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## Preface

The economic, climatic and geopolitical processes of the modern world set a task for humanity for comprehensive study of the seas and coastal areas of strategic importance. The beaches and coastal areas of the Russian seas are its national heritage, the economic, environmental, recreational and aesthetic value of which is constantly growing. It should be recognized that, in the era of globalization and in the midst of the avalanche of technogenic intrusions into all spheres of nature, the seashores are a nonrenewable natural resource. To design a rational approach for the use of unique coastal landscapes so that problems may be fully resolved from a regional perspective, there must be complex research and analysis of the development of natural and socioeconomic processes in each region.

Russia is the largest country in the world by area, and it has the longest coast. This configuration determines the diversity of its coasts. Russian territory includes 12 coastlines along three oceans, located in different time, natural and climatic zones, with a total length of 37,653 km. These seas can be divided into four groups, according to their geographic position – Southern, Northwestern, Arctic and Far Eastern seas.

*Southern seas.* The Black and Azov Seas, by their geographical position, belong to this group. They are located at the same latitude (between 36 and 37 N) and are geographically close to each other, which gives them a certain similarity. Both of them have a tectonic origin, and their geological history is connected with the alternating uplift and subsidence of the crust all over the southern region, and the weakening or strengthening of the influence of salty oceanic and continental fresh waters. The geological past of the southern seas determined their most important modern natural peculiarities – almost complete isolation from the World Ocean and low salinity. Mainland stock is one of the most significant factors in the formation of the hydrological conditions and the most important component of the water balance of the southern seas. A variety of physical and geographical, hydrological and hydrochemical, and related biological conditions allow for distinguishing two regional types: the estuary-shelf and the oceanic. The first of these concerns the Azov Sea and the northwestern part of the Black Sea. They are characterized by shallow water, strong desalination, great influence by atmospheric processes and runoff. The second type, the oceanic, includes a deep part of the Black Sea. This type's characteristic feature is a large volume of water mass, creating a stable system, with relatively little exposure to external influences. The coastal landscapes and coastal forms of the southern seas are very diverse. The coast of the Russian part of the Sea of Azov in the north and east consists of clay and sand deposits and is subject to destruction as a result of active erosion. The beaches of the Taman Peninsula consist of solid limestone and are more resistant to abrasion. The surf zone represents sand and shell beaches. The coastal zone of the Black Sea, owned by Russia, is represented by different types of geomorphological shores, mainly abrasion, but accumulative forms are also present.

*Northwestern seas.* The northwestern group consists of the Baltic and White Seas. They occupy an intermediate position between the southern and Arctic seas, the first drawn to the south, and the second, to the Arctic. The Baltic and White seas are peculiar to large continental runoff. As a result of having a very weak connection with the neighboring seas, river water determines many of the essential features of these seas. They are characterized by a three-layer vertical structure of waters: freshened surface, intermediate saline water and deep saline water.

The observed vertical structure of the water column leads to their stable state, making it difficult for convective mixing to take place in the wind seas. However, the isolation of these seas, and the limited vertical mixing, does not entail a substantial permanent stagnation of the deep water in the Baltic and the White; they are renewed annually. Every year, both seas are covered by the winter sea ice. The shores of the White Sea are divided into several types: primary partitioned and little changed by wave processes, abrasion-denudation, accumulative and littoral, and abrasion-accumulative resulting in beaches with dead cliffs and modern marine terraces. The Russian Baltic Sea coast is indented with bays (Curonian, Kaliningrad, Vistula) and has an accumulative marine formation; the Curonian Spit and the Baltic Spit have spectacular Aeolian landscapes.

*Arctic seas.* This group is made up of marginal seas of the Arctic Ocean similar in nature: the Barents, Kara, Laptev, East Siberian and Chukchi Seas. All of them are within the Arctic Circle, limited in the south by natural boundaries, such as the coast of Eurasia, and widely and freely communicating with the ocean in the north, separated by conventional boundaries, such as lines drawn around the edge of the shelf. Between them, these seas are separated mainly by islands, as well as conventional lines. All are geologically young and of the same origin. The vast spaces of the Arctic seas lie in the region of relatively small (up to 200 m) depth, but the bottom topography is significantly different for each of them. The most complex and dissected relief is in the Barents and Kara Seas, simplified and leveled off to the east. On the northern outskirts of the Kara, Laptev and Chukchi Seas, relatively deep submarine trenches have been traced, penetrating far into the relatively shallow-water regions of these seas. The geological structure in the western segment is dominated by boulder loam, sand and gravel, and sandy material and in the east, by alluvial, lacustrine-marsh and fluvioglacial deposits. These materials are usually long-term frozen and perennially cooled, forming cryogenic shores (thermoabrasive, thermodenudation, abrasion-solifluction, etc.), occupying about 60% of the coastline.

*Far-East seas.* The fourth part of the coast of the Russian Federation is along the Pacific Ocean and its marginal seas – Bering, Okhotsk and Japan, combined into the group of Far East Seas. From a geomorphological point of view, these seas lie in the transition zone in the north-western periphery of the Pacific Ocean. Here are the epicenters of earthquakes and the submarine areas of modern volcanism. One distinctive feature of the considered seas is a small continental runoff. A significant part of the water area of the Russian Far East freezes in winter. Variable in structure and external forms, the coasts of the Far East Seas belong to different geomorphological types. In general, they are scarp coasts, but there are accumulative ones as well. The shores are mostly rocky and steep, but there are valleys along certain parts of the coast.

Even these minimum characteristics of the Russian seas and coasts give an idea of their natural diversity and the peculiarities of each of them. And the first ones to notice that were sailors who worked in navigation. Farmers, manufacturers and traders who developed coastal areas also made notes on the natural landscape and climatic conditions. Later, these precious materials were used by coastal researchers.

The planning of economic activity on the coast should comply with requirements of environmental safety, rational use of natural resources, and economic feasibility. Meeting these requirements is especially important in areas with unique coast estuaries and lagoons of various types.

Among the water reservoirs of different genesis deeply protruding into the land, lagoons are of great interest, occupying one tenth of the coasts of the world and having considerable practical interest for many economic activities.

The physical and geographic features of lagoons – their relative shallowness, protection from storm surge of the open sea, large daily and seasonal variability of hydrodynamic and hydrochemical parameters, high biological productivity and circulation of nutrients, as well as rapid removal of metabolic products due to the influence of the tides – allow us to consider

them as unique natural entities. Estuaries and marine lagoons are very common types along Russian sea coasts.

This book was created to summarize the knowledge and experience of economic activity along the Russian sea coasts accumulated to date. Description of estuaries of particular seas is divided by chapters. In Chap. 1, following the present preface, the main definitions of Russian sea lagoons and their classification and evolution in time are described.

Subsequent chapters examine individual regions.

Chapter 2 describes the most neglected lagoons of the Russian coast, those of the Arctic Seas.

Chapter 3 is devoted to lagoons and estuaries, which are widespread along the coasts of the Far Eastern Seas.

Chapter 4 represents two significant lagoon localities for the Russian sector of the Black Sea: the Kuban limans and the Imeretinskaya lowland

Chapter 5 is devoted to the lagoons of the eastern coast of the Sea of Azov.

The next two chapters describe lagoons of two Russian sectors of the Baltic Sea: the Curonian and Vistula Lagoons (Chap. 6) and a technogenic lagoon on the eastern gulf of Finland (Chap. 7).

Chapter 8 describes the structural organization of the White Sea as an estuarine system and the characteristics of the main factors forming the sea regime.

Finally, Chap. 9 synthesizes the primary information on the diversity of Russian sea estuaries

This book represents the first time a comprehensive description of the estuarine seas of Russia has been carried out and it required the use of data from different fields of earth sciences, economic sciences, and management areas. That is why a wide range of specialists (ecologists, oceanographers, geomorphologists, biologists) was engaged in the preparation of the book. We used materials derived mainly from specialists of the P.P. Shirshov Institute of Oceanology, RAS, and its branches located close to the various seas of Russia. Specialists from the Far Eastern Federal University and the A.P. Karpinsky Russian Geological Research Institute were also involved. Successful problem-solving was promoted by a comprehensive study of the natural and anthropogenic factors that determine the development of sea coasts, in all the complexity of their relationships, identification of common patterns, regional characteristics, and the analysis of the positive (negative) experience. The developed recommendations, constructed from data of natural observations and the analysis of published sources, will facilitate a more effective assessment of the impact of planned economic activity on these unique coasts and more rational environmental management of these peculiar geographical and ecological objects.

The monograph will be useful and interesting to a wide range of experts and professional scientists: to oceanologists, geologists, hydrotechnicians, researchers, environmental managers, and all of whom are engaged in questions of environmental protection and the developmental planning of coastal regions.

The book will also be useful to students, graduate students and teachers specializing in the natural sciences at institutions of higher education.

In the final words of the preface, I want greatly to thank Mrs. Svetlana Chayka and Mrs. Tatiana Podymova for their technical assistance in the creation of this book. I also want to give my special grand thanks to Dr. Jean-Paul Ducrotoy. It was on his recommendation that many authors agreed to participate in this monograph. His very valuable advice and assistance helped us very much in the completion of the book.

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