can be considered estuarine, because they are influenced by river flows and sediment inputs. Examples of these estuarine-influenced seas include the Gulf of Mexico, Mississippi River, Beaufort Sea, Mackenzie River, Adriatic Sea, and Po River. Last, polar seas that are adjacent to the Arctic and Antarctic coasts can be considered a unique type of coastal sea because of their extreme environmental conditions and predominantly pristine nature. Coastal seas, particularly estuaries

and adjacent coasts, have played a critical role in human development for most of human history, and are most affected by human activities. Historically, coastal seas were primary commercial fishing grounds. Based on their depth and seafloor, they can provide protection from moderate storms and extreme events. Coastal seas contain abundant life because of sunlight diffusing through the shallow waters over the continental shelves, in contrast to the sparser life of the deeper abyssal plains. Most commercial exploitation from the sea, such as mining and hydrocarbon development, also takes place on continental shelves.

Increasing numbers of the world's people live in coastal regions adjacent to coastal seas. Many of the world's major cities have been built near natural harbors and have port facilities. The coast is also a frontier for military invaders, smugglers, and migrants. Coastal beaches and warm water can be important tourist attractions. As a result of these increasing populations and uses, coastal seas face many environmental challenges from human-induced impacts. While human activity and adverse impacts have been occurring in coastal seas since early times, the decline of coastal seas has significantly accelerated in the last two to three centuries. For example, records from all coastal seas illustrate that seagrass habitats have been destroyed, water quality has decreased significantly, and marine species and diversity have lessened.

A perfect storm of overexploitation, nutrient pollution, and climate change is creating an uncertain future for coastal seas. Land-based and marine pollution includes petrochemicals and biological waste, while climate change contributes to sea-level rise, which threatens coastal ecosystems. Jeremy Jackson of the Scripps Institution of Oceanography refers to the synergistic effects of habitat destruction, overfishing, ocean warming, increased acidification, and massive nutrient runoff that are transforming complex ocean ecosystems. Areas that previously had intricate marine food webs with large fish and mammals are being converted into simplistic ecosystems dominated by microbes, algal blooms, jellyfish, and disease. Knowledge of coastal seas and their original ecosystems is important for understanding the cur-

rent and possible future ecosystems. Managing and conserving the world's coastal seas and their ecosystems now and in the future will require science-based approaches, commitment, and resources for managing these seas and human activities.

Pelagic Seas

The North Sea is located on the European continental shelf, and connects to the Atlantic Ocean through the English Channel in the south and the Norwegian Sea in the north. The North Sea is an important shipping lane and supports major fisheries. The sea is popular for tourism and recreation, has significant hydrocarbon production, and wind and wave energy generation. The coasts adjacent to the North Sea are subject to high populations and industrialization, and intense uses of the sea and coasts. Environmental impacts on the sea include overfishing, industrial and agricultural pollution, dredging, and dumping. Climate change is affecting its food web and encouraging its fisheries to migrate northward, while new species enter from southern waters.

The European Union has been implementing coastal zone management and marine spatial planning in the North Sea, and there is extensive regional cooperation. The Wadden Sea is adjacent to the North Sea and borders Denmark, Germany, and the Netherlands. It is a pelagic sea that has been modified through a system of dikes and causeways to become a semi-enclosed sea. The Wadden Sea has long been an important source of food and transport for adjacent communities. Eutrophication and nutrient pollution extend over 100 years. Given its significance, a Joint Declaration on the Protection of the Wadden Sea was agreed to by the three adjacent countries in 1982, and a Trilateral Wadden Sea Plan was adopted in 1997.

The South China Sea is bordered by China to the north; the Philippines to the east; Malaysia, Singapore, Indonesia, and Brunei to the south; and Thailand, Cambodia, and Vietnam to the west. The sea lies above a drowned continental shelf that was above the sea during the prior ice ages, when the global sea level was hundreds of meters lower. The South China Sea contains many small islands, atolls, cays, shoals, reefs, and sand-