

NEW REPORTS ON THE PRESENCE OF *CALLINECTES SAPIDUS* (RATHBUN, 1896) ALONG THE CALABRIAN COAST

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Abstract – This work, carried out in collaboration with professional fishing operators, aims to indicate new areas of settlement of the species *Callinectes sapidus* (Rathbun, 1896) present both in the Tyrrhenian Sea and in the Ionian Sea along the coast of Calabria. Part of the individuals of *C. sapidus* sampled were taken at the mouths of the rivers and part in the salt lakes. For each individual caught, biometrics, weight, specific areas and distribution periods, as well as fertility or the presence of eggs (if female) were recorded. The captured individuals have been housed in aquariums to monitor and study their social behavior, predation techniques and food preferences for about six months. The sampled individuals of the species *C. sapidus* were found for the most part in the Ionian Sea and, more precisely, in the surroundings of the mouth of the river Corace in the direction of Catanzaro Lido (CZ), in the area of Steccato di Cutro where the river Tacina flows into the Gulf of Squillace and within the lakes of Sibari (artificial lakes), in whose area are currently also used as a food resource. Other specimens have been found in the Tyrrhenian Sea in the lakes La Vota of Gizzeria (CZ).

Introduction

Callinectes sapidus is a decapod crustacean of the Portunidae family, native to the western Atlantic Ocean and Mexican gulf. Its introduction into the Mediterranean Sea occurred through ballast water present in ships coming from the Atlantic calling at the ports of our coasts [6]. *C. sapidus* is found to be one of the most prevalent alien species in European waters [4].

C. sapidus is considered an invasive alien species because, by establishing itself outside its native range, it has overcome biotic and abiotic obstacles that have favored its establishment. This species has generated a negative impact both at the ecological level and at the quantitative level of the number of native species present [1].

C. sapidus tolerates large variations in temperature and salinity, euryhaline and eurytherm, tolerating values below 0.08 mg/l of dissolved oxygen. It is assumed that fertilized females head to the open sea for the release of eggs [5].

C. sapidus usually lives at depths of 35-90 meters and prefers sandy and muddy bottoms. It has been also reported in estuaries and mouths of rivers [10]. It is moderately omnivorous and feeds on fresh algae, small echinoderms, actinias, fish, molluscs, and organic debris of all kinds, with a marked preference for fish [7].

The first reported capture of this species in the Mediterranean occurred in 1949 in Grado (upper Adriatic Sea), and it was an adult female specimen.

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In 1950 a male specimen was caught in the Venice Lagoon. Also found in the Gulf of Genoa [5], Calabria and Sicily [9].

C. sapidus has also been found in Sardinia in marine, freshwater and transitional sites in the period between 2017 – 2018 [2].

Another 5 individuals have been found in the Channel Sicily off the port of Mazara del Vallo [3], the species is continuing its expansion.

The small number of *C. sapidus* specimens on which the study has been conducted, only 8, delivered by fishermen in the areas concerned, is not an indication of a low presence of the species, but represents a small portion of the quantities currently caught and exploited for food. Capture of mature females and males reveals possible establishment of the species in the reference area although no juvenile or postlarval stages have been observed. The objective of this work is to report the presence of *C. sapidus* in the new areas colonized by it in the Ionian and Tyrrhenian Seas of Calabria. The rapid expansion of this species underscores the importance and priority of conducting invasive species monitoring. In addition to documenting the presence and speed of expansion of the species themselves, monitoring also serves to understand whether their distribution in Calabria is due to a natural spread of crabs into areas increasingly suitable for their survival or has been induced by fishermen as a new commercially exploitable resource.

Materials and Methods

C. sapidus specimens were generally acquired by delivery from fishing companies with whom cooperation agreements were made through the intermediation of the 4 Calabrian FLAGs (Fisheries Local Action Groups).

These organizations are concerned with pursuing balanced development of the fisheries sector while respecting marine and environmental resources by making investments on the ground from EMFF (European Maritime and Fisheries Fund) resources.

When one of the boats owned by the agreement companies caught the specimens, the project contact person was notified.

If the latter was in a position to go to the landing site when the fishing vessel arrived, the animal was delivered in its live state; otherwise, the specimen was frozen and delivered later. For each specimen, of course, the boatmaster indicated the coordinates of the point of capture and reported them to the project contact person.

For each delivery, the specimen acquired was not chosen from all those available according to predetermined criteria, but one was acquired at random.

Since this is a very desirable species, currently used for food purposes in Calabria and increasingly in demand by the restaurant industry, the number of crabs delivered by fishermen for study purposes is by no means representative of the total quantities found in a given area, but should be considered only an index of its presence in the new territory.

Eight specimens of *C. sapidus* were caught during fishing operations. The sampled individuals of the *C. sapidus* species have mostly been found in the Ionian Sea and, more precisely, in the surroundings of the mouth of the Corace River in the direction of Catanzaro Lido (Cz), in the area of Steccato di Cutro (Kr) where the Tacina River flows into the Gulf of Squillace, and inside the Lakes of Sibari (artificial lakes), in whose area they are also currently used as a food resource.

Other specimens have been found in the Tyrrhenian Sea in the La Vota Lakes of Gizzeria (Cz). One ovigerous female specimen (Figures 2-3) was caught at a depth of about 20 meters in front of one of the rivers in which its presence was confirmed. Biometrics, weight, specific areas and periods of distribution, and fertility or presence of eggs (if female) were recorded for each individual caught.

The captured individuals (Figure 1 specimen A - B) were housed in aquariums to monitor and study their social behavior, predation techniques and food preferences for about six months.

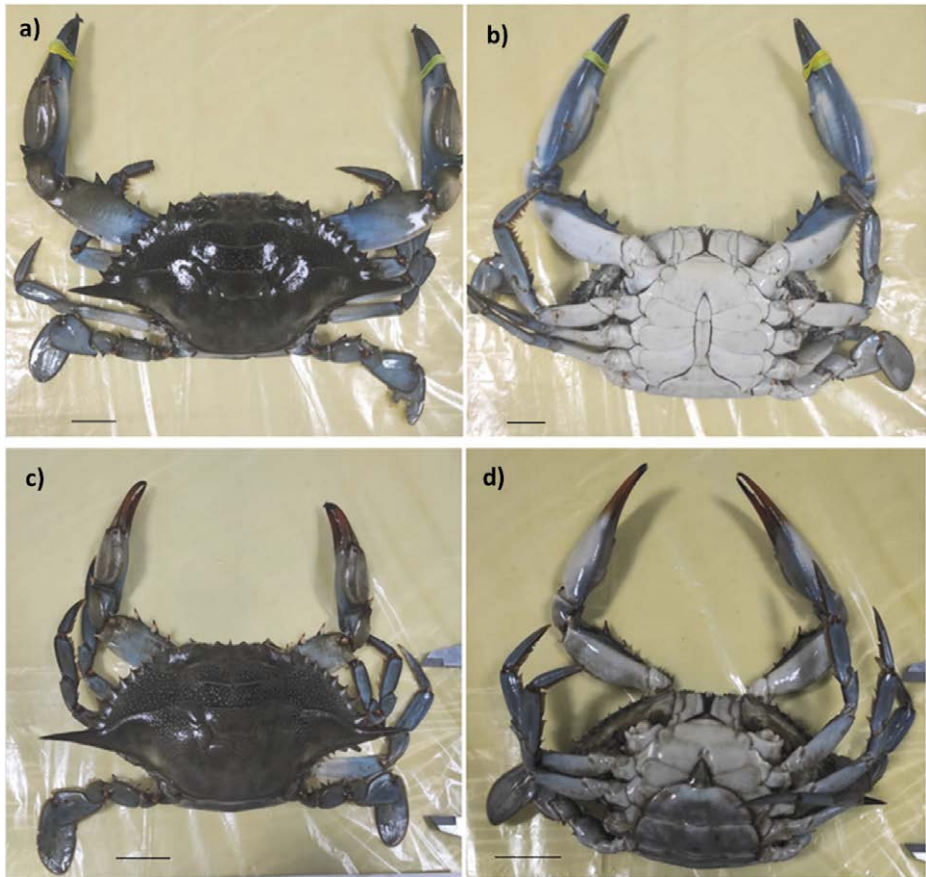


Figure 1 – a-b) Specimen (A) *C. sapidus* male found in Catanzaro Lido. c-d) Specimen (D) *C. sapidus* female belly and abdomen found in Falerna Marina. (Scale bars =2 cm).

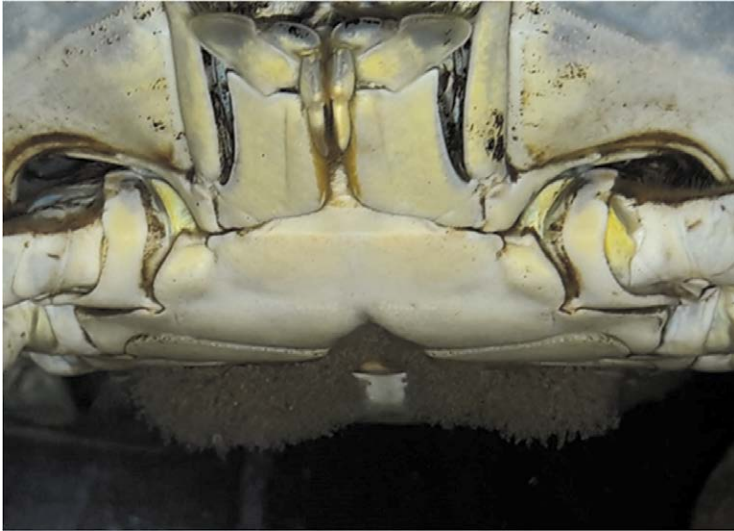


Figure 2 – Female of *C. sapidus* with presence of eggs (from MUPEM).

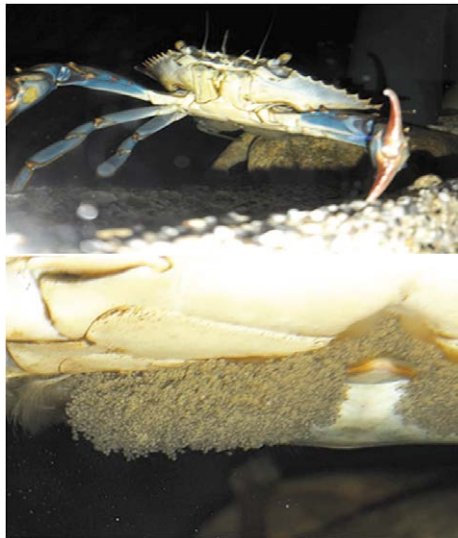


Figure 3 – Abdominal area enlargement (From MUPEM, photo taken on 10/05/2020)

Results

The first specimen (A) of *C.sapidus*, male (Figure 1- a-b), weighed 227 g, was from Catanzaro at the mouth of the Corace River captured alive on 03/05/2019 and died on

06/12/2019 in the aquarium, where it was possible to study its behavior. The carapace length of (A) (CL, mm - the distance between the center of the anterior interorbital margin and the center of the posterior margin) was 66 mm and the carapace width (CW, mm - the maximum distance between the posterior anterolateral spines) was 146 mm.

The second specimen (B), male, who died on 8/11/2019 in the aquarium e captured alive on 16/06/2019 and came from Crotona in the municipality of Cutro at the mouth of the Tacina River, weighed 252 g, with CL 74 mm and CW 163 mm.

The specimen (C), female from Catanzaro and municipality of Falerna in the locality of Lake La Vota captured dead on 13/ 11/ 2019, weighed 158 g, with CL 72 mm and CW 165 mm.

The specimen (D), female, captured dead on 13/11/2019 (Figure 1- c-d), from Falerna, weighed 171 g, with CL 68 mm and CW 151 mm.

The specimen (E), male, from Falerna, in the locality of La Vota Lake captured alive on 20/06/2019 and died on 2/12/2019, weighed 144 g, with CL 64 mm and CW 125 mm, had many epiphytes on the carapace and blackish cover.

The specimen (F), female, from Falerna captured dead on 13/11/2019, weighed 233 g, with CL 75 mm and CW 170 mm, with the presence of black spots on the limbs.

The specimen (G), an ovigerous female (Figures 2-3), from Laghi di Sibari in the municipality of Corigliano Calabro in the province of Cosenza and captured alive on 05/11/2019 and died on 01/07/2020, weighed 122 g, with CL 58 mm and CW 123 mm.

The last specimen (H), male, from Laghi di Sibari in the municipality of Corigliano Calabro in province of Cosenza and captured live on 05/06/2020, weighed 147 g, with CL 60 mm and CW 125 mm and dead on 05/10/2020.

The results (table 1) obtained showed a rapid expansion of their distribution area, but also a corresponding greater attention of the fish system operators towards the species, as well as towards other potentially impacting but with great potential for exploitation for food purposes.

Table 1 – Information related to the specimens of *C. sapidus* examined.

Specimen name	Finding location	Province	Municipality	Sex	Weight (g)	CL (mm)	CW (mm)	UTM_X	UTM_Y	Date of catch	Date of death	Sea
A	Foce fiume Corace	Catanzaro	Catanzaro	M	227	66	146	640468	4297419	03/05/2019	06/12/2019	Ionian
B	Foce del fiume Tacina	Crotone	Cutro	M	252	74	163	664065	4309619	16/06/2019	08/11/2019	Ionian
C	Lago La Vota	Catanzaro	Falerna	F	158	72	165	602458	4311405	13/11/2019	13/11/2019	Tyrrhenian
D	Lago la Vota	Catanzaro	Falerna	F	171	68	151	602458	4311405	13/11/2019	13/11/2019	Tyrrhenian
E	Lago la Vota	Catanzaro	Falerna	M	144	64	125	602458	4311405	20/06/2019	02/12/2019	Tyrrhenian
F	Lago la Vota	Catanzaro	Falerna	F	233	75	170	602458	4311405	13/11/2019	13/11/2019	Tyrrhenian
G	Laghi di Sibari	Cosenza	Corigliano Calabro	F Ovigerous	122	58	123	630666	4392203	05/11/2019	01/07/2020	Ionian
H	Laghi di Sibari	Cosenza	Corigliano Calabro	M	147	60	125	630666	4392203	05/06/2020	05/10/2020	Ionian

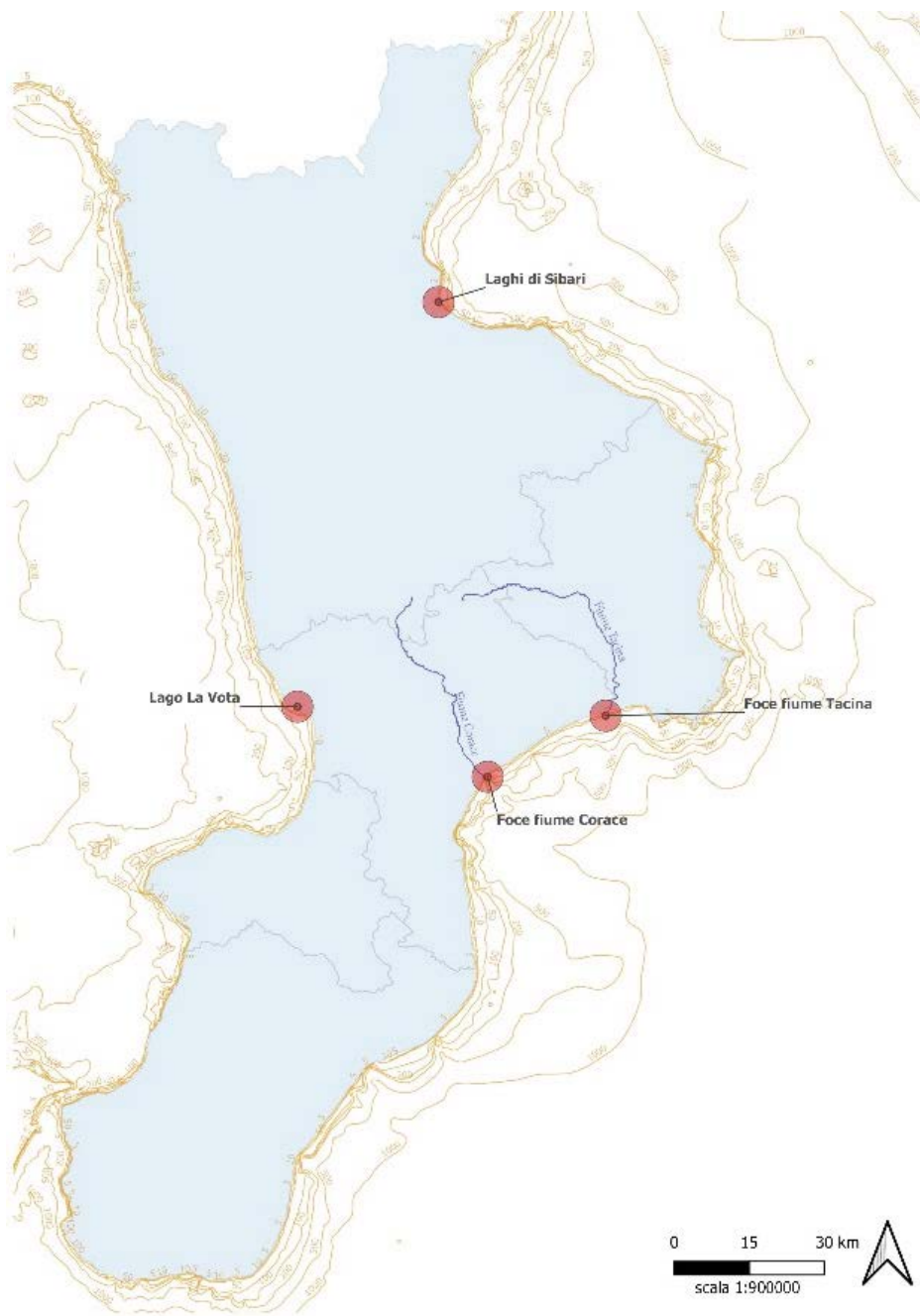


Figure 4 – Geolocation map of *C. sapidus* finding sites.

Discussion

In our opinion, the capture of mature females and males reveals a possible settlement of the species *C. sapidus* for the most part in the Ionian Sea in the following areas: mouth of the Corace River in the direction of Catanzaro Lido (Cz), Steccato di Cutro area at the point where the Tacina River flows into the Gulf of Squillace, Sibari Lakes (artificial lakes), although no juvenile or postlarval stages have been observed. Other specimens in smaller numbers have been found in the Tyrrhenian Sea in the La Vota lakes of Gizzeria (Cz).

Individuals of *C. sapidus* were monitored in a controlled environment for about 6 months and showed considerable aggression among individuals of the same species and both sexes, with females being more aggressive than males. The individuals studied and monitored in aquarium were very violent in the competition to grab food and win space. When a new specimen was placed in the aquarium, the attack took place in few seconds, and only one of the two specimens survived. It should be noted, however, that no phenomena of cannibalism were found among the specimens observed in the aquarium. The ovigerous female present in the aquarium was monitored and hatched on May 16, 2020. Unfortunately, the larvae did not survive.

Conclusions

These results confirm the continued expansion of *C. sapidus* in the Tyrrhenian and Ionian Seas areas. The monitoring of this species is of paramount importance to try to mitigate the impact it is generating on the ecosystem and biodiversity of native species and to look for future models of containment and utilization.

In conclusion, given the new numerous reports of the presence of *C. sapidus* specimens along the Tyrrhenian coasts, one wonders if the individuals sampled in the Tyrrhenian Sea come from the Ionian Sea and, if so, if this is the result of a spontaneous migration or due to deliberate anthropogenic activity. A first answer could be provided by an environmental DNA analysis, which, through molecular methodologies, is able to reveal information about the presence of a given species in a target area, on the vastness of the invasion and on its relative abundance [6].

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