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Urbanization and the ocean

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The sea and the oceans have long fascinated mankind, and this has been leading to the concentration of human populations on the shores. In many countries around the world, coastlines are now subject to urbanization and urban dynamics. In the context of climate change, cities that are set up by the ocean raise a number of questions. How can they be protected against the onslaught of the sea? Should their expansion be slowed down? Can they be designed in harmony with the ocean?

Coastal urbanization, a marker of the ocean’s attraction

Human societies have historically been attracted to the coast. However, urban settlements long remained occasional one-off events around port sites, to exploit resources from the sea, organize trade flows and ensure control of maritime areas (Fig. 1). Since World War II, massive urbanization of the coasts occurred due to economic development, the maritimization of trading, and subsequently the growth of tourism and the leisure industry. Nowadays, alongside industry- and port-based urbanization, residential and tourism-based urbanization (hotel complexes, seaside resorts, marinas, condominiums) dominates the landscape, often in a very wide variety of forms (Fig. 2). In some developing countries, this is intensified by often poorly controlled urbanization, giving rise to informal urban extensions (slums or spontaneous residential developments) housing people in search of employment and a better future.

Assessing human population density on the shores of seas and oceans is not easy. Based on various methods, assessments produce figures that are not always convincing, as the geographical delimitation of coastal areas can vary. According to the most recent estimates (Institute of Geography, Kiel, 2015), based on figures for the year 2000, nearly 11% of the world's population (625 million inhabitants) live in coastal areas at an altitude lower than 10 m. The population is highly concentrated, reaching densities of around 241 inhabitants/km², more than 5 times higher than the world average. Projections show a tendency towards increased density, with the littoral population potentially reaching 900 million inhabitants in 2030, and 1.4 billion in 2060, corresponding to 534 inhabitants/km², more than double today's figure.

Urbanization and disruption of coastal dynamics

But the attractiveness of the sea and the coast generates problematic situations. Cities, areas of economic activity and transport infrastructure are extended to the detriment of natural and agricultural areas, which often disappear at a worrying rate. For example, several cities have been built on former, rehabilitated marshlands (Boston, Amsterdam, Venice, Tokyo) and many seaside resorts have been built on dunes or lagoons. The regression of these therefore rare coastal environments has important repercussions on marine ecosystems. Locally, traditional economic systems based on coastal resources are threatened, as coastal geomorphological dynamics are disrupted.
Today, many cities built on soft substrate on the coast or dunes are exposed to serious problems of erosion. Seaside resorts are seeing their beaches disappear (Côte d'Azur, Balearic Islands, Australian Gold Coast) and are striving to restore them at a high price. Elsewhere, under the weight of urban construction, the natural subsidence of many deltas, and the cities established there (Bangkok, Venice, New Orleans), is accentuated by the over-consumption of water and the scarcity of sedimentary deposits. To an ever increasing extent, by spreading and developing, cities are disrupting natural dynamics and are faced with an ocean whose level is rising and whose assaults will multiply.

**Tomorrow's coastal urbanization?**

At global level, the growing trend towards urbanization of coastal areas - exemplified by Dubai and Monaco - and the impossibility, or at least the great difficulty (technical, economic and social), of dismantling cities on the coasts make urbanization likely to remain a long-term coastal feature and issue. This suggests the need to consider how best to maintain existing settlements and to design any future ones. Urbanization no longer simply faces the ocean: it has to deal with the ocean.

Already, innovations in city design are in progress and examples for tomorrow are being developed. For example, in Jakarta, to combat the risk of marine submersion, protective structures incorporating new urban spaces are projected in such a way that limit their environmental impact. In order to reduce their carbon footprint, Copenhagen, Honolulu and Marseille are taking advantage of the sea as an energy reservoir by constructing seawater loops that supply certain districts with heat and air conditioning networks. Floating cities are being designed and old submarine habitat projects are resurfacing. These initiatives reflect the great capacity of human societies to innovate, so as to overcome adversity and adapt to new environmental challenges. But they also raise questions about the sustainability of such developments, especially since plans for the coastal city of tomorrow cannot simply be based on engineering. More than ever, scientific communities need to work together with citizens to design it. A challenge that is both immense and stimulating for research.

**References**


Fig. 2 - Residential urbanization affecting the shore and hills, Bodrum Peninsula (Turkey). © S. ROBERT