Human activities and sustainability of the sea

Fatiha Maaroufi1, Mohamed El Malki2, Mourad Arabi3, and Latifa Mechkirrou4

1LPTPME, Department of Physics, Faculty of Sciences, Mohammed First University, Oujda 60000, Morocco
2LaMOn2E, Department of Physics, Faculty of Sciences, Mohammed First University, Oujda 60000, Morocco
3Laboratory for Improvement of Agricultural Production, Biotechnology and Environment (LAPABE), Faculty of Sciences, Mohamed First University, BP717, 60000, Oujda, Morocco
4Laboratory of Natural Resources and Sustainable Development (LNRS), Department of Biology, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco

Abstract. The marine system is undergoing profound changes, following global change, rising sea levels as a consequence of rising temperature, significant biogeochemical transformations having multiple impacts in terms of environmental biodiversity and resources. The phenomenon of coastalization represents a fundamental factor of evolution. The coastal population represents more than 60% of the world's population and continues to grow rapidly through immigration; the population rate expected in 2020 will be 75%. Coastal urbanization is increasing with the creation of coastal mega-cities. This has the consequences of increasing pressure on the coastal terrain and pressure on marine resources. This paper is a short review that reported the danger which face the coastal heritage with a case study on Morocco.

1 Introduction

1.1 Coastal heritage

The coastal heritage, comprising invaluable natural resources and vital economic sectors, faces unprecedented challenges from human activities and natural phenomena. Urgent conservation efforts are needed to protect irreplaceable elements such as rare species and manage resources sustainably [1]. However, various human activities, including shipping, fishing, and tourism, pose significant threats to coastal sustainability [1].

Technological solutions have been proposed to mitigate these impacts, particularly in regions like southern Italy's Apulian region [2]. Initiatives such as the Coastal Heritage Project aim to empower communities to manage coastal transformation [3].

Conflicts persist between tourism development and conservation goals, requiring innovative management strategies [4]. Effective governance structures and equitable access to heritage sites are essential for sustainable management [4]. Achieving consensus on preservation policies and institutional coordination is critical for the long-term sustainability of coastal natural heritage [5]. The cultural maritime heritage plays a vital role in sustainable coastal development but faces challenges in recognition and preservation [6].

This paper aims to explore the interactions between human activities and coastal heritage sustainability, contributing to the discourse on conservation and development in coastal areas.

1.2 Environmental impacts

The different activities that take place in the coastal area interact more or less strongly with the environment. They can therefore have significant impacts on the functioning and quality of the coastal system by:

- Exploiting its biological and mineral resources, which disrupts the natural equilibrium of coastal ecosystems, affecting biodiversity and ecosystem stability.
- Causing accidental or chronic pollution linked to increasing maritime traffic, contributing to both accidental and chronic pollution, posing significant threats to marine life and coastal habitats.
- Installing sometimes heavy infrastructure there, altering coastal landscapes and habitats, leading to habitat loss and fragmentation.
- Leading to overcrowding of certain sites, which intensifies environmental stress, resulting in degradation of coastal ecosystems and reduced resilience to environmental changes.
- Chronic pollution from human activities further deteriorates water quality, impacting marine ecosystems and posing risks to human health.

The conservation and sustainable management of coastal heritage is a pressing issue, as highlighted by various studies. Michel [7] emphasizes the need for a multidisciplinary approach to address the environmental challenges faced by coastal heritage. Augier underscores the potential of ecotourism in the Caribbean to promote sustainable development [8], while Dauvin et al. [5] and

* Corresponding author: f.maaroufi@ump.ac.ma / m.elmalki@ump.ac.ma

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Deboudt [9] both stress the importance of preserving natural coastal heritage and integrating tourism with conservation efforts. These studies collectively underscore the urgency of conservation and sustainable management of coastal heritage.

2 Case of Morocco

Located in the northwest of the African continent, Morocco has a Mediterranean facade almost 550 km long and an Atlantic facade which stretches for almost 3000 km, from Cape Spartel to Cap Blanc, between 36° and 21° northern parallels [10]. One of the richest countries in biodiversity in the Mediterranean area. Along the 3.500 km of coastline, Morocco's marine ecosystems are:

- Relatively extensive cliffs on the Mediterranean coast;
- Sandy and stony beaches;
- Coastal dunes;
- Swamp;
- Lagoons and estuaries widely represented on the Atlantic coast are, certainly, among the most diverse and richest in the Mediterranean.

This richness, associated with the strategic space represented by the coastal and coastal zone, have made the latter a major area for the development of the country in terms of urbanization, industrial zones, tourist facilities, etc.

2.1 Characteristics of the Moroccan coast

The Moroccan coastal area, consisting of marine environments, lagoons, estuaries, and adjacent beach-adjacent environments, has been identified as one of the most vulnerable areas due to excessive human activities and particularly economic activities. Urbanization in the coastal areas within the past century almost doubled percentage wise to roughly 60 % in 2010, with the extreme differences in proportional terms between the Atlantic and the Mediterranean regions (National report from the institution in charge of sustainable development, 2018). Such significant scale of urbanization has overconnected maritime ecosystems which has intensified the existing environmental vulnerabilities to the full extent of the matter undermining the overall health of marine environment. Besides, the Moroccan coast still has a huge issue of pollution, usually due to the quenching water of the urban cities that end up littering the Mediterranean area [11].

As these are just a few of the environmental burdens that are intensified by issues such a coastal erosion, climate change impacts, and pollution. Many coastal areas, which are often popular among beach tourists, are have been severely affected by beach erosion, which is worsening with the rise of sea levels [12]. The coastal areas of Mediterranean, consisting of low-lying land topography as a result, are very much affected by the negative impacts of climate change such as soil erosion, flooding and salinization of ground water by [13]. Sustainable management of costal ecosystems, such as lagoons, becomes a necessity in order to maintain the crucial ecosystem services they provide and keep their habitats safe from the negative consequences of global warming [14]. These environmental challenges require the implementation of policies that take into account the integration of sustainable development and the management of the health of the environment by prioritizing the conservation of coastal ecosystems while at the same time addressing the socio-economic needs of coastal communities. The holistic approach to coastal management offers a plausible solution for environmental problems such as the devastating consequences of the anthropogenic activities and assures the wise use of the coastal areas by posterity.

2.2 Chronology of the evolution of human activities in Morocco

2.2.1 Coastal Communities: Historical Dynamics

The relationship between human communities and a coastal environment in the historical Coastal regions of the world has been dynamic ever changing being susceptible to the inimical weather, sea level rise and increasing human interference. At the same far back year of 13th century, rising international trade and exchange along with European routes was the initial step of development that brought city life and the growing economy into coastal region [15]. These times saw the rise of port cities dense with business activity and that significantly contributed to the long-distance trade networks which clearly demonstrate the central role played by coastline regions in long-range business. Furthermore, European powers strived to extend their legal spheres of influence and the shore territories became disputed areas which led them to the preparation of strategic fortifications along the coastlines [15]. The Mediterranean boundary was a distinct place not only for acquiring new region but also for geopolitical rivalries, which resulted in the pattern of social-economic architecture of coastal communities.

2.2.2 The Moroccan Experience

The bond between Moroccan men and the coast or sea is changeable on different stages of the circular history whose key point is the reason for the determination of social and economic life. Such a change implies that sometimes it would feature the changing of outlooks and in other cases it would exhibit deliberate distortions of reality. To mention all the remins of this era, it will unquestionable leave positive collective and individual footprint to these new coastlines, Tangier and Sebtushi [15]. This strong interchange in fact had an edge because it could take place through these big cities which were the primary markets for the trade in exchange between Northern Africa and the Mediterranean, so making sure the sustainability of trade as the main driver for both economic and cultural growth.
Piracy was blossoming at the European continent from the mid of the 16th century as well, making the sea become the object of conflicts between the nations with each of them claiming the captured or captured fleets as a part of their struggle for power. The Spanish and Portuguese ports meant for the Portuguese and the Spaniards one of the means for achieving independence, as they needed to constantly feel safe from the attacks of the invaders. It was this feeling that determined these conquerors to set their defensive fortifications and military camps specifically on the shores [15].

Besides social and economic changes those regions which were impacted by the county along XXth century II faced at least revamp and social and economic changes. The coastline of modern-day communities is re-appraised by the process of guardianship which is features of the industrial infrastructure construction after what the most significant settlement and production's areas became the new urban centers and industrial giants [16]. As for tourism, it has most sought out coastal locations. The majority of investments are directed towards the coastal zone and this trend is reinforced by current tourist equipment projects for international and national tourism. Moreover, evolution of the population growth rate: between 1930 and 2000 this rate is 5% in the Atlantic and in the Mediterranean, it is around 3% between 1960 and 1990.

The developments of the last 30 years of overlooking the major coastal towns coastlines were of great iconic value as is true of occasions across urbanization and industrialization. Likewise, this aspect is highly determinant. Because of this phenomenon, the real estate field on tourist coastlines expanded, with investors coming from outside the country for their projects along the coastline, contributing to recreational activity [17].

To sum up, the coastal development in Morocco exemplifies the spread of global tendencies: environmental impacts from urbanization, industrialization, tourism, and any other human activity that may be caused by resource extraction can be difficult to so see. These problems and the underlying factors that result in these issues could be challenging to identify.

3 Overconcentration of economic activities

The coastline concentrates the majority of industrial and economic activities of great importance. This is the case of the most powerful industrial complexes: refining and petrochemicals in Mohammedia, phosphate industries in Safi and Jorf Lasfar. We once again observe the preponderance of the Kenitra-Safi axis with 60% of industrial units and 80% of national industrial jobs, main activities: textile, chemistry, mechanical and electrical industry. On the Mediterranean, Tangier and Nador represent the two industrial centers, with steel, textiles and clothing. Demographic, tourist (50% of reception capacity) and commercial (92% of foreign trade) concentration.

Fig. 2. Industrial concentration process in northern Morocco [10]

4 Urbanization and tourism development

These are either towns which develop a seafront, or urbanization linked to seaside leisure activities is often carried out in a non-regulatory manner. Planned tourist urbanization is booming, on the Tetouan coast, Tangier, Saidia-El Houceima region, in the Rabat-Casablanca region or around El Jadida or Agadir. Urbanization is progressing at the expense of virgin spaces and leaving only rare temporary windows (Figure 3).

The privatization of this coastal area is tending to become real, even if it is often denounced.

- **Martil**: experienced the development of popular national tourism and which recorded a strong urban expansion. The city's population is multiplied by more than 6 in summer, by tourists residing in campsites, in the city's few hotels, but above all and increasingly in second homes, used by rental.
- **Saida**: social housing and also high-end urbanization to meet the needs of the wealthy classes (villas, class hotels, seaside resort, etc.)
- **Rabat-Casa**: The beaches and their immediate surroundings are heavily occupied and increasingly permanently built up. The area closest to the sea, between the road and the shore, is the most heavily used.

Fig. 1. Evolution of Moroccan cities with more than 50,000 inhabitants from 1900 to 2004 [10].
4.1.1 Marinas are booming.

Morocco is a meeting point for Mediterranean yachting and tall ships making great voyages from Europe. 35 sites are under construction in the more or less long term (8 in the Mediterranean and the rest in the Atlantic). These ports can contribute to the imbalance of coastal sediment transits and can cause accentuated erosion or cases of silting. The accompanying urbanization also creates pollution problems. The coastline has attracted the majority of investments made over the past thirty years and today it concentrates 70% of the capacity in classified beds, 67% of hotel nights and more than 60% of tourist stays. Four major tourist centers stand out: Agadir and its region, the El Jadida-Casablanca-Mohammedia center, the Rabat-Témara-Skhira-Bouznika center and the Tangier-Tetouan center. The Tangier and Agadir sectors alone represent 70% of nights in classified establishments and 70% of approved hotel capacity.

Fig. 3. Hotel capacity of the main tourist cities [10].

5 Different Impacts

In this part we will discuss the consequences on the coastal area of (i) demography and coastline, (ii) coastal urbanization, (iii) industrial activity, (iv) overfishing and aquaculture, (v) the port establishment (for commerce and pleasure), (vi) frequentation of beaches, coastal leisure activities and seaside tourism, (vii) maritime transport facing the Moroccan coast.

5.1 Chemical pollution and erosion phenomena

The marine environment directly receives 98% of industrial and agricultural liquid discharges and 52% of urban domestic discharges emanating from coastal towns. The Kenitra-Safi axis would concentrate more than 60% of urban discharges and more than 80% of industrial discharges in Morocco. The sea receives oils and hydrocarbons from shipping vessels, particularly oil tankers. Maritime areas with closed or calm traffic experience problems with eutrophication and colored water. This indicates strong nitrogen and phosphate pollution and explains the oxygen deficit in marine waters. The dosage of heavy metals and pesticides indicates high levels in coastal sediments in most stations.

5.2 Erosive phenomena

The physical stability of the coast tends either to erosion or siltation. Many beaches are becoming depleted of sand (Tangier, Moulay Bousselham, Kariat Arekmane). Out of 47 beaches examined by the facilities services, 7 have completely disappeared due to erosion, 19 are undergoing intense degradation. The border dune has become a preferred location for setting up second homes, which reduces the possibilities of sediment exchange between the sea and the continent. Other dunes have been destroyed by intense trampling and overcrowding.

6 Case of the Nador lagoon
The Nador lagoon, which extends over a length of 25 km and a width of around 7.5 km, presents a site of biological and ecological interest due to its richness, its biodiversity and its economic interest. The lagoon is subject to liquid and solid discharges, of various origins:

1) Domestic pollution, linked to wastewater from neighborhoods without collective sanitation and discharges from the treatment plant and its drying sludge, stored at the edge of the lagoon and which constitute nitrogen and phosphate pollution favorable to the eutrophication of the environment. The wadis drain pollution from further afield.
2) Fish farming practiced by the Moroccan Society of Oyster Farming and Fish Farming.
3) Discharges of hydrocarbons used in fishing boat engines, and those of waste oil and washing water from service stations.
4) Solid pollution from uncontrolled landfills. Industrial waste, mining residues and household waste from greater Nador.

7 Tools for sustainable development of Moroccan coastal areas

7.1 International “Recommendations” for Integrated Coastal Zone Management (ICZM)

Does this law aim to achieve the following objectives:

- The preservation of biological and ecological balances, natural and cultural heritage, historical and archaeological sites, natural landscapes and the fight against coastal erosion;
- The prevention, fight and reduction of pollution and coastal degradation and the rehabilitation of polluted or deteriorated areas and sites;
- Planning, notably through a national coastal plan and regional coastal plans that are compatible and in perfect harmony with land use planning documents;
- The involvement of associations, the private sector and the local authorities concerned in making decisions relating to coastal management;
- The guarantee of free and open access to the sea shore;
- Promoting a research and innovation policy with a view to promoting the coastline and its resources.

The law gives a legal definition of the coastline which includes both a maritime part and a land part. It recommends an integrated management approach for this environment based on scientific data and which takes into consideration the impact of climate change on the coastline. In addition, and in order to achieve the objectives of protection, development and conservation of the coastline to guarantee the balance and sustainability of its multiple functions, the law establishes a national commission and regional commissions having a unifying character. and mobilizer bringing together all national and regional components. With regard to protection and conservation measures, the law establishes the principle of prohibition of harm to the natural state of the sea shore. Furthermore, the law establishes a non-building zone, adjacent to the coast of a width of 100m, calculated from the land limit of this coastline, as well as a transport infrastructure withdrawal zone with a width of 2000 m. In terms of combating pollution, the law on the coast prohibits any discharge causing pollution of the coast and requires authorization for the discharge of liquid discharges which do not exceed the limit values upon payment of a fee. Likewise, the law guarantees the right of public access to the sea shore and the right of passage along this shore.

8 Conclusion

In conclusion, the coastal heritage is facing challenges as a result of activities and natural processes. It is crucial to take action to put in place conservation and sustainable management plans. Collaboration, among groups involved, incorporating policies and engaging in long range planning are essential for dealing with the issues affecting coastal regions. To make this happen establishing a strategy, with an outlook that goes beyond individual sector interests is necessary. This strategy should encourage participation by bringing various stakeholders to work together cohesively. Additionally, an integrated approach is required to harmonize policies, actions and resource management. Ultimately this strategy should focus on the wellbeing of ecosystems and take into account the needs of upcoming generations.

References


