Inventory of marine molluscs in Gulf of Oran
(Western Algerian coastline)

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Abstract
This present paper made it possible to update the inventory of benthic malacofauna in the soft bottoms of gulf of Oran. Samples of macrobenthic fauna were collected and separated from the Molluscs from other zoological groups. 116 Molluscs inventoried and determined by the species, including 13 orders, 20 families, 24 genuses and 29 species. Bivalvia is represented better than Gastropoda with respectively, 24 and 5 species. The analyzed taxa highlighted the dominant and main species on the bottom of the study sites, including Nuculana commutata, which appeared as the major species, followed by Nucula sulcata with respectively 23.46% and 12.34%. The present inventory indicates that the malacological fauna is less diversified than in the other zones studied of the Algerian coast.

Keywords: Malacofauna, Softbottom, Mollusc, Bivalvia, Gasteropoda, Gulf of Oran

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Introduction
In the west Algerian coast, few works were done on marine macrobenthic fauna. Most of the previous inventories of the benthic fauna of continental shelf in the west coast of Algeria were not updated (Dautzemberg, 1895; Pallary, 1900; Llabador, 1935; Amar, 1998, Kerfouf et al., 2007; Bakalem et al., 2008). The benthic fauna found in abundance in all marine ecosystems is a food source for a great diversity of animals, vertebrates, and invertebrates, some of which either fished or reared. The Molluscs are one of the biological keys to detecting any disturbance of the ecological system (Benzaoui et al., 2015; Rouabhi, 2020). Molluscs are an essential indicator of estuaries and coastal ecosystem health, and the absence or presence of some species can give information about the water quality status (Dauvin et al., 2010). The objective of this research is an inventory and an update of the list of mollusc species of the soft bottom in the gulf of Oran.

Material and methods
Study area
Gulf of Oran is between Cap Aiguille and Cap Falcon on the Algerian West coast (Fig. 1). Two of the largest harbor in Algeria is in this area: Oran and Mers El Kébir. Waters coming from the Atlantic Ocean nourished the gulf of Oran. The circulation is very turbulent along the North African continent, which favors the dispersion of possible sources of pollution (Millot, 1989). This coastal water of the gulf of Oran exposed to different pollution whose origin is the urban concentration and socio-economic development (Remili and Kerfouf, 2013; Dilem et al., 2014; Benali et al., 2017).

Sampling
We explored Forty-nine stations in this study. Samples were taken from a depth ranging from 30 to 106 m along the shore region and from offshore (Table 1).
Table 1: Geographic position and depth of stations.

| Stations | Position Latitude N | Position Longitude W | Depth (m) |
|----------|---------------------|----------------------|-----------|
| 1.7      | 35°45′45″           | 00°42′65″            | 70        |
| 1.8      | 35°46′95″           | 00°42′75″            | 80        |
| 1.9      | 35°47′23″           | 00°41′55″            | 90        |
| 1.9'     | 35°37′47″           | 00°41′60″            | 92        |
| 1.10     | 35°47′95″           | 00°41′55″            | 102       |
| 2.1      | 35°44′23″           | 00°41′08″            | 46        |
| 2.2      | 35°44′95″           | 00°40′05″            | 73        |
| 2.2'     | 35°44′95″           | 00°40′05″            | 73        |
| 2.3      | 35°45′80″           | 00°40′90″            | 81        |
| 2.4      | 35°46′70″           | 00°40′60″            | 82        |
| 2.5      | 35°47′60″           | 00°40′50″            | 87        |
| 2.6      | 35°48′50″           | 00°40′35″            | 98        |
| 2.2      | 35°44′38″           | 00°40′25″            | 61        |
| 3.1      | 35°45′05″           | 00°40′00″            | 73        |
| 3.2      | 35°45′85″           | 00°39′80″            | 81        |
| 3.3      | 35°46′90″           | 00°39′50″            | 82        |
| 3.4      | 35°47′90″           | 00°39′25″            | 91        |
| 3.5      | 35°48′50″           | 00°38′80″            | 91        |
| 3.6      | 35°42′00″           | 00°39′03″            | 42        |
| 3.7      | 35°43′05″           | 00°39′00″            | 66        |
| 3.8      | 35°44′05″           | 00°39′00″            | 74        |
| 3.9      | 35°43′09″           | 00°38′09″            | 77        |
| 4.1      | 35°44′09″           | 00°38′05″            | 77        |
| 4.2      | 35°43′05″           | 00°38′00″            | 82        |
| 4.3      | 35°43′05″           | 00°38′00″            | 87        |
| 4.4      | 35°44′05″           | 00°38′00″            | 98        |
| 4.5      | 35°44′05″           | 00°38′05″            | 98        |
| 4.6      | 35°47′03″           | 00°37′40″            | 110       |
| 4.7      | 35°48′50″           | 00°37′05″            | 56        |
| 4.8      | 35°43′05″           | 00°37′05″            | 60        |
| 4.9      | 35°45′00″           | 00°37′00″            | 70        |
| 5.1      | 35°45′00″           | 00°37′05″            | 82        |
| 5.2      | 35°45′00″           | 00°37′05″            | 94        |
| 5.3      | 35°45′00″           | 00°36′07″            | 106       |
| 5.4      | 35°45′00″           | 00°36′05″            | 39        |
| 5.5      | 35°46′35″           | 00°35′70″            | 55        |
| 5.6      | 35°46′35″           | 00°35′75″            | 61        |
| 5.7      | 35°46′35″           | 00°35′75″            | 66        |
| 5.8      | 35°46′35″           | 00°34′60″            | 60        |
| 5.9      | 35°46′35″           | 00°34′50″            | 70        |
| 5.10     | 35°46′35″           | 00°34′50″            | 80        |
| 6.1      | 35°46′35″           | 00°34′50″            | 100       |
| 6.2      | 35°46′35″           | 00°34′50″            | 100       |
| 6.3      | 35°46′35″           | 00°34′50″            | 32        |
| 6.4      | 35°46′35″           | 00°34′50″            | 41        |
| 6.5      | 35°46′35″           | 00°34′50″            | 49        |
| 6.6      | 35°46′35″           | 00°34′50″            | 61        |
| 6.7      | 35°46′35″           | 00°34′50″            | 70        |
| 6.8      | 35°46′35″           | 00°34′50″            | 80        |
| 6.9      | 35°46′35″           | 00°34′50″            | 95        |

Sampling have been randomly selected in the coastal regions having both sandy and gravel substrates. The type of machine used for the sample was Aberdeen or “Smith Mc Intyre” grab. The residue was fixed with formalin (N/10) for laboratory study after sieving the samples. A first segregation was made, according to their belonging to one of the largest zoological groups. All molluscs were identified down to the species level, using Marsh (1964), Hinton (1972), Dance (1976), Springsteen and Leobrera (1986), Abbott (1991), Poppe (2008), Wong and Arshad (2011) and (http://www.marinespecies.org/) as references.

Data analysis

For each inventoried species, the frequency was noted to establish species abundance and dominance calculations.

Results

The 164 individuals of Molluscs were collected and inventoried in the Gulf of Oran. The determination of each specimen allowed us to identify 2 class, 13 orders, 20 families, 24 genus, and 29 species.

Two classes are highlighted: Bivalvia, and Gastropoda with 24 and 5 species.

Class: Bivalvia

We noted four (4) subclasses: Pteriomorpha, Heterodonta, Protobranchia, and Autobranchia.

Subclass: Pteriomorpha

Three (3) orders are identified: Mytiloida, Pectinoida, and Limoida.
**Order:** Mytiloida  
Super family: Mytiloidea  
**Family:** Mytilidae  
Genus: Lioberus  
Species: *Lioberus agglutinans* (Cantraine, 1835) synonym *Amygdalum agglutinans* (Cantraine, 1835)  
Genus: Amygdalum  
Species: *Amygdalum phaseolinum* (Philippi, 1844)  
**Order:** Pectinoida  
Super family: Pectinoidea  
**Family:** Pectinidae  
Sub family: Palliolinae  
Genus: Peplum  
Species: *Peplum clavatum* (Poli, 1795)  
**Order:** Limoida  
Super family: Limoidea  
**Family:** Limidae  
Genus: Limatula  
Species: *Limatula subauriculata* (Montagu, 1808)  
**Subclass:** Heterodonta  
Six (6) orders are identified: Carditoida, Myoida, Euheterodonta, Lucinoida, Anomalodesmata and Veneroida.  
**Order:** Carditoida  
Super family: Carditoidea  
**Family:** Carditidae  
Genus: Centrocardita  
Species: *Centrocardita aculeata* (Poli, 1795) synonym *Cardita aculeata* (Poli, 1795)  
Genus: Cardites  
Species: *Venericardia antiquata* (Linné, 1758) Synonym: *Cardites antiquatus* (Linnaeus, 1758)  
Super family: Crassatelloidea  
**Family:** Astartidae  
Genus: Gonilia  
Species: *Gonilia calliglypta* (Dall, 1903)  
**Order:** Myoida  
Super family: Myoidea  
**Family:** Corbulidae  
Genus: Corbula  
Species: *Corbula gibba* (Olivi, 1792)  
**Order:** Euheterodonta  
Super family: Hiatelloidea  
**Family:** Hiatellidae  
Genus: Hiatella  
Species: *Saxicava arctica* (Linnaeus, 1767)  
**Order:** Lucinoida  
Super family: Lucinoidea  
**Family:** Lucinidae  
Genus: Loripes  
Species: *Loripes lacteus* (Poli, 1791) synonym *Loripes lucinalis* (Lamarck, 1818)  
**Order:** Anomalodesmata  
Super family: Pandoroidea  
**Family:** Lyonsiidae  
Genus: Lyonsia  
Species: *Lyonsia norwegica* (Gmelin, 1791)  
**Order:** Veneroida  
Super family: Cardioidea  
**Family:** Veneridae  
Genus: Pitar  
Species: *Pitar dione* (Linnaeus, 1758)  
Species: *Pitar rudis* (Poli, 1795)  
Genus: Timoclea
Species: *Venus ovata* (Pennant, 1777) 
synonym *Timoclea ovata* (Pennant, 1777)  
Superfamily: Tellinoidea  
**Family:** Tellinidae  
Genus: *Moerella*  
Species: *Tellina donacina* (Linnaeus, 1758) synonym *Moerella donacina* (Linnaeus, 1758)  
Superfamily: Tellinoidea  
**Family:** Tellinidae  
Genus: *Tellina*  
Species: *Tellina distorta* (Poli, 1791)  
Superfamily: Tellinoidea  
**Family:** Psammobiidae  
Genus: *Gari*  
Species: *Gari costulata* (Turton, 1822)  
**Subclass:** Protobranchia  
Three (3) are identified: Nuculanoida, Nuculida, and Cardiida.  
**Order:** Nuculanoida  
Superfamily: Nuculanoida  
**Family:** Nuculanidae  
Subfamily: Nuculaninae  
Genus: *Nuculana*  
Species: *Nuculana commutata* (Philippi, 1844) synonym *Leda fragilis* (Chemnitz, 1784)  
**Order:** Nuculida  
Superfamily: Nuculoidea  
**Family:** Nuculidae  
Genus: *Nucula*  
Species: *Nucula turgida* (Gould, 1846)  
Species: *Nucula sulcata* (Bronn, 1831)  
Species: *Nucula nucleus* (Linnaeus, 1758)  
**Subclass:** Autobranchia  
**Order:** Cardiida  
**Family:** Tellinidae  
Genus: *Gastrana*  
Species: *Gastrana fragilis* (Linnaeus, 1758) synonym *Uncidens arupinensis* (Coen, 1933)  
**Class:** Gastropoda  
**Subclass:** Caenogastropoda  
**Order:** Neogastropoda  
Superfamily: Buccinoidea  
**Family:** Nassariidae  
Genus: *Nassarius*  
Species: *Nassa limata* (Philippi, 1836) synonym *Nassarius lina* (Dillwyn, 1817)  
**Species:** *Hinia reticulata* (Linne, 1758) synonyme *Nassarius reticulatus* (Linnaeus, 1758)  
**Family:** Fascioliariidae  
Subfamily: Fusininae  
Genus: *Fusinus*  
Species: *Fusinus rostratus* (Olivi, 1792)  
**Family:** Buccinidae  
Genus: *Euthria*  
Species: *Euthria cornea* (Linnaeus, 1758)  
Superfamily: Naticoidea  
**Family:** Naticidae  
Subfamily: Naticinae  
Genus: *Natica*  
Species: *Natica Dillwni* (Payraudeau, 1826)  
**Discussion**  
The abundance of Molluscs varies from one site to another, depending on the substrate nature and the environmental quality. There is a high abundance in coastal stations of pollution indicator species, particularly those located at the level of wastewater discharges (Fig. 2).
The specific richness is high in the coastal stations, particularly in the east of the gulf of Oran, that is in the Oran’s harbour, in a little disturbed area without any anthopic activities (Fig. 3).

Molluscs from the Gulf of Oran are all considered rare species (frequency <25%). Only five species have a frequency greater than 5%. Seven species have a frequency of 4.08% (Corbula gibba, Hinia reticulata, Nassula limata, Nucula nucleus, Parvicardium scabrum, Tellina donacina, Venus ovata). The other species represent only 2.04%. Nuculana commutata shows the highest dominance (23.46%), followed by Nucula sulcata (12.34%) and Nucula turgida (9.87%). Most of the species sampled are represented by only one species per sample, except for the species Lima subauriculata (4.93%).
Papillicardium papillosum, and Tellina donacina with a dominance of (3.70%). Ecologically the mixticole (Mix) species dominate in the gulf of Oran, followed by the coastal detritus species (DC). This Gulf is distinguished from other open Algerian environments by the absence of large rivers draining terrigenous inputs to the coastal bottoms of the gulf as is the case in other bays and gulfs: Algiers, Annaba, Bejaia, and Arzew. This situation explains to a large extent the organization of the benthic fauna settlements in the Gulf of Oran. The distribution of Molluscs in the gulf of Oran depends on the nature of the substrate, its composition in organism matter, and the quality of the environment, as reported in the Mediterranean Sea (Bakalem et al., 2020).

The comparison of the marine molluscs of the gulf of Oran with other areas in the Algerian coast (Gulf of Arzew, Bou Ismail bay, and Algiers bay) confirmed the superiority of species with wide ecological distribution. In this study about of the gulf of Arzew, a total of 66 species identified which is higher than what is observed in the gulf of Oran. The distribution of molluscs showed that their ecological preference to the substratum and higher species richness may be explained to the siltation of this gulf (Amar, 1998). This difference may be linked to a temporal evolution since the data for the Gulf of Arzew date back more than 20 years and or to a difference in the ecological state of the environment. As observed in the Gulf of Oran, molluscs have a clear quantitative dominance in Bou-Ismail Bay (Hassam, 1991; Oulmi, 1991) and in Algiers bay (Bakalem et al., 2020). In contrast to the dominance of bivalves in the gulf of Oran, the prospecting of rocky substrates of the Algerian west coast made it possible to identify 26 species of Gastropoda molluscs divided into 11 families (Meziane et al., 2020). All research work carried out on marine mollusks in the western Algerian coast is related to one species within the framework of the Biomonitoring Programs (Bendoula et al., 2017; Benali et al., 2017; Meziane and Kerfouf, 2018).

Conclusion
The faunistic composition analysis of the sampled stations in the Gulf of Oran allowed us to count 116 individuals of Molluscs inventoried and determined by the species, including 13 orders, 20 families, 24 genus and 29 species. The large ecological stocks are mixiole species and coastal detritus species. The malacofauna of the gulf of Oran is scarce and less diversified (29 species) due to the nature of the soft bottoms (sand and gravel) and the absence of terrigenous inputs. The present study carried out on samples of macrofauna in the gulf of Oran made it possible to update the inventory of benthic macrofauna in the soft bottoms of these coasts. Spatio-temporal monitoring will provide more information on the dynamics of these macrobenthic communities. The present list of molluscs in Oran's gulf is the first step of an inventory which will be completed with a future article that will
provide information and argumentation on each species with their references.

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