

**Rapid Communication****On the occurrence of the blue crab *Callinectes sapidus* (Rathbun, 1896) in Sardinian coastal habitats (Italy): a present threat or a future resource for the regional fishery sector?**Pierluigi Piras<sup>1</sup>, Giuseppe Esposito<sup>2</sup> and Domenico Meloni<sup>2,\*</sup><sup>1</sup>Veterinary Public Health and Food Security Service of the Region of Sardinia, Cagliari, Italy<sup>2</sup>Department of Veterinary Medicine, University of Sassari, Sassari, ItalyAuthor e-mails: [pirasp@tiscali.it](mailto:pirasp@tiscali.it) (PP), [gsesposito@uniss.it](mailto:gsesposito@uniss.it) (GE), [dmeloni@uniss.it](mailto:dmeloni@uniss.it) (DM)

\*Corresponding author

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**OPEN ACCESS****Abstract**

The capture of a male specimen of blue crab *Callinectes sapidus* (Rathbun, 1896) in the coastal waters of Matzaccara, Sardinia, Italy (South-Western Mediterranean Sea, 39°11'N; 8°43'E) is reported with morphometric data. The crab was collected by local small-scale fishery operators and brought to the attention of the Sardinian Forest Ranger Service/Environmental Surveillance and professional scientists. This record confirms the spread of this species in the south-western coastal habitats of Sardinia (Italy). The ongoing expansion of *C. sapidus* and its first appearance in the Sardinian fish market highlight the need for official sampling campaigns to update the population size of this non-indigenous species and evaluate its potential influence on the regional fishery sector. Control and mitigation of the ecological impact of *C. sapidus* can be coordinated with its possible exploitation as a future resource for the regional fishery sector.

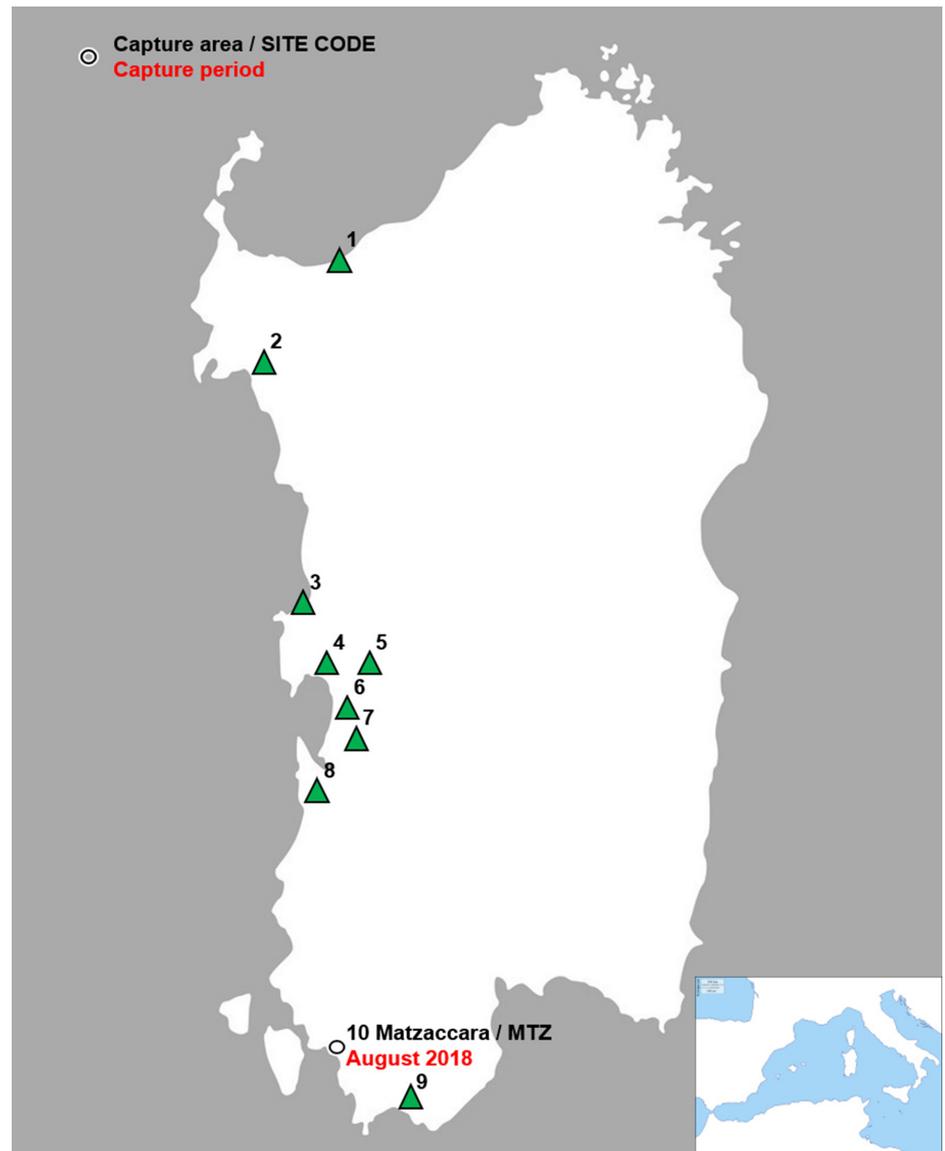
**Key words:** non-indigenous species, control management, Mediterranean Sea, Sardinia**Introduction**

The blue crab, *Callinectes sapidus* Rathbun, 1896 (Crustacea, Decapoda, Portunidae), is a western Atlantic species which occurs naturally between southern Canada and northern Argentina (Williams 1984). It has been present in the Mediterranean Sea since the mid-twentieth century (Garcia et al. 2018); the first Mediterranean record was reported in 1948 in the northern Adriatic Sea (Giordani-Soika 1951; Galil et al. 2002), although its presence in the Aegean Sea was suspected as early as 1935 (Riedl 1983; Nehring 2011). The spread of *C. sapidus* in Mediterranean coastal waters and in Atlantic Europe has been previously reviewed by Castejón and Guerao (2013); Ribeiro and Veríssimo (2014); Manfrin et al. (2016) and Mancinelli et al. (2017a). Noticeably, with the only exception of the Aegean Sea (Pancucci-Papadopoulou et al. 2005; Tureli Bilen et al. 2011), most of the reports in Mediterranean and, in general, European waters refer to

episodic captures, limited in the number of collected specimens and the temporal period considered (Dulčić et al. 2010; Nehring 2011). *Callinectes sapidus* is an eurythermal and euryhaline species, with high fecundity, strong swimming capacity and aggressive behaviours. These traits may have contributed to its establishment in the Mediterranean Sea (Galil et al. 2002), and its inclusion on the list of the 100 worst invasive alien marine species in the Mediterranean, given negative impacts on human activities (Zenetos et al. 2005; Streftaris and Zenetos 2006; Katsanevakis et al. 2014). Recent Italian records were reported from Abruzzi waters in the central Adriatic Sea (Cagri et al. 2012), in the Acquatina lagoon (South Adriatic Sea) and Torre Colimena basin in the Ionian Sea (Mancinelli et al. 2013; Carrozzo et al. 2014), within the Sacca di Goro in the North Adriatic Sea (Manfrin et al. 2015), at the mouth of Basento and Bradano rivers near Metaponto, at the border of the Basilicata and Apulia regions, Ionian Sea (Stasolla and Innocenti 2014), near the harbour of La Spezia in the Ligurian Sea (Suaria et al. 2017), and at the eastern coast of Sicily (Lipej et al. 2017). More recently, the first information on the occurrence of *C. sapidus* in Sardinia (Italy, western Mediterranean) in 2017 and its spread along the Sardinian coastline in June 2018, have been described (Culurgioni et al. 2018). In the last few years, the Sardinian coastal environments have witnessed the arrival and establishment of several non-indigenous species, including macroalgae (Cossu et al. 1992), fouling organisms (Ferrario et al. 2017), fish (*Fistularia commersonii* Rüppell, 1838), crustaceans (*Penaeus japonicus* Spence Bate, 1888; *Procambarus clarkii* Girard, 1852), and molluscs like *Melibe viridis* (Kelaart, 1858), *Rapana venosa* (Valenciennes, 1846), *Anadara transversa* (Say, 1822), *Arcuatula senhousia* (Benson, 1842), *Brachidontes pharaonis* (P. Fisher, 1870), *Fulvia fragilis* (Forskål in Niebuhr, 1775), *Magallana gigas* (Thunberg, 1793), *Ruditapes philippinarum* (Adams and Reeve, 1850) and *Xenostrobus securis* (Lamarck, 1819). These species have had different impacts on native biodiversity and the regional fishery sector (Lumare 1988; Savarino and Turolla 2000; Cannas et al. 2009; Holdich et al. 2009; Doneddu 2011; Lodola et al. 2011; Mura et al. 2012; Meloni and Piras 2013; GSA-SIBM 2018). In the present study, we report another newly detected specimen of *C. sapidus* and document the ongoing expansion of this alien species in south-western Sardinian coastal habitats.

## Materials and methods

An adult male specimen of blue crab *C. sapidus* was incidentally captured on August 1<sup>st</sup>, 2018 in the coastal waters of Matzaccara (Figure 1, South-Western Mediterranean Sea, 39°11'N; 8°43'E), a small fishery village belonging to the Municipality of San Giovanni Suergiu, Province of Carbonia-Iglesias (CI), Sardinia, Italy. Capture was carried out by local small-scale



**Figure 1.** Distribution of the recent records of *Callinectes sapidus* in the Sardinian coastal habitats. Capture area, period and site code of the present finding of *Callinectes sapidus* collected in South-Western Sardinia (10, black and white circle). Previous records (1–9) are indicated in green triangles and are based on Culurgioni et al. 2018. For details see Supplementary material Table S1.

fishery operators with a funnel trap baited with fish. These funnel traps are used for the artisanal coastal fishery and are located in low depth waters (bathymetry < 3 m). Once the crab was captured, it was immediately delivered to the Sardinian Forest Ranger Service and Environmental Surveillance, who contacted the authors in order to identify the crab to species level. The crab was identified as a male *C. sapidus* using the key and description in Williams (1974, 1984), on the basis of the characteristics of the shell and the shape, the arrangement of the first pleopods and the typical T-shaped abdomen (Figure 2). The specimen was photographed and measured with calipers and linear meter. The following measurements were determined: Carapace Width (*CW*), which is the distance between the base of the marginal spines, and the Carapace Length (*CL*), which is the



**Figure 2.** Dorsal coloration of the *Callinectes sapidus* specimen captured in the coastal waters of Matzaccara (Sardinia, Italy). Photograph by Pierluigi Piras.



**Figure 3.** Ventral white coloration, bluish coloration of the legs and T-shaped abdomen of the *Callinectes sapidus* specimen captured in the coastal waters of Matzaccara (Sardinia, Italy). Photograph by Pierluigi Piras.

distance from the pick of the epistomial spine and the back margin of the carapace. The captured specimen was deposited in the Department of Veterinary Medicine of the University of Sassari (Sassari, Italy).

### Results and discussion

The CW of the captured *C. sapidus* was 136 mm and CL was 64 mm. The distinctive characters were represented by a wider than long carapace (more than twice, including the antero-lateral spines), by a brownish to green color dorsally (Figure 2) and by a white color ventrally (Figure 3).

Diverse bluish colored tints were present on the legs (Figure 3). The front presented two obtuse to acuminate, broadly triangular teeth with sinuous inner margins longer than outer margins, and nine anterolateral, acuminate teeth, the larger one long and sharp-pointed at the lateral corner. Moreover, the male *C. sapidus* specimen presented the typical T-shaped abdomen. In the present study, we documented the presence of this species in the south-western coastal habitats of Sardinia (Italy). Culurgioni et al. 2018 reported the first record of *C. sapidus* in Sardinia in April 2017 in a brackish lagoon of the central-western coast. The same authors documented the spreading of *C. sapidus* along the western coast of Sardinia in June 2018 (Figure 1). Both records show the rapid expansion of *C. sapidus* along the Sardinian coastline from North to South, while the eastern coast of Sardinia has not yet experienced the expansion of the blue crab (Culurgioni et al. 2018). The population of *C. sapidus* closest to the western coast of Sardinia is the one from the Balearic Islands (Garcia et al. 2018), which is about 300–400 km far away. The colonization of the Sardinian coastal habitats by *C. sapidus* could have happened in three different ways: a) natural spread from neighbouring populations, by active swimming of adults or passive transport of larvae (Galil et al. 2002); b) introduction of larvae by ballast tanks of ships (Galil et al. 2002; Nehring 2011) or c) intentional introduction for commercial purposes (Garcia et al. 2018). At present, there is no definitive evidence of which of these three is the most likely vector of the introduction of *C. sapidus* in Sardinian coastal habitats. Several reports of negative effects of the blue crab on invaded benthic communities and on fishing (Nehring 2011; Perdikaris et al. 2016) have been reported. The ability of *C. sapidus* to attack fish and other crustaceans trapped in fishing nets and to damage fishing gear are the reasons why this species is now considered to be a potential social and economic impact, in addition to its effect on native biodiversity (Mancinelli et al. 2017b; Garcia et al. 2018). In the United States, the blue crab is considered a valuable seafood and supports important commercial and recreational fisheries (Sharov et al. 2003; Perry 2015). In the last decade, several investigations have emphasized the high nutritional qualities of Mediterranean blue crab meat (Küçükgülmez and Çelik 2008; Zotti et al. 2016), and small *C. sapidus* fisheries are currently located in Turkey (Ayas and Ozogul 2011) and northern Greece (Kevrekidis and Antoniadou 2018). The blue crab is also included in the FAO List of Species for Fishery statistics Purposes (AFSIS) and identified with the FAO-3-Alpha Species code CRB, a unique code consisting of 3 letters and defined to be directly related to the scientific name of this species. In 2016, the Spanish Ministry of Fishery included *C. sapidus* on its list of commercial fish species (Garcia et al. 2018). In Italy, *C. sapidus* is not included in the recent Italian official list of seafood trade names (MIPAAF

2017), although the generic term of “*Granchio nuotatore*” (= “swimming crab”), which is ascribed to all the species belonging to the genus *Callinectes*, is under use. Despite this, *C. sapidus* has started to penetrate the Sardinian fish market: sporadically appearing in local markets, mixed with native crab species (Meloni, *unpublished data*). It is difficult to predict a precise impact of *C. sapidus* on the Sardinian biodiversity. At present, due to its potential invasive behaviour and its pronounced aggressiveness, it is considered a present threat for native crab species (eg. *Portunus* spp., *Carcinus aestuarii* (Nardo, 1847), *Carcinus maenas* (Linnaeus, 1758)). However, according to Mancinelli et al. (2017b), the implementation of management plans of *C. sapidus* in invaded habitats may support the integration and coordination of common policies focused on both fishery sectors and non-indigenous species management among Mediterranean countries. The ongoing expansion of the blue crab along the Sardinian coastline offers the possibility of identifying successful policies of exploitation and marketing for a seafood product whose economic value has already been recognized in the United States (Mancinelli et al. 2017b). Efforts need to be applied by the Regional authorities including sampling campaigns to control and update the population size and occupancy area of the Sardinian coastline by this non-indigenous species. The management and control costs of *C. sapidus* in invaded habitats may ultimately be converted into profits for local coastal populations as a future resource for the regional fishery sector (Mancinelli et al. 2017b). However, the possible ecological impact of the blue crab on Sardinian biodiversity is presently unclear and needs greater scrutiny.

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#### Supplementary material

The following supplementary material is available for this article:

**Table S1.** Records of *Callinectes sapidus* in the Sardinian coastal habitats.

This material is available as part of online article from:

[http://www.reabic.net/journals/bir/2019/Supplements/BIR\\_2019\\_Piras\\_etal\\_Table\\_S1.xlsx](http://www.reabic.net/journals/bir/2019/Supplements/BIR_2019_Piras_etal_Table_S1.xlsx)