Short Communication

Further evidence of the occurrence of the Atlantic blue crab *Callinectes sapidus* (Rathbun 1896) (Crustacea: Decapoda: Portunidae) along the central Tyrrhenian coast

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Abstract - We report evidence of the occurrence of the alien invasive crab *Callinectes sapidus* along the coast of Latium (central Tyrrhenian Sea, Italy). Original data refer to five adult females found in July 2022 in the Special Protection Area of "Torre Flavia" (Municipalities of Ladispoli and Cerveteri; IT6030020). Indirect evidence was obtained by web sources and personal communications by tourists and fishermen from the same site (including a juvenile reported on February 2023) and from neighbouring localities: Passoscuro (Municipality of Fiumicino), Santa Marinella, and Tarquinia. The Atlantic blue crab appears sparsely distributed along the coast of Latium, although its presence, even if still occasional, might prelude to a concerning scenario in relation to its high invasiveness. The Atlantic blue crab is known to have a severe impact on the invaded habitats, including the transmission of pathogens and parasites. Therefore, further monitoring aimed at collecting data about the distribution and population structure of this species are urgently required in order to develop strategies for the effective control of this non-native crustacean and the mitigation of its impact.

Key words: invasive species, Latium, Mediterranean Sea, non-indigenous species.

Riassunto - Ulteriori prove della presenza del granchio reale blu *Callinectes sapidus* (Rathbun 1896) (Crustacea: Decapoda: Portunidae) lungo la costa tirrenica centrale.

Sono qui riportati nuovi dati sulla presenza del granchio alloctono invasivo *Callinectes sapidus* lungo le coste del Lazio (Mar Tirreno centrale, Italia). I dati originali sono relativi a cinque femmine adulte rinvenute nel periodo luglio-agosto 2022 nella Palude di Torre Flavia (ZPS IT 6030020; Ladispoli, Cerveteri). Altri dati indiretti sono stati ricavati da fonti web e da comunicazioni personali di turisti e pescatori provenienti da siti limitrofi (Passoscuro-Fiumicino, Santa Marinella, Tarquinia). La presenza di *C. sapidus* appare sparsa lungo le coste del Lazio e questo scenario desta preoccupazione per gli impatti a livello ecosistemico e la potenziale trasmissibilità di parassiti e patogeni. Pertanto, è urgente un ulteriore monitoraggio sulla loro presenza e distribuzione (compresi i dati sulla struttura della popolazione). Al riguardo, questa nota intende stimolare la realizzazione di strategie per il controllo di questo crostaceo non autoctono e la mitigazione dei suoi impatti sulle comunità autoctone.

Parole chiave: Lazio, Mar Mediterraneo, specie alloctone, specie invasive.

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The Atlantic blue crab *Callinectes sapidus* (Rathbun, 1896) (Crustacea: Decapoda: Portunidae) is a commercially important species, widely distributed in estuaries and lagoons along the Western Atlantic coast from Canada to Argentina (Nehring, 2011). This invertebrate is a voracious euryhaline omnivorous predator commonly found on muddy and sandy bottoms, generally at depths <35 m (Hill *et al.*, 1989; Galil *et al.*, 2011). The Atlantic blue crab is considered one of the 100 worst invasive alien species in the Mediterranean Sea, producing strong negative impacts on coastal human activities and on native biological diversity (e.g., Streftaris & Zenetos, 2006; Daban *et al.*, 2016; Mancinelli *et al*., 2017; Prado *et al*., 2020; Di Martino & Stancanelli, 2021).

This crustacean was probably introduced into the Mediterranean through ballast water and, perhaps, by cleaning fishing nets in non-infested waters after they had been contaminated in places where the species is present (Morais *et al.,* 2019). The earliest confirmed records in the Mediterranean were found in the northern Adriatic Sea (Giordani-Soika, 1951) and in Israel (Holthuis & Gottlieb, 1955) in mid-20th century, although its presence in the Aegean Sea was recorded already in 1935 (Nehring, 2011). Nowadays, the species is considered "virtually ubiquitous" in the Mediterranean Sea (see Mancinelli *et al.*, 2017, 2021, for a complete database of the species' distribution).

In Italian waters, most records were collected in the Adriatic and Ionian seas, primarily in coastal and estuarine habitats but also in few freshwater habitats (see Castriota *et al*., 2012; Cilenti *et al*., 2015; Gennaio *et al*., 2006; Manfrin *et al*., 2015, 2016; Brusco *et al.,* 2021;

Mancinelli *et al.*, 2021; Scalici *et al.*, 2022; Vecchioni *et al*., 2022a, 2022b). Furthermore, the species is expanding westwards, with confirmed records in the Ligurian Sea (Suaria *et al.*, 2017) and in Sardinian coastal waters (Piras et al., 2019; Culurgioni *et al.*, 2020), as well as in the central and southern sectors of the Tyrrhenian Sea, in Latium, Campania and Tuscany (Bisconti & Silvi, 2005; Stasolla & Innocenti, 2014; Cerri *et al.*, 2020; Tiralongo *et al*., 2021), Calabria, Basilicata and Sicily (Cavaliere & Berdar, 1975; Stasolla & Innocenti, 2014; Giacobbe *et al*., 2019; Cerri *et al.*, 2020), both in marine and freshwater habitats (Cerri *et al.,* 2020; Scalici *et al.*, 2022; Vecchioni *et al.*, 2022a, 2022b).

We recorded information on the Atlantic blue crab occurrence along the central Tyrrhenian coast of Latium by using both direct (collection of specimens) and indirect records (interviews to local fishermen and websites).

The five specimens were collected with a fishing hand net on 28 and 31 July 2022 by a group of children bathing during their summer holidays within the Torre Flavia wetland Special Protection Area (IT6030020, 147/2009/EU Bird Directive) in the central Tyrrhenian Sea, on a muddy bottom near the mouth of a small stream (Fosso della Piscina di Torre Flavia; 41°57'26.5 "N 12°02'58.1 "E; Fig. 1) and at a depth of about 5-15 cm (further information about the site in Causarano & Battisti, 2009; Battisti *et al.,* 2021). The specimens were then preserved in 90% ethylic alcohol and deposited in the invertebrate collection of Torre Flavia "Long Term Ecological Research Station" (catalogue numbers 001 to 005) under the care of C. Battisti.

The five specimens of *C. sapidus* (all females) were identified following Williams (1974) and their carapace width (CW) and carapace length (CL) measured using a professional Vernier calliper. The specimens had an average carapace width (CW) of 152.2 mm (± 2.95; range: 150-157 mm) and an average carapace length of 79.4 mm (± 1.52; range: 69-73 mm; Fig. 2).

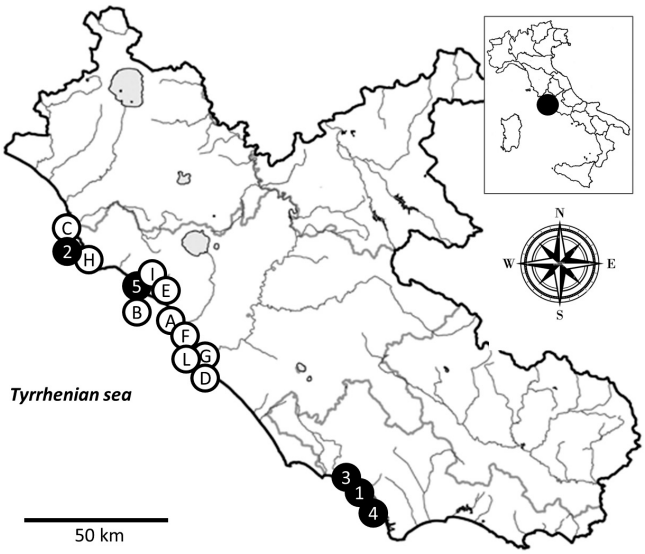

Fig. 1 - Map of the study area (Latium, Tyrrhenian central Italy) with record of Atlantic blue crab *Callinectes sapidus* (Rathbun 1896). Black dots: original data (numbers); white dots: indirect data (letters). See Table 1 for details. / Mappa dell'area di studio (Lazio, Italia centrale tirrenica) con segnalazioni del granchio reale blu *Callinectes sapidus* (Rathbun 1896). Cerchi neri: dati originali (numeri); cerchi bianchi: dati indiretti (lettere). Si veda Tabella 1 per dettagli.

Indirect data were obtained through interviews to local fishermen and citizens, and through local verified web sources.

The new direct records add to those already published for other sites of Latium. Moreover, further indirect data have been obtained from fishermen and citizens, and through local web sources starting from 2021 (Tab. 1, Figs. 1 and 2).

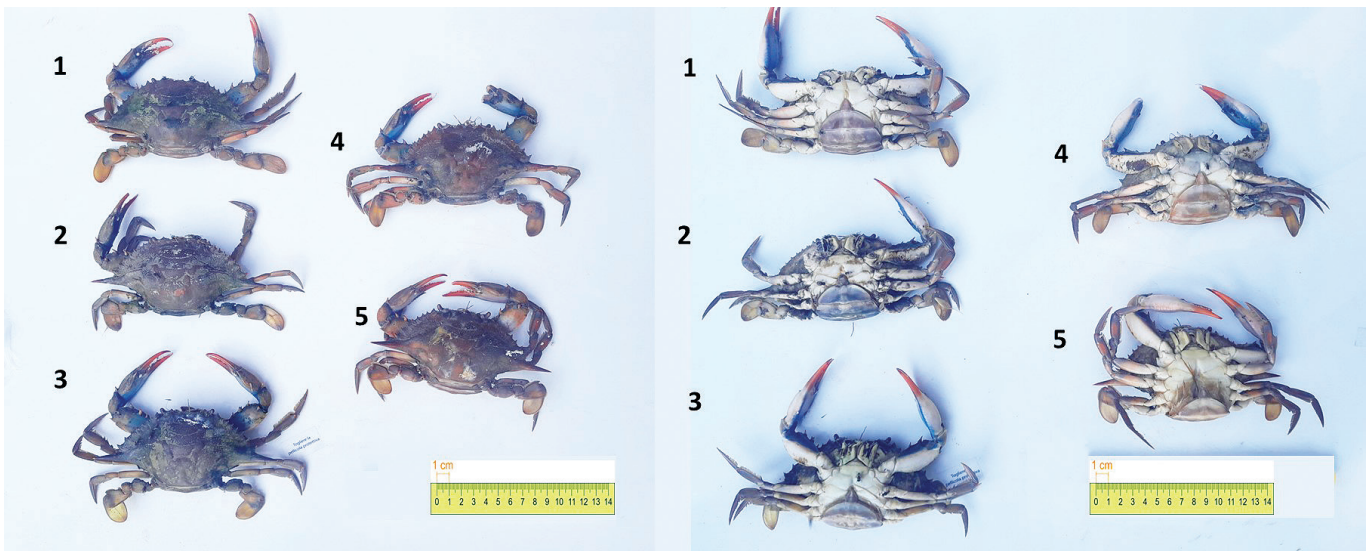

Fig. 2 - Specimens of Atlantic blue crab *Callinectes sapidus* (Rathbun 1896) caught in the Torre Flavia wetland. CW (carapace width) and CL (carapace length) measurements (in mm): 1: CW: 15.7; CL: 7.3; 2: CW: 15.1; CL: 7; 3: CW: 15.3; CL: 7; 4: CW: 15: CL: 7; 5: CW: 15; CL: 6.9). / Esemplari di granchio reale blu *Callinectes sapidus* (Rathbun 1896) catturati presso la Palude di Torre Flavia. Misurazioni di CW (ampiezza del carapace) e CL (lunghezza del carapace): 1: CW: 15,7; CL: 7,3; 2: CW: 15,1; CL: 7; 3: CW: 15,3; CL: 7; 4: CW: 15: CL: 7; 5: CW: 15; CL: 6,9).

Although small numbers of individuals do not attest to the presence of a viable local population of the Atlantic blue crab, these additional data for northern Latium may rise concern. In fact, this coastal area hosts many protected areas, both coastal (Macchiatonda Nature Reserve; Sabbie Nere Nature Reserve; Special Protection Area of the Torre Flavia Wetland; Riserva naturale del Litorale romano), and marine (Secche di Torre Flavia; Special Area of Conservation IT6030009; Habitat Directive 92/43/EEC) that protect native biological diversity of high ecological and conservation interest (Battisti *et al.*, 2007).

Due to their special characteristics (ease of access, location in anthropised areas), coastal wetlands are particularly susceptible to invasion by alien species (Tricarico *et al*., 2016). In our case, evidence have already been obtained for the Torre Flavia wetland of the occurrence of a large number of non-native species of both vertebrates (Amori & Battisti, 2008; Marini *et al.*, 2011, 2013; An-

Tab. 1 - List of original (numbers) and indirect (letters) records of Atlantic blue crab *Callinectes sapidus* (Rathbun 1896) from Latium (central Italy). Sites, notes (including number of specimens when available), date, and related sources (original data: bibliographic references and this study; unpublished data: personal communications and web sites) have been reported. / Elenco delle segnalazioni originali (numeri) e indirette (lettere) di granchio reale blu *Callinectes sapidus* (Rathbun 1896) nel Lazio (Italia centrale). Sono riportati i siti, le note (compreso il numero di esemplari quando disponibili), la data e le fonti correlate (dati originali: riferimenti bibliografici e questo studio; dati non pubblicati: comunicazioni personali e siti web).

n	Original data	Notes	Date	Ref
1	Between Capo Portiere and Foce Verde (Latina) (approx. 41°24'46"N 12°50'38"E)	1 adult (caught by recreational fishermen)	2019 (undermined)	Gaglioti & Mancini (2021)
2	Civitavecchia, in the sea in front to 'La Frasca' Natural Monument (42°08'54.6" N, 11°43'13.8"E)	1 female (caught by fishermen with a trimmel net; 35 m in depth)	December, 9, 2019	Tiralongo *et al*. (2021)
3	Rio Martino, Latina (approx. 41°22'59.3"N 12°54'55.2"E)	1 female with eggs (caught by a fishermen)	June, 2020	Gaglioti & Mancini (2021)
4	Bufalara (Circeo National Park, Sabaudia Municipality: 41°21'42.07''N, 12°57'02.12" E)	carcass (7 cm long claw) recorded by citizen scientists	March, 3, 2021	Gaglioti *et al*. (2021)
5	Ladispoli, Fosso della Piscina di Torre Flavia (41°57'26.7"N 12°02'58.1"E)	5 adult (females)	July, 28-31, 2022	this study
	Unpublished data	**Notes**	**Date**	**Sources**
A	sector of the sea in front of Passoscuro (Municipality of Fiumicino; approx. 41°54'04"N 12°09'21"E)	large number of specimens	from 2021 (undermined)	C. Magagnoli and fishermen of Porto Pidocchio (Ladispoli) (pers. comm.)
B	sector of the sea in front of Ladispoli (approx. 41°57'07"N 12°02'54"E)	1-3 specimens	from 2021 (undermined)	C. Magagnoli and fishermen of Porto Pidocchio (Ladispoli) (pers. comm.)
C	mouth of Mignone river (42°10'35.9"N 11°44'03.5"E)	2 specimens	July, 13, 2022 and August, 2022	http://www.tusciaweb.eu/2022/08/due-granchi-blu-pescati-vicino-la-foce-del-mignone/
D	Ostia (Tibidabo beach; 41°43'14.2"N 12°17'48.4"E)	1 adult	August, 2022	https://video.corriere.it/granchio-blu-passeggiata-spiaggia-il-ritrovamento/c404ce8e-1d64-11ed-9bc5-36542fd1b108
E	Ladispoli (Fosso della Piscina di Torre Flavia; 41°57'26.7"N 12°02'58.1"E)	1 female	August, 2022	pers. comm. (anonymous)
F	Fregene-Focene (undetermined site)	undetermined	August/ September, 2022	https://www.ilmessaggero.it/roma/news/granchio_blu_costo_fregene_focene_prezzo_commestibile_ricette_news-6952279.html
G	Fiumicino (Ponte della Scafa; 41°45'12.5"N 12°16'40.7"E)	undetermined number caught by fishermen (anonymous)	October, 2022	https://www.civonline.it/2022/10/02/il-granchio-blu-invade-il-litorale-romano/
H	sandy bottom near Santa Marinella (approx. 42°01'51"N 11°50'35"E)	undetermined number	n.d. 2022	U. Pessolano (pers. comm.)
I	Torre Flavia beach (41°57'28.4"N 12°02'55.8"E)	1 juv.	February, 14, 2023	C. Mentonelli (pers. comm.); https://www.civonline.it/2023/02/16/a-torre-flavia-spunta-il-primo-baby-granchio-blu/
L	Mouth of Tiber river (undetermined site)	undetermined number	undermined	https://roma.repubblica.it/cronaca/2022/09/27/news/roma_granchio_blu_strage_telline-367559336/

gelici *et al.*, 2012; Battisti *et al.*, 2015; Ferri *et al.*, 2020, 2021; Grillo *et al.*, 2020; Di Blasio *et al.*, 2021; review in Battisti *et al.*, 2021; Gallitelli *et al.*, 2022) and invertebrates (Chiesa *et al.*, 2006; Scalici *et al.*, 2010).

Currently, *C. sapidus* along the Latium coast appears to be sparse and stable, although the very presence of the species is a cause for concern due to its high invasiveness, its impact in invaded habitats (Clavero *et al*., 2022) and the risk of transmission of pathogens and parasites that use this crab as a host or vector, as in the case of the alien leech *Myzobdella lugubris* Leidy 1851 (Liuzzo *et al.*, 2018; see also: Coates & Rowley, 2022; Marangi *et al.*, 2022).

Therefore, further assessment of the presence, distribution, and population structure of this crustacean is urgently required using all available approaches, including citizen science projects and the use of social media. These methods have proven particularly effective in detecting and mapping blue crab distribution in Southern Europe (Italy: Cerri *et al.*, 2020; Spain: Clavero *et al.* 2022; Izquierdo-Gómez, 2022; Portugal: Encarnação *et al.*, 2021). Early detection and the continuous collection of records about alien species distribution are crucial in order to act effective control and mitigation measures to limit their impact on invaded habitats (Encarnação *et al.*, 2021).

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