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Biodiversity of Echinological Fauna of Hard Substrates of the Algerian West Coast

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Abstract

Echinoderms, exclusively marine animals, present a great diversity and are an important and very ancient phylum. Whether they are predators, vegetarian or scavengers, echinoderms frequently dominate the ecosystems in which they are subservient. Benthic macrofauna and particularly echinoderms acting directly on the functioning of marine ecosystems, represents the fundamental link in the food chain and an essential source of food for many consumers. There has been very little work on the echinoderms found in the western Algerian coast. The objective of this work is to conduct an inventory on the echinological fauna in the intertidal zone, including the description of the morphological and ethoecological characteristics of the echinoderms in their ecosystem. To this end ten stations were surveyed. For each station, a random sampling was performed on hard substrates found in the coast of Oran. The identification of species and faunal analysis permitted to identify six species belonging to this phylum with a presence of 55.17% of Echinoids (Echinoids), 34.8% of sea cucumber (holothurian) and 10.34% of starfish (Asteroidean).

***Keywords**:* echinoderms; benthic macrofauna; Macro-invertebrates; marine ecosystems; Coast of Oran; West of Algeria.

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1. Introduction

The rich variety of aquatic life in the water and in the coastal zone of the Mediterranean Sea, especially the Algerian coast, is facing a bleak future due to the increasing exploitation, by man, of its natural resources; the highest pressure linked to human activity is now widely concentrated along the coast. The sea and the coast are among the most threatened in the Mediterranean region. Our knowledge of biodiversity is still very poor. According to [1], we now know only the tenth of all species on the planet.

The benthic macro fauna and especially the echinoderms are invertebrates represented by 6000 marine species that are all different from one another. They are found throughout the world and at any depth. Despite this, we have very little information on this clade in the Mediterranean Sea, and especially on the Algerian west coast.

2. Study area

Like all the grounds emerged around the Mediterranean, the septentrional end of the African continent is prolonged at sea by a not very wide underwater edge, more or less continues [2].

Our study area focusses on the Bays of Beni Saf and Oran which are located on the west of the Algerian coast with a spain of approximately 180 km. The coast of Oran is a set of landforms that have shapes which depend, directly or indirectly, on the effect of the sea. It includes the coastline that comprises in part beaches and cliffs, which differ from one zone to another. It is also characterized by a small plateau, with large open beaches, much of which is formed by a rocky terrain [2].

The study area is bathed by Atlantic water. Circulation appears very turbulent along the North-African continent. These turbulences would support the dispersion of possible sources of pollution and allow a relatively significant development of all the food chain [3].

3. Materials and Methods

3.1 Samplings and data collection

Observations of the organisms (species) were carried with the naked eye by walking on the foreshore area of the sampling sites. The campaign survey was conducted during the period from the month of April to the month of October of 2012. Fig. 1 shows the location of 10 sampling stations whose natural substrate is hard (rocky areas) or artificial (dike) from the Bay of Oran to the Bay of Beni Saf. The station farthest East is that of Ain El Turk (station 10) and the farthest West is that of Rechgoun (station 01).

The collection of the samples was made by hand directly or using a stainless steel knife depending on the size of the organisms, at a distance between 0 and 10m from the coast, and between 20cm and 1m depth in the supralittoral zone and intertidal zone. The collected samples were placed in glass jars, fixed with 5% diluted formalin and transported to the laboratory for later identification.

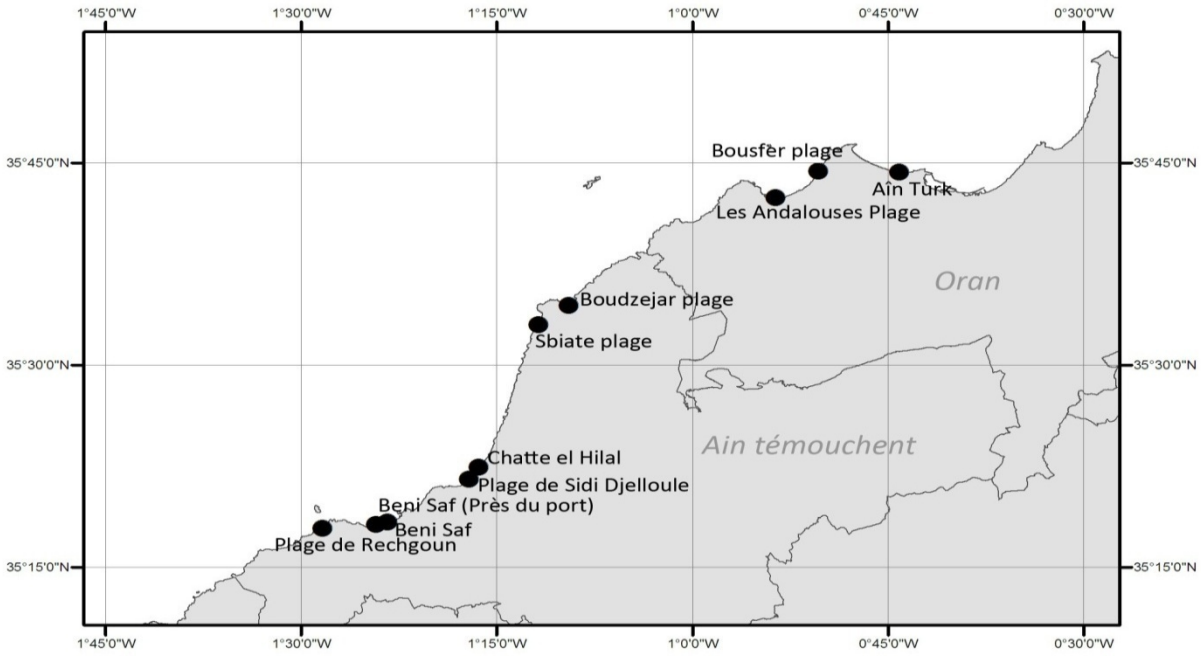

Fig. 1: Location of study sites.

Table 1: Presence of echinoderms in the 10 stations.

Stations	*Paracentrotus lividus*	*Arbacia lixula*	*Holothuria tubulosa*	*Holothuria forskali*	*Coscinasterias tenuispina*	*Echinaster Sepositus*
1	+	+	+	+	-	-
2	+	-	+	-	-	-
3	+	+	+	+	-	+
4	+	+	+	+	-	-
5	+	+	-	-	+	-
6	+	-	-	-	-	-
7	+	+	+	+	-	+
8	+	+	-	-	-	-
9	+	-	-	-	-	-
10	+	-	-	-	-	-

3.2 Analysis of samples

The first sorting in the laboratory is done with the naked eye and allowed a separation of species according to their affiliations to the following classes: Echinoids, Starfish, Sea Cucumbers.

The determination of harvested species is made by observation with the naked eye of the form or shape and after incision. The systematic routine was performed based on the work of [4, 5, 6, 7] and the key of determination of the FAO in1987.

4. Results and Discussions

During our sampling campaign of the ten stations surveyed, we identified 6 species belonging to three classes: Echinoids, Starfish, Sea Cucumbers (see Table 1).

Our results show the dominance of Echinoids with 55.17%, followed by Sea Cucumbers with a percentage of 34.8%, and the Starfish with the lowest percentage of 10.34% (see Fig. 2).

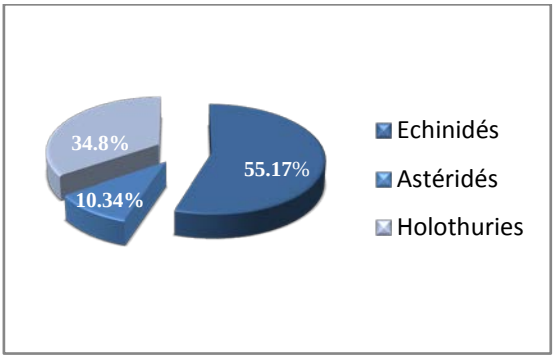

Fig. 2: Species richness of the phylum studied.

By analyzing the structure of echinoids, Paracentrotus lividus (Lamarck 1816) ranks first with a presence in all stations, dominance of 100%, followed by Arbacia lixula (Linnaeus, 1758) with an abundance of less importance of 60 % (present in 6 stations out of 10). These two species live sometime in groups and are often associated with other echinoids and Sea Cucumbers such as Holothuria tubulosa (Gmelin, 1788) and Holothuria polii (Delle Chiaje, 1823), present in the Mediterranean Sea but have not been found in our samples.

Concerning the sea cucumbers, Holothuria tubulosa (Gmelin, 1788) is present in 60% of the surveyed stations, followed by Holothuria forskali (Delle Chiaje, 1823) with a rate of 40% presence. These two species are well known in the Mediterranean area for their low presence. They are much more rare in zones frequented by humans. Sea cucumbers, an important component of the large benthic compartment of the seagrass Posidonia oceanic [8,9], actively participate in the recycling of organic material [10]. They are involved in the process of "bioturbation" [11], organize the return of nutrients to the water layer and enhance the production of bacteria

associated with sediments by stimulating the activity of these bacteria, which contribute to the destruction of certain types of litter ingested by sea cucumber as those derived from marine seagrass [12].

For the Starfish, the presence of Coscinasterias tenuispina (Lamarck, 1816) is due to a prospection with the fishermen of the port of Beni Saf (station 5) and close to this station with a presence of 10%, and this presence is probably due to the Bailiwick of boats near the port. On the other hand, Echinaster sepositus (Retzius, 1783) is detected in two stations (20%) under rocks or platforms. These Starfish are the main predators of Paracentrotus lividus (Lamarck 1816) and Arbacia lixula (Linnaeus, 1758).

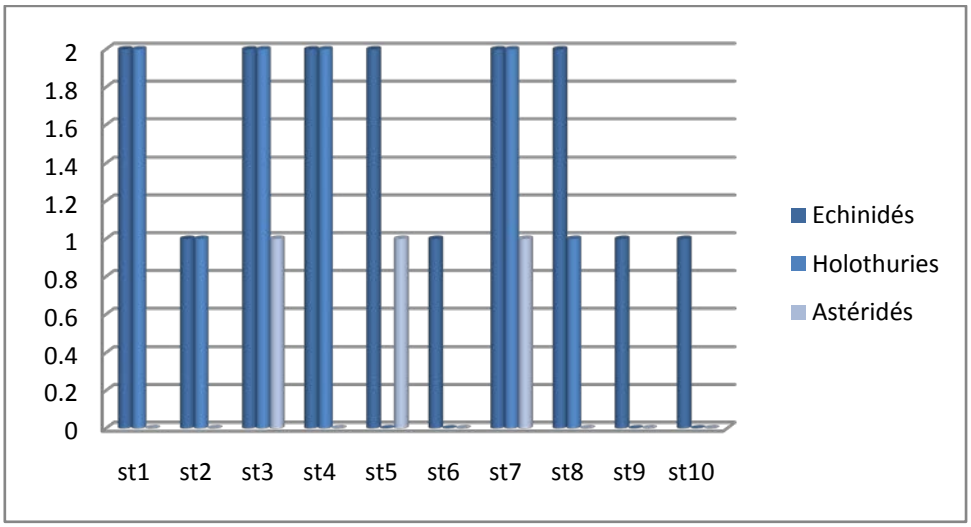

Fig. 3: Distribution of species per station.

The diversity of the echinological wildlife is increased in station 3 (Sbiaat beach) and this is due to the non-disturbance of this area that is considered isolated and rarely frequented by humans. This station is characterized by a lack of overbuilding of sewage from all kinds of pollution discharges with a presence of a marine aquaculture farm that was not yet functional. While this area was not frequented by humans, in recent years it has become a supervised beach during summer time.

By constrast at stations 9 (Les Andalouses) and 10 (Ain el Turk), the diversity is much less important and this is probably due to the disturbance of the environment by urban discharges.

5. Conclusions

The composition of the echinological fauna on the Algerian west coast is very varied and this has allowed us to understand the importance of echinoderms which are bio-indicators of the health of the marine environment.

This work explains the echinological wealth that is presented by three classes: Echinoids by two species: Paracentrotus lividus (Lamarck 1816), Arbacia lixula (Linnaeus, 1758), Sea Cucumber (Holothurian) by two species also: Holothuria tubulosa (Gmelin, 1788), Holothuria forskali (Delle Chiaje, 1823), as well as starfish

(Asteroidean) by two species: Coscinasterias tenuispina (Lamarck, 1816), Echinaster sepositus (Retzius, 1783) and with a dominance of the edible sea urchin in all studied stations. This indicates that this herbivore species is considered a key species that is capable of determining, by the effect of its pasture, the composition and dynamics of the algal community [13], and is effective for any kind of pollution.

Our results remain to be confirmed in the long-term evaluation of the echinological benthic fauna. This populating environment should be studied primarily in terms of spatial and temporal distributions [14]. More monitoring of algal cover and associated wildlife must be made to determine the ecological status of the coast and the relation to the phylum. This will be followed by a map and a statistical study to better value our results.

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