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MARINE CALANOIDA (CRUSTACEA: COPEPODA) OF THE GULF OF GABES: A REVIEW

SUMMARY

This study presents a faunal list of Copepoda Calanoida in the Gulf of Gabès (Tunisia). A total of 52 species belonging to 15 families were reported in this study area, including 11 species belonging to family Acartiidae. Due to the geographical position of Gulf of Gabès in the middle of the Mediterranean Sea, the Tunisian Calanoida fauna in this area can be considered as a mixture of non-indigenous species mainly from Atlantic, cosmopolitan species, and endemic species.

HISTORY OF STUDIES

The first study known about coastal marine Copepoda in Tunisia was that of HELDT (1929) in the northern lagoon in the period from 1924 to 1928. The aforementioned study reported two dominant species of Calanoida: *Acartia clausi* GIESBRECHT, 1889 and *Paracartia latisetosa* (KRICHAGIN, 1873). That study also reported 6 sporadic taxa not well adapted to the lagoon conditions, belonging to the genera of *Calanus*, *Paracalanus*, *Centropages*, *Isias*, *Temora*, and *Labidocera*. Successively other studies by ROSE and VAISSIÈRE (1952a;b; 1953) in the offshore areas of the North African coasts revealed the presence of a total of 176 Copepoda species including Calanoida.

The first attempt to list Calanoida in the Gulf of Gabès was undertaken in the coastal waters of Jerba island during a circumstantial study in March 1970 (BERNARD and BERNARD, 1973). This latter study reported 4 dominant species: *Isias clavipes* BOECK, 1865, *Acartia clausi* GIESBRECHT, 1889, *Centropages kroyeri* GIESBRECHT, 1893 and *Paracalanus parvus* CLAUS, 1863, in addition to two less abundant species, which were *Labidocera* sp. and *Paracartia latisetosa* (KRICHAGIN, 1873). From April 1992 to March 1993, DALY YAHIA and

ROMDHANE (1994) inventoried 4 Calanoida species in Bou Grara Lagoon in the Gulf of Gabès: *C. kroyeri*, *A. clausi*, *P. latisetosa*, *P. parvus*.

Since 2005, many studies on Calanoida in Gulf of Gabès were carried out (DRIRA *et al.*, 2010; 2014; 2017; REKIK *et al.*, 2012; 2018 a, b; BEN LTAIEF *et al.*, 2015; 2017; BEN SALEM *et al.*, 2015; KMIHA MEGDICHE *et al.*, 2019), and their results are the basis of the present faunal summative report.

STUDY AREA

The Gulf of Gabès is situated between 35°N and 33°N and from *Ras Kapoudia* to the Tunisian-Libyan border (Fig.1) and characterized by a semi arid Mediterranean climate. This area is characterized by shallow waters, weak currents, high salinity, and high temperature (LADHAR-CHAABOUNI *et al.*, 2012). It is considered highly productive (BEN BRAHIM *et al.*, 2013) and it contributes to approximately 40% of the national fish production in Tunisia (DGPA, 2015). This area is considered as an important nursery for various fish species (ÉNAJJAR *et al.*, 2015).

Unfortunately, Gulf of Gabès is influenced by anthropogenic inputs associated with a considerable demographic growth. Many industrial activities such as crude phosphate treatment, chemical industry, tannery, and plastic plants release their effluents containing pollutants such as toxic metals into the Gulf (BÉJAOUÏ *et al.*, 2004; GARGOURI *et al.*, 2011).



Fig. 1. Localization of the gulf of Gabès.

RESULTS AND DISCUSSION

A total of 52 Calanoida species belonging to 15 families are listed here as shown in table 1. As a comparison, only 29 Calanoida are known in the Bay of Tunis (DALY-YAHIA *et al.*, 2004) and 34 Calanoida were observed along the Mediterranean Moroccan coast (BERRAHO *et al.* 2016). However, the Gulf of Annaba and El Kala (east coast of Algeria) showed a species richness of 81 Calanoida (KHELIFI-TOUHAMI *et al.* (2007). RAZOULS *et al.* (2005-2020) reported a total of 101 Calanoida in the area of the Mediterranean Sea which includes the Gulf of Gabès. Acartiidae is the most diversified family with 11 species. The neritic community was the most important one in term of species richness, with *Paracartia latisetosa*, *Centropages hamatus*, *Isias clavipes*, *Labidocera wollastoni* and *Clausocalanus furcatus*, as the most represented species. Among the recorded species, only *Acartia adriatica* and *Stephos marsalensis* are classified as endemic in the Mediterranean Sea (COSTANZO *et al.*, 2000; RAZOULS *et al.*, 2005-2020). *Centropages ponticus* was only observed in both Mediterranean and Red Sea waters (RAZOULS *et al.*, 2005-2020). Two Atlantic species have been reported as recently arrived (Non Indigenous Species): *Paracartia grani* and *Acartia tonsa*. RODRÍGUEZ and VIVES (1984) were the first to report *Paracartia grani* in the Mediterranean, in Malaga harbour close to Gibraltar Strait, probably involuntarily introduced as a by-product of human activities (BELMONTE and POTENZA, 2001). *Acartia tonsa*, a species typical of coastal embayment, is a well-known invasive non-indigenous species in the Mediterranean area (GRAVILI *et al.*, 2010). This species has recently entered the Ponto-Mediterranean Province from the Baltic Sea probably via the Black Sea (GUBANOVA, 2000; BELMONTE, 2018). Other species of Atlantic origin are *Calocalanus contractus* Farran, 1926, *C. tenuis* Farran, 1926, *Acartia bifilosa* Giesbrecht, 1881, and *Metacalanus inaequicornis* Sars G.O., 1903 which have been recorded mainly in the offshore region of the Gulf of Gabès showing that hydrology and water masses exchange are certainly influenced by the Atlantic Tunisian Current (BEN LTAIEF *et al.*, 2015).

A. clausi is the most abundant Calanoida copepod found in coast samples and near 50 m bathymetry (DRIRA *et al.*, 2010). The prevalence of this taxon was otherwise reported for the Bay of Tunis (DALY YAHIA *et al.*, 2004). The spatial distribution of *A. clausi*, *A. longiremis*, *C. typicus* and *C. kroyeri* was linked to the biomass of ciliates, diatoms and Chlorophyll-*a* in this area (BEN LTAIEF *et al.*, 2015).

Table 1. List of the Calanoida species in the Gulf of Gabès obtained by the following literature: 1 : DRIRA *et al.*, 2010, 2 : REKIK *et al.*, 2012, 3 : DRIRA *et al.*, 2014, 4 : BEN LTAIEF *et al.*, 2015, 5 : BEN SALEM *et al.*, 2015, 6 : BEN LTAIEF *et al.*, 2017, 7 : DRIRA *et al.*, 2017, 8 : REKIK *et al.*, 2018a, 9 : REKIK *et al.*, 2018b, 10 : KMIHA MEGDICHE *et al.*, 2019.

Family	Species	Authors
Acartiidae	<i>Acartia adriatica</i> Steuer, 1910	3
	<i>Acartia bifilosa</i> Giesbrecht, 1881	3,4, 5, 6
	<i>Acartia clausi</i> Giesbrecht, 1889	1,2, 3,4, 5, 6, 7, 8, 9, 10
	<i>Acartia danae</i> Giesbrecht, 1889	6, 10
	<i>Acartia discaudata</i> Giesbrecht, 1881	3,4, 6, 7, 9
	<i>Acartia italica</i> Steuer, 1910	1, 2, 3, 5, 9
	<i>Acartia longiremis</i> Lilljeborg, 1853	3,4,5, 6, 10
	<i>Acartia tonsa</i> Dana, 1849	4,6
	<i>Acartia negligens</i> Dana, 1849	6
	<i>Paracartia grani</i> Sars, 1904	1,2, 3, 5,6, 7, 8, 10
	<i>Paracartia latisetosa</i> (Krichagin, 1873)	1, 2, 3, 5, 7, 8, 9, 10
Arietellidae	<i>Metacalanus inaequicornis</i> Sars G.O., 1903	4, 6
Calanidae	<i>Calanus helgolandicus</i> Claus, 1863	4, 5, 9
	<i>Calanus tenuicornis</i> Dana, 1849	3
	<i>Megacalanus longicornis</i> Sars, 1905	3
	<i>Megacalanus princeps</i> Brady, 1883	1, 3
	<i>Nannocalanus minor</i> Claus, 1863	1, 3,4, 6
Candaciidae	<i>Candacia armata</i> Boeck, 1872	4, 6
	<i>Candacia bipinnata</i> Giesbrecht, 1889	6
	<i>Candacia elongata</i> Boeck, 1872	3
Centropagidae	<i>Centropages chierchiae</i> Giesbrecht, 1889	3,4, 6
	<i>Centropages hamatus</i> Lilljeborg, 1853	1, 3, 4, 6, 9
	<i>Centropages ponticus</i> Karavaev, 1895	4, 6
	<i>Centropages kroyeri</i> Giesbrecht, 1893	1, 2, 3,4, 6, 7, 8, 9
	<i>Centropages typicus</i> Krøyer, 1849	1, 2, 3, 4, 5, 6, 8, 9
	<i>Centropages violaceus</i> Claus, 1863	6
	<i>Isias clavipes</i> Boeck, 1865	5, 8
Clausocalanidae	<i>Clausocalanus furcatus</i> Brady, 1883	4, 6
Euchaetidae	<i>Euchaeta hebes</i> Giesbrecht, 1888	1, 3
Eucalanidae	<i>Eucalanus</i> sp. Dana, 1852	6, 7
	<i>Eucalanus attenuatus</i> Dana, 1849	9
	<i>Eucalanus monachus</i> Giesbrecht, 1888	9

Metridinidae	<i>Pleuromamma xiphias</i> Giesbrecht, 1889	4
Paracalanidae	<i>Paracalanus aculeatus</i> Giesbrecht, 1888	9
	<i>Paracalanus parvus</i> Claus, 1863	2,3,4, 5, 6, 7, 8, 9, 10
	<i>Calocalanus contractus</i> Farran, 1926	4, 6
	<i>Calocalanus pavo</i> Dana, 1852	6
	<i>Calocalanus styliremis</i> Giesbrecht, 1888	6
	<i>Calocalanus tenuis</i> Farran, 1926	6
	<i>Acrocalanus gracilis</i> Giesbrecht, 1888	6
	<i>Mecynocera clausi</i> Thompson I.C., 1888	6
Platycopiidae	<i>Platycopia pygmoea</i> Sars, 1911	1, 3
Pontellidae	<i>Anomalocera patersoni</i> Templeton, 1837	3, 6
	<i>Labidocera brunescens</i> Czerniavsky, 1868	4, 6
	<i>Labidocera fluviatilis</i> Dahl F., 1894	6
	<i>Labidocera</i> sp. Lubbock, 1853	3
	<i>Labidocera wollastoni</i> Lubbock, 1875	1, 3, 6
Rhincalanidae	<i>Rhincalanus</i> sp. Dana, 1852	3
	<i>Rhincalanus nasutus</i> Giesbrecht, 1888	4, 6
Stephidae	<i>Stephos marsalensis</i> Costanzo, Campolmi and Zagami, 2000	2, 3
Temoridae	<i>Temora longicornis</i> Müller O.F., 1785	1,2, 3, 7, 8, 9, 10
	<i>Temora stylifera</i> Dana, 1849	1, 3,4, 6, 7, 8, 9

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