

Rapid Communication

The first recorded occurrences of the invasive crab *Callinectes sapidus* Rathbun, 1896 (Crustacea: Decapoda: Portunidae) in coastal lagoons of the Balearic Islands (Spain)

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Abstract

The introduction of species is a major threat to biodiversity conservation. Island biodiversity is especially sensitive to the arrival of new species, and species introductions are one of the major concerns of conservation management policies. Here, we report for the first time the arrival of *Callinectes sapidus*, a new potentially invasive crab species from the East coast of America to the Balearic Islands (Spain). It appeared simultaneously in both Mallorca and Menorca islands. Nine different records of 20 individuals were documented in six different localities, suggesting an initial colonization process of the territory.

Key words: Atlantic blue crab, wetlands, Nature 2000, island ecosystems, Western Mediterranean

Introduction

To date, the Mediterranean Sea is known to have been colonized by almost 70 species of alien decapod crustaceans (Galil 2011). The Atlantic blue crab, *Callinectes sapidus* Rathbun, 1896 (Crustacea, Decapoda, Portunidae) appears to be naturalized in the Mediterranean Sea since the mid-twentieth century. This crab is an Atlantic species which occurs naturally at the eastern coast of America, between southern Canada and northern Argentina (Williams 1984). Its range has increased via introduction and currently it also occurs in Europe. The most likely dispersal vector in the Mediterranean appears to be the ballast tanks of ships (Galil et al. 2002). The first Mediterranean record was in 1935 when *C. sapidus* was introduced from America, although it was at first mistakenly identified as *Portunus pelagicus*, an Indo-Pacific species (Giordani-Soika 1951; Galil et al.

2002). Since 1955, it has become naturalized on the Israeli coast, Alexandria, Egypt and Rhodes Islands, and at the Gulf of Tesseloniki (Riedl 1983). It colonized Venice (Italy) in 1949 (Giordani-Soika 1951), presumably from the east Mediterranean. The southern and western European records were previously summarized by Mancinelli et al. (2017), who considered the occurrence of *C. sapidus* naturalized and expanding along the eastern coast of the Iberian Peninsula and the Atlantic coast of Portugal and northern Spain. In 2016 the Spanish Ministry of Fishery included *C. sapidus* on its list of commercial fish species (BOE-A-2016-3357).

Callinectes sapidus is an eurythermal and euryhaline species, with high fecundity, strong swimming capacity, and a pronounced aggressiveness. These traits may have contributed to its establishment in the Mediterranean Sea (Galil et al. 2002) and its inclusion on a list of the 100 worst invasive alien marine species



Figure 1. Natural eutrophic coastal lagoons at the natural park of s'Albufera de Mallorca (Balearic Islands, Spain). Photo by Samuel Pinya.

of the Mediterranean (Streftaris and Zenetos 2006). The species' ability to attack fish and other crustaceans trapped in fishing nets and to damage fishing gear are the reasons this species is now considered as causing a potential social and economic impact, as well as an environmental impact on native biodiversity.

Island biodiversity is especially sensitive to the introduction of alien and invasive species. The Balearic Islands have witnessed the arrival and establishment of dozens of invasive species of different taxonomic groups (Álvarez 2010) with different impacts on native biodiversity. Here, we present a new case of species introduction to the Balearic Islands, with *C. sapidus* being documented for the first time in coastal lagoons of the north-eastern of Mallorca (Spain) and other records around the archipelago.

Methods

Study site

S'Albufera de Mallorca is the largest wetland of the Balearic Islands with a surface of 1646.48 ha. It belongs to the European Nature 2000 net under the Special Protection Areas (SPAs) for Birds and Site for Community Importance (SCI). Natura 2000 is a network that stretches across all 28 EU countries; the aim of the network is to ensure the long-term survival

of Europe's most valuable and threatened species and habitats. Besides, s'Albufera de Mallorca is included in the Ramsar Convention since 1988, which is an International Convention on Wetlands that provides the framework of national action and international cooperation for the conservation of wetlands. Individuals of *C. sapidus* were captured at the European priority habitat Coastal lagoons and Natural eutrophic lagoons with *Magnopotamion* and *Hydrocharition* vegetation, according to the Habitats Directive (Council Directive 92/43/EEC) (Figure 1).

Capture, determination and biometry

Crabs were captured accidentally from June to August of 2017 in the brackish waters of s'Albufera de Mallorca Natural Park (Balearic Islands, Spain). Captures were carried out with twelve funnel traps baited with fish (see Nall and Thomas 2009 for trap traits). These traps were used for population control of the invasive red slider tortoise *Trachemys scripta* and a population study of the native European pond turtle *Emys orbicularis*. Traps were checked on a weekly basis from June to September of 2017. Once the crabs were captured, they were frozen for further morphological analysis, then fixed and preserved in 70% ethanol.



Figure 2. *Callinectes sapidus* captured at the island of Mallorca. An adult male (left) and female (right). Photo by Samuel Pinya and COFIB.

Table 1. Records of *Callinectes sapidus* at the Balearic Islands. Localities, island and UTM coordinates are provided, as well as the names of observers. Preserved individuals in scientific collection at the MBCN (MBCN 23250–23252) appear with a *. Natural protected areas are indicated with a +.

Date	N	Locality	Island	UTM	Observers
2017 Jun 22th	1 ♀*	Gran Canal (Albufera) +	Mallorca	3.076214; 39.795221	V. Colomar, T. Paris
2017 Jul 17th	3 ♂*	Gran Canal (Albufera) +	Mallorca	3.101586; 39.796733	S. Trenado, S. Pinya
2017 Jul 20th	1	Torrent de Muro (Albufera) +	Mallorca	3.077374; 39.788688	S. Pinya, A. Sureda
2017 Jul 21th	1	Albufera des Grau +	Minorca	4.263478; 39.946397	O. Perona
2017 Jul 24th	6	Torrent de Siller (Port de Pollença)	Mallorca	3.077516; 39.903764	J.R. Coves, B. Perelló, C. Fiol
2017 Jul 24 th	2	Torrent de Cala Galdana	Minorca	3.958519; 39.939319	F. de Pablo
2017 Aug 12th	1 ♂*	Canal den Moix (Albufera) +	Mallorca	3.104618; 39.793533	S. Trenado, S. Pinya
2017 Aug 25th	4	Gran Canal (Albufera) +	Mallorca	3.101586; 39.796734	S. Trenado, S. Pinya
2017 Aug 25th	1	Canal den Moix (Albufera) +	Mallorca	3.104618; 39.793533	S. Trenado, S. Pinya

The crabs were identified as *C. sapidus* using the key and description proposed by Williams (1974, 1984), on the basis of the characteristics of the shell and the shape and arrangement of the first male pleopods. Five specimens were deposited in the scientific crustacean collection of the Balearic Museum of Natural Sciences (Sóller, Balearic Islands) with the reference codes: MBCN23250–MBCN23252. Of these specimens width (distance between the base of the marginal spines, Wc) and length of carapace (distance from the pick of the epistomial spine and the back margin of the carapace, Lc) were measured with callipers.

Results

Five *C. sapidus* adults (1♀, 4♂) were captured (Figure 2, Table 1). An adult female was captured on June, 22th on Gran Canal, with a direct connection to the sea (Figure 3B). Three male individuals were also captured at the same locality on July 17th by using funnel traps. Finally, a fourth male was captured on August 12th at a different locality inside the

s'Albufera wetland (see Table 1 for details). Measurements of the captured and preserved individuals were the following for females (Wc: 146, Lc: 77 mm) and for males (Wc: 115, Lc: 61.5; Wc: 101, Lc: 56; Wc: 90, Lc: 57 and Wc: 101, Lc: 47 mm). These specimens were captured up to 4.2 km away from the sea in the inner wetland with salinity values of 2.5–3.2 ‰ and depths values from 0.3–1.8 m.

In the following weeks, up to 20 specimens were observed at six different coastal localities in Mallorca and Minorca (Table 1, Figure 3). In addition, in the past few years some fishermen from Palma Bay (Mallorca) captured large exotic Portunidae species that were not identified. According to verbal description they are likely to have been *C. sapidus*. However, these specimens were not preserved or photographed, so these observations cannot be confirmed.

Discussion

Here, we report *C. sapidus* for the first time in the Balearic Islands, Spain. The individuals reported in

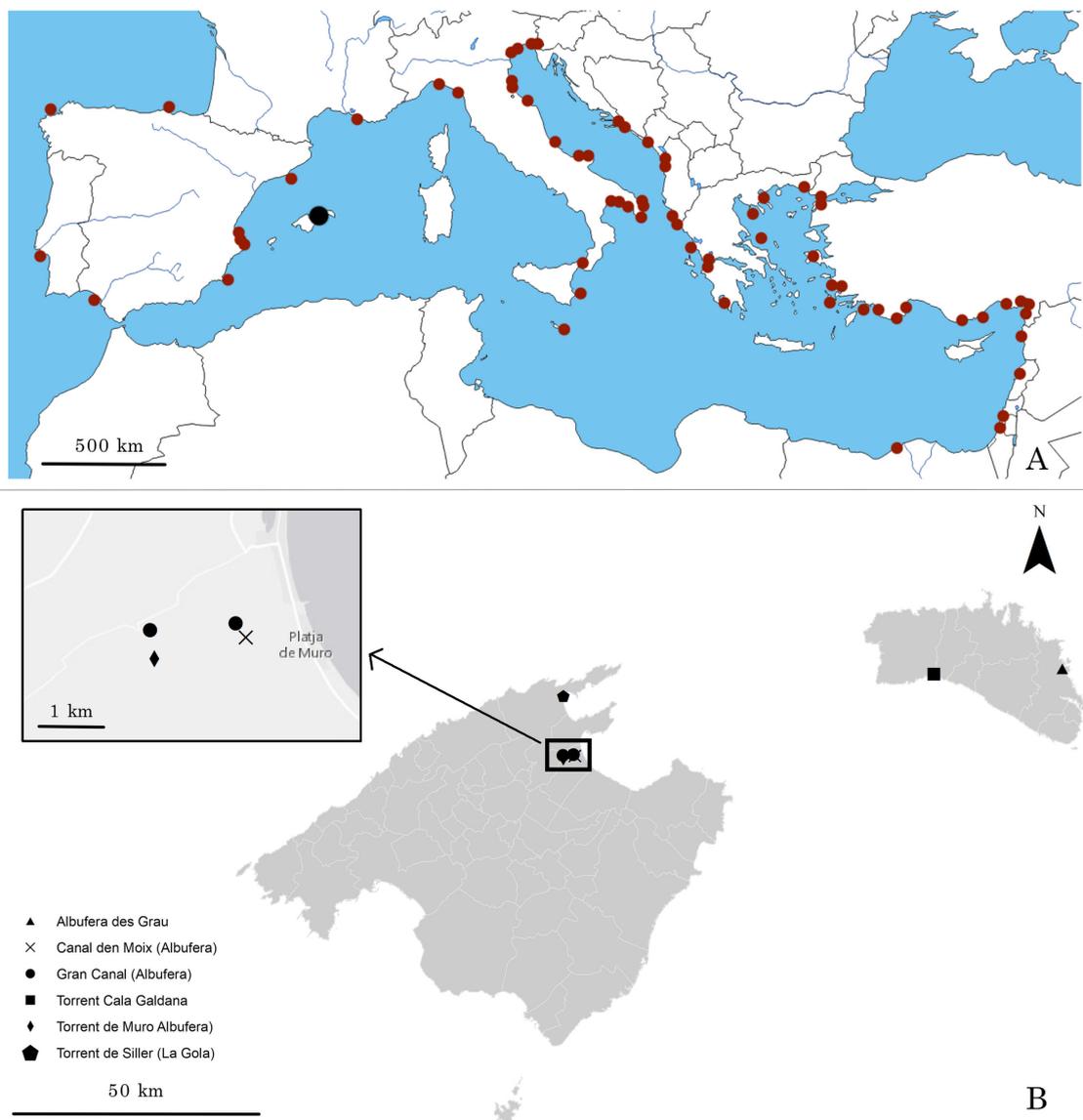


Figure 3. (A) Distribution of the records of *Callinectes sapidus* in the Mediterranean based on Suaria et al. (2017) in red dots and the Balearic Islands in black dot. (B) Distribution of the records of *C. sapidus* found at the Balearic Islands.

this study were located in coastal lagoons, a typical habitat of its natural distribution and other colonized areas. *Callinectes sapidus* was first reported on the Spanish Mediterranean coast in 2013 in the coastal lagoons of Delta de l'Ebre (Catalonia, Spain) (Castejón and Guerau 2013). A more southern locality was recently recorded at the estuary of the Segura River (Alicante, Spain) by González-Wangüemert and Pujol (2016). Previously, some isolated records were from the Atlantic coast in Lisbon (Portugal) (Gaudencio and Guerra 1979), the Galician coast (Spain) (Bañón et al. 2016), and at Bizkaia Bay at the Cantabrian

Sea (Basque Country, Spain) (Cabal et al. 2006). The establishment of the species on the Atlantic Portuguese coasts has also been documented recently (Ribeiro and Verísimo 2014).

All these records show a rapid expansion along the Iberian coastline. The increase of the distribution range including the Balearic Islands appears to be a new advance of this species towards insular zones in the western Mediterranean. The Balearic Islands are separated from the most proximal populations of *C. sapidus* at the mainland from 182 to 190 km, depending of the population. Previously it was

recorded at the small island of Montecristo (Tuscany, Italy) at 70 km from the Italian coast (Stasolla and Innocenti 2014), and at the eastern coast of Sicily at the Ionian Sea (Lipej et al. 2017). The colonization of the Balearic Islands by *C. sapidus* could have happened by three different pathways: a) natural arrival by adults due to its swimming ability (Galil et al. 2002), b) dispersal of larvae by ballast tanks of ships or c) intentional introduction for commercial purposes as it happened in the eastern Mediterranean with its arrival from America in the 1930s (Giordani-Soika 1951). There is no definitive evidence of which of these three is the most likely vector of introduction. Although once *C. sapidus* arrived in the islands, the dispersion between Mallorca and Minorca was more likely to occur by natural dispersal of adults.

The potential invasive behaviour of *C. sapidus* and its effects on native biodiversity at s'Albufera de Mallorca should be studied. Previously, several other invasive species have been reported there, including the European carp (*Cyprinus carpio*), the red slider tortoise (*Trachemys scripta*), and the small marsh flower (*Cotula coronopifolia*) (Rebassa 2008). The impacts of these alien species, together with a salinization process of this protected wetland, are the major known threats to this Nature 2000 site. It is difficult to predict a precise impact on local biodiversity, since a combined effect is likely to occur both by the invasive species and the salinization process. Major effort needs to be applied by the environmental authorities to preserve this flagship wetland in the Balearic Islands, by driving restoration actions. This restoration action should include not only habitat management but control campaigns to decrease the population size and occupancy area of invasive species, and eventually the eradication of them.

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References

Álvarez C (2010) Seminari sobre espècies introduïdes i invasores a les Illes Balears. Ed. Conselleria de Medi Ambient i Mobilitat. Sóller, Spain

Bañón R, Cuesta JA, Almón B, Pérez-Dieste J, Trigo JE, Ríos MB (2016) First records of two decapod crustaceans, the caramote prawn *Penaeus kerathurus* and the blue crab *Callinectes sapidus* from Galician waters (NE Atlantic). *Cahiers de Biologie Marine* 57: 323–328

Cabal J, Pis Millán JA, Arronte JC (2006) A new record of *Callinectes sapidus* Rathbun, 1896 (Crustacea: Decapoda: Brachyura) from the Cantabrian Sea, Bay of Biscay, Spain. *Aquatic Invasions* 1: 186–187, <https://doi.org/10.3391/ai.2006.1.3.14>

Castejón D, Guerao G (2013) A new record of the American blue crab, *Callinectes sapidus* Rathbun, 1896 (Decapoda: Brachyura: Portunidae), from the Mediterranean coast of the Iberian Peninsula. *BiolInvasions Records* 2: 141–143, <https://doi.org/10.3391/bir.2013.2.2.08>

Galil B (2011) The alien crustaceans in the Mediterranean Sea: An historical review. In: Galil BS, Clark PF, Carlton JT (eds), In the Wrong Place - Alien Marine Crustaceans: Distribution, Biology and Impacts, *Invading Nature - Springer Series in Invasion Ecology* 6, pp 377–402, https://doi.org/10.1007/978-94-007-0591-3_13

Galil B, Frogliá C, Noël P (2002) CIESM Atlas of Exotic Species in the Mediterranean. Vol 2. Crustaceans: decapods and stomatopods. Briand F (ed), CIESM Publishers, Monaco, 192 pp

Gaudencio MJ, Guerra MT (1979) Note on the blue crab *Callinectes sapidus* Rathbun 1896 (Crustacea, Decapoda, Brachyura) capture in the Tagus estuary. *Boletim do Instituto Nacional de Investigação das Pescas* 2: 67–73

Giordani-Soika A (1951) Il *Neptunus pelagicus* (L.) nell'alto Adriatico. *Natura* 42: 18–20

González-Wangüemert M, Pujol JA (2016) First record of the Atlantic blue crab *Callinectes sapidus* (Crustacea: Brachyura: Portunidae) in the Segura River mouth (Spain, southwestern Mediterranean Sea). *Turkish Journal of Zoology* 40: 615–619, <https://doi.org/10.3906/zoo-1511-23>

Lipej L, Acevedo I, Akel EHK, Anastapoulou A, Angelidis A, Azzurro E, Castriota L, Çelik M, Cilenti L, Crocetta F, Deidun A, Dogrammatzi A, Falautano M, Fernández-Álvarez FA, Gennaio R, Isacco G, Katsanevakis S, Langeneck J, Lombardo BM, Mancinelli G, Mytilineou Ch, Papa L, Pitacco V, Pontes M, Poursanidis D, Prato E, Rizkalla SI, Rodríguez-Flores PC, Stamouli C, Tempesti J, Tiralongo F, Timetta S, Tsirintanis K, Turan C, Yaglioglu D, Zaminos G, Zava B (2017) New Mediterranean Biodiversity Records (March 2017). *Mediterranean Marine Science* 18: 179–201, <https://doi.org/10.12681/mms.2068>

Mancinelli G, Chainho P, Cilenti L, Falco S, Kapiris K, Katselis G, Ribeiro F (2017) The Atlantic blue crab *Callinectes sapidus* in southern European coastal waters: Distribution, impact and prospective invasion management strategies. *Marine Pollution Bulletin* 119: 5–11, <https://doi.org/10.1016/j.marpolbul.2017.02.050>

Nall IM, Thomas RB (2009) Does method of bait presentation within funnel traps influence capture rates of semiaquatic turtles? *Herpetological Conservation and Biology* 4(2): 161–163

Rebassa M (2008) La conservació de espècies en el Parque Natural de s'Albufera de Mallorca: dos camins de actuació diferents però complementaris. In: Mayol J, Viada C (eds), *Actas de El Rumbo del Arca. Congreso Técnico de Conservación de Fauna y Flora Silvestres*. Conselleria de Medi Ambient del Govern de les Illes Balears, Palma, Spain, pp 133–138.

Ribeiro F, Verísimo A (2014) A new record of *Callinectes sapidus* in a western European estuary (Portuguese coast). *Marine Biodiversity Records* 7: E36, <https://doi.org/10.1017/S1755267214000384>

Riedl R (1983) *Fauna und Flora Des Mittelmeeres*. Ed. Verlag Paul Parey, Hamburg und Berlin, pp 447–517.

Stasolla G, Innocenti G (2014) New records of the invasive crabs *Callinectes sapidus* Rathbun, 1896 and *Percnon gibbesi* (H. Milne Edwards, 1853) along the Italian coasts. *BiolInvasions Records* 3: 39–43, <https://doi.org/10.3391/bir.2014.3.1.07>

Streftaris N, Zenetos Z (2006) Alien Marine Species in the Mediterranean - the 100 'Worst Invasives' and their Impact. *Mediterranean Marine Science* 7: 87–118, <https://doi.org/10.12681/mms.180>

Suaría G, Pierucci A, Zanello Pierpaolo, Fanelli E, Chiesa S, Azzurro E (2017) *Percnon gibbesi* (H. Milne Edwards, 1853) and *Callinectes sapidus* (Rathbun, 1896) in the Ligurian Sea: two additional invasive species detections made in collaboration with local fishermen. *BiolInvasions Records* 6: 147–151, <https://doi.org/10.3391/bir.2017.6.2.10>

Williams AB (1974) The swimming crabs of the genus *Callinectes* (Decapoda, Portunidae). *Fishery Bulletin* 72(3): 685–798

Williams AB (1984) Shrimps, lobsters, and crabs of the Atlantic Coast of the Eastern United States, Maine to Florida. Smithsonian Institution Press, Washington, D.C., pp: I–XVIII, 1–550

Laws and regulations

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)
BOE-A-2016-3357. Resolución de 28 de marzo de 2016, de la Secretaría General de Pesca, por la que se publica el listado de denominaciones comerciales de especies pesqueras y de acuicultura admitidas en España. Boletín Oficial del Estado (BOE) 84: 24605–26661.