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## **Environmental Diagnosis of Coastal Wetlands and Analysis of Anthropogenic Activities: Case of the West Coast of Algeria**

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### **Abstract**

The Mediterranean basin is rich in wetlands of great ecological, social and economic value. Yet these important natural assets have been considerably degraded or destroyed, mainly during the 20<sup>th</sup> century. The wetlands of western Algeria are characterized by massive urbanization. This anarchic urbanization leads to over exploitation of the natural environment. The installation of numerous residential, industrial and tourist complex sites is a complication that suffocates many recreational sites and degrades the coastal environment. This situation has created a spatial disruption of the entire ecosystem, causing physical and biological disturbances. It is in this context that our diagnosis is inscribed to better understand the stakes of human activities and the urban dynamics of the Algerian west coast. The diagnosis made it possible to highlight an intense anthropogenic activities, and an important industrial activities generating numerous damages to the coastal environment.

**Keywords:** wetlands; environmental diagnosis; coastal ecosystem; anthropogenic activities; Algeria.

### **1. Introduction**

Coastal wetlands are transition environments that are at the point of contact between the human and economic issues of water management and the biological issues of ecological continuity.

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The contamination of the coastal and marine ecosystem became one of the major problems posed by the environment. Demography, the technological development and all anthropic factors constitutes a danger to the public health [1]. Population concentration in the coastal municipalities of western Algeria has expanded significantly in the last decade. Each municipality pours a large quantity of wastewater at sea each day, which is channeled through collective sanitation flowing directly to the sea without any purification [2]. Indeed, a worrying volume of wastewater flows annually on the Algerian west coast. This clarifies the importance, seriousness and severity of this problem for the entire marine ecosystem and fish stocks. The coastal regressive dynamics during the last 30 years clearly show the harmful impact of tourism on the coast: destruction of a large number of natural landscapes, concreteisation of the coasts, increase of the waste and pollution of the bathing waters and tarring of the wild sites [3].

## 2. Study area

The west coast of Algeria is the site of a very high industrial concentration especially towards the East (Figure 1). The large industrial area of Arzew is the seat of incessant pollution. The existence of the Arzew refinery multiplies the concentration of large numbers of industrial vessels (oil tankers, méthaniers) [4], in addition to the various petrochemical activities (storage, refining and treatment), and the decline of the coastline which is accompanied by large reconfigurations of natural landscapes [5]. Small-scale industrial facilities along the shoreline are also reported without any impact studies, such as seawater desalination plants [6].

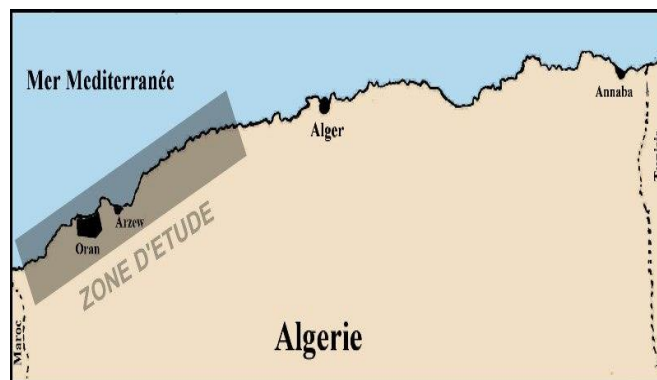


Figure 1: Location of the study area

The gulf of Oran is supplied by waters originated from the Atlantic Ocean. The circulation seems to be very turbulent along the African continent. These turbulences favour the dispersion of eventual pollution sources and permit a so relative important alimentary chain development [7].

## 3. Methods

Regular monitoring and *in situ* surveys are carried out to inventory the main human activities, in order to assess their impacts on the coastal environment. A consultation of the works carried out made it possible to orient our researches.

#### 4. Results and discussion

During the last decades, there has been an uncontrolled urban settlement that has caused very serious and severe depletion, degradation and pollution of the marine environment. Indeed, these irrational settlements have caused a destabilization of reliefs (Canastel) and an imbalance of the coastal system (Cap Falcon). This situation has created a spatial rupture of the entire ecosystem (the case of separation, by a road from the Oued Macta). This situation has created a spatial rupture of the entire ecosystem (the case of separation, by a road from the Macta wetlands). The excessive phenomenon of agglomeration of populations supported by a strong urbanization are the heavy tendencies generating the deep imbalances of the littoral zone. Thus, the urban network of the coastal zone is composed of about twenty urban agglomerations and the coastal zone is characterized by its high urbanization rate of 63% (58.30% national average). Nearly 90% of the population of the wilaya of Oran is urban, about 45% of the urban population and almost 1/3 of the total population of the coastline [1]. The discharges of different actions and anthropogenic developments in coastal areas are clearly expressed in the Oran coastal strip by numerous deposits on the coast, to which are added the various pollutants conveyed by surface or underground watercourses as well as runoff from rainwater or irrigation. Liquid household waste has the highest proportion on the Oran strip. Others are channeled through domestic sewers, and accumulate as organic matter causing bacteriological pollution. It should be noted that this form of pollution is increasingly accentuated by the total absence of sewage treatment plants in coastal towns. Liquid household waste has the highest proportion on the Oran strip. Others are channeled through domestic sewers, and accumulate as organic matter causing bacteriological pollution. It should be noted that this form of pollution is increasingly accentuated by the total absence of sewage treatment plants in coastal towns. The dumping of waste has caused on the Oran coastline serious problems for the use of this environment either for fishing, swimming or boating [2]. Various observations made, confirmed by numerous previous studies, on urban waste sites show the existence of very harmful effects on the entire ecosystem [3]:

- Contamination of the sediments and consequently of the substrate.

- Degradation of bathing waters and seafood products.

- An imbalance of natural stands such as *Posidonia oceanica*.

More particularly, at the level of sediments, the pollution is intense, because near any village, beach or agglomeration, there is a direct and significant diversion of sewage into the sea. In general, the urban discharges observed on the Oran coast can be ordered as follows:

- Discharges upset the physical quality and appear in suspension breaking the transparency of the water (light, photosynthetic processes) and modifying following their sedimentation the substrate.

- Chemical releases (dissolved organic matter).

- Petrochemical hydrocarbon discharges (industrial zone of Arzew), and dissolved mineral and metal wastes, are thrown away to a large extent in the effluents of various industries. The pollution caused by these is considerable (acids, bases, metals). It should be noted that in order to manage these industrial spills the

legislation remains an archive. Leaching of coastal soils destabilized by deforestation and fires that contaminate the marine environment (Kristel, Maddagh) has been reported. The impact of development on the coastal and marine environment is localized mainly in the coastal metropolitan areas characterized by high urbanization and concentration of activities [8]. Because of its great landscape diversity and richness, the Oran, and Algerian littoral in general, presents itself as a gigantic natural reserve with a large and important heritage and potential to safeguard [9]. Sustainable development requires a protective management of a given wealth (landscape heritage, natural heritage, built heritage), so as to allow its renewal and pass it on to future generations. This development requires the intervention of specialists and experts both in the monitoring and in the realization of the study. In this respect, the collaboration of decision-makers with scientists is of great interest in sustainable development. The whole of the Oran coastline has experienced during the last thirty years a great development of spaces and species. Indeed, the extension of towns and coastal villages is mainly along the coast (Ain El Turk, Oran, Arzew, Mostaganem ...). The developments (tourist, industrial or residential) oppose the protection of the good quality of the environment and has largely contributed to its degradation and pollution of the marine system. Many desalination complexes (6 in total) are located on the coast causing a release of brine and chemical elements (Figure2) [6]. A large petrochemical complex in Arzew and near a large LNG port. There are 3 major ports (Oran, Mostaganemet, Beni saf and Ghazaouet), two small fishing ports (Bouzedjar and Kristel) and a great naval base at Mers El Kebir (Figure3).



Figure 2: Main seawater desalination stations

There are also several beaches, very popular during the summer season. This important human activity generates serious disturbances of the coastal ecosystem. An environmental monitoring program must be rigorously put in place to preserve these vulnerable coastal areas, and our investigations confirm Djad's work carried out between 2010 and 2015 [1]. Liquid household waste has the highest proportion on the coastal strip. Others are channeled

through domestic sewers, and accumulate as organic matter causing bacteriological pollution. It should be noted that this form of pollution is increasingly accentuated by the total absence of sewage treatment plants in coastal towns. The dumping of waste has led to serious problems on the coast for the use of this environment for fishing, swimming or boating. Various observations made, confirmed by many previous studies, on urban waste sites show the existence of very harmful effects on the whole ecosystem [1,2,3,10,11].



A



B



C



D



E



F

**Figure 3:** Main ports on the west coast (A: Mers El Kébir, B: Ghazaouet, C: Oran, D: Béni Saf, E: Arzew, F: Mostaganem)

## 5. Conclusion

In a socio-economic context, development standards are totally uncertain and hypothetical (Arzew, Mers El Hadjadj, Cap Falcon ...), which is characterized by the same industrialization and urbanization, required by developers, and whose balance sheet ecological and global environmental remains to be done. Such a situation is not unusual because we only think of immediate profitability, when we have to think of the consequences of this development which is exhausting and destroying all the renewable resources, especially coastal and marine. Let us note the disappearance of gigantic forest areas along the coast (Kristol, Maddagh), the destabilization of the coastal and coastal reliefs (Mers El Hadjadj, Ain El Turk) and the various pollutions that undergo the marine ecosystem. This means a total absence of an environmental economy.

The consequences of this urban development, with the resulting needs for soils, water and other recreational areas, are the most constraining factor currently affecting the landscape, by the weakening, degradation, exhaustion or pollution of these environments. The coastline and the marine and coastal areas in Algeria remain exposed to multiple forms of pressure, in particular the problems linked to the littoralization of development, the effects of marine pollution due to the development of industries, cities and infrastructures in coastal zone . This situation is exacerbated by non-compliance with regulations in various coastal areas and areas [11].

Wetlands around the world play an important role in disaster risk reduction if they are effectively managed and restored. Natural defenses against disasters, they protect the most threatened and vulnerable communities from the devastating effects of extreme weather events. The essential issues of coastal wetlands are related to the ecosystem, ecological continuity and the adaptation of water management to uses [12]. The development of a national ICZM strategy must mark a new coastal and maritime governance in Algeria [11].

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