

Rapid Communication

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

Giuseppe Suaria^{1,2}, Andrea Pierucci³, Pierpaolo Zanello⁴, Emanuela Fanelli⁵, Stefania Chiesa⁶ and Ernesto Azzurro^{7,*}

¹CNR-ISMAR, Institute of Marine Sciences – National Research Council, 19032 La Spezia, Italy

²Instituto Español de Oceanografía, Centro Oceanográfico de Baleares, Palma de Mallorca, Spain

³Australian Research Council – Centre of Excellence for Coral Reef Studies, James Cook University, Townsville QLD 4811, Australia

⁴Microbiology and Virology Unit, Department of Biomedical, Biotechnological, and Translational Sciences, Università degli Studi di Parma, Parma, Italy

⁵ENEA, Marine Environment Research Centre, P.O. Box 224, 19100 Pozzuolo di Lerici (SP), Italy

⁶Ca' Foscari University of Venice - Department of Environmental Sciences, Informatics and Statistics, Scientific Campus, via Torino 155, 30172 Mestre (Ve), Italy

⁷ISPRA, National Institute of Environmental Protection and Research, Sts Livorno, Piazzale dei Marmi 2, 57123 Livorno, Italy

*Corresponding author

E-mail: ernesto.azzurro@isprambiente.it

Received: 20 December 2016 / Accepted: 3 March 2017 / Published online: 24 April 2017

Handling editor: Stelios Katsanevakis

Abstract

The non-indigenous crabs *Percnon gibbesi* (H. Milne Edwards, 1853) and *Callinectes sapidus* (Rathbun, 1896) (Crustacea, Decapoda, Portunidae) are reported from Genoa and La Spezia, respectively, in the Ligurian Sea at the northern rim of the Mediterranean Sea. Both specimens were collected by fishermen who then brought them to the attention of professional scientists. This illustrates the importance of engaging local communities in detecting non-indigenous species and monitoring their spread.

Key words: non-indigenous species, participatory monitoring, awareness, Mediterranean Sea

Introduction

The grapsoid crab *Percnon gibbesi* (H. Milne Edwards, 1853) (Percnidae) is widely distributed on shallow, infralittoral, rocky shores from: California to Chile in the Pacific Ocean; North Carolina to Brazil in the Western Atlantic Ocean; and the Azores to Angola in the Eastern Atlantic Ocean (Katsanevakis et al. 2011). In the Mediterranean Sea, the species was likely introduced through shipping (Galil et al. 2008), although aquarium releases (Katsanevakis et al. 2011) and larval drift through the Strait of Gibraltar (Pipitone et al. 2001) cannot be excluded as potential pathways. In 1999, the species was first detected almost simultaneously

from the Island of Linosa (Sicily) (Relini et al. 2000) and the Balearic Islands (Garcia and Reviriego 2000). It has since spread rapidly throughout the Mediterranean. In Italian waters, the species spread north from the first record in Linosa (Relini et al. 2000), through Sicily (Pipitone et al. 2001; Mori and Vacchi 2002; Catalano 2004), the Adriatic Sea (Gravili et al. 2010), the Ionian Sea (Faccia and Bianchi 2007; Crocetta and Colamonaco 2010), and the southern (Bellantoni and Corazza 2002) and central Tyrrhenian Sea (Russo and Villani 2005). North of Naples, the distribution of this species is deemed as “not continuous” (Katsanevakis et al. 2011) and, until recently, there were no observations of *P. gibbesi* north of the Tuscan Archipelago (Stasolla and

Innocenti 2014). The species was considered absent from the Ligurian Sea (Katsanevakis et al. 2011); nevertheless, in 2016 high densities of *P. gibbesi* were reported from Elba and Capraia Islands, just south of the Ligurian Sea (Stasolla et al. 2016). Here we report a specimen from Genoa, at the northernmost extent of the Ligurian Sea.

The blue crab *Callinectes sapidus* (Rathbun, 1896) (Crustacea: Decapoda: Portunidae) is a commercially important species, widely distributed in estuaries and lagoons along the entire Western Atlantic coast from southern Nova Scotia, Canada, to Argentina (Nehring 2011). It is an euryhaline crustacean commonly found on muddy and sandy bottoms, generally at depths < 35 m (Hill et al. 1989). The earliest confirmed record in the Mediterranean is from 1948 when two specimens were found in the Northern Adriatic (Giordani Soika 1951), although its presence in the Aegean Sea was suspected as early as 1935 (Nehring 2011). Since then, *C. sapidus* has been widely recorded in Mediterranean coastal waters (Galil et al. 2008; Galil 2011; Daban et al. 2016) and in Atlantic Europe (reviewed by Manfrin et al. 2016; Mancinelli et al. in press). In Italy, there now are established populations of blue crab in the Adriatic Sea (Cilenti et al. 2015; Manfrin et al. 2016). Elsewhere from Italian seas, there are only a few reports from the Ionian and Tyrrhenian Seas (Cavaliere and Berdar 1975; Bisconti and Silvi 2005; Gennaio et al. 2006; Stasolla and Innocenti 2014; Sperone et al. 2015). In the Ligurian Sea, the only records are of two specimens collected in the the port of Genoa (1962) and a large male caught near La Spezia in 1965 (Tortonese 1965). Here we report another specimen from the eastern part of the Ligurian Sea.

Material and methods

A single specimen of *Percnon gibbesi* (Figure 1) was captured by hand on 24 October 2016 in Genoa, Italy (44°23'30.1"N; 8°57'37.6"E) at 1 m depth by a sport-fisherman. Wishing to document an unusual occurrence, the fisherman contacted professional researchers and provided the specimen. On 11 November 2016, a single specimen of *Callinectes sapidus* (Figure 2) was captured by artisanal fishermen, near the harbour of La Spezia, in a gill net set at 3–5 m depth (44°04'48.2"N; 9°52'17.58"E). Both specimens were photographed and carapace measures (length and width) were taken to the nearest mm. Thereafter, the *P. gibbesi* specimen was fixed in 75% ethanol and deposited in the biological collection of CNR-ISMAR of Pozzuolo di Lerici, whilst *C. sapidus* was fixed in 75% ethanol and kept by the collector.



Figure 1. *Percnon gibbesi*, male specimen captured on October 24th, 2016 along the coast of Genoa, Italy (Photo by A. Pierucci).



Figure 2. *Callinectes sapidus* male specimen collected on November 11th, 2016 in the Gulf of La Spezia, Italy (Photo by E. Azzurro).

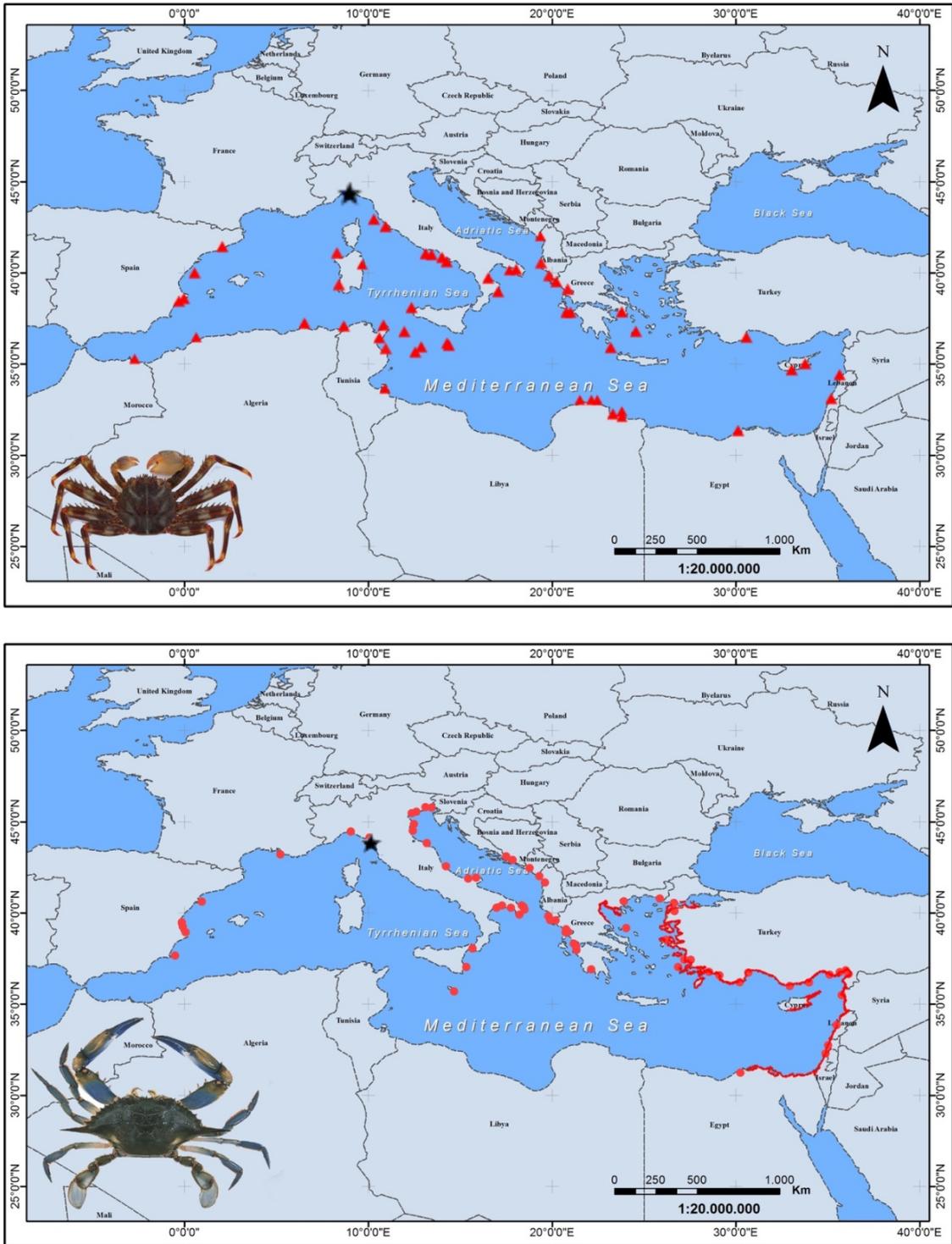


Figure 3. Capture locations of *Percnon gibbesi* (top) and *Callinectes sapidus* (bottom) in the Mediterranean Sea. Present findings are marked with a black star. Previous records are marked in red and based on the revisions of Katsanevakis et al. (2011) and Stasolla et al. (2016) for *P. gibbesi*; Galil et al. (2008), Manfrin et al. (2016) and Mancinelli et al. (in press) for *C. sapidus* (see details in supplementary material Tables S1–S2).

Results and discussion

The *P. gibbesi* specimen was an adult male with carapace length (CL) of 32.0 mm, carapace width (CW) of 27.5 mm and orbital spine width (OW) of 16 mm (Figure 1). During collection, the 4th right pereopod and the left cheliped were lost, however all morphological features fitted very well with the literature descriptions of this species. Water temperature at the time of collection was 21 °C and the bottom consisted of artificial boulders and scattered pebbles with low macro-algal cover. These characteristics of the collection habitat agree with the preferences of *P. gibbesi* for shallow artificial rocks (i.e., in ports) (Thessalou-Legaki et al. 2006), as also reported by many other observations (e.g. Pipitone et al. 2001; Fanelli and Azzurro 2004; Deudero et al. 2005; Russo and Villani 2005). More importantly, our finding confirms anecdotal reports of the occurrence of this invader in the Genoa Gulf (cited by Stasolla et al. 2016). The distribution of *P. gibbesi* has therefore expanded up to the Ligurian Sea, at the northernmost rim of the Mediterranean Sea (Figure 3). Noteworthy, the sighting of *P. gibbesi* in this case, as on other occasions (e.g. Stasolla et al. 2016), was provided first by interested citizens and then confirmed by professional scientists.

The *C. sapidus* specimen was an adult male 190.5 mm CW. At the time of collection, the surface-water temperature was 21.2 °C, and the area is mostly characterized by sandy-muddy bottoms. The fishermen immediately recognized the blue crab as an “unusual capture” of a conspicuous species “never seen before”, factors that can be key components for the participation of fishermen in the detection of exotic species (Azzurro 2016). Multiple introduction events by ballast waters are considered the most probable initial vector (Nehring 2011), and the finding of this specimen in proximity of La Spezia port is consistent with the role of ships in the spread of this species.

Both, *P. gibbesi* and *C. sapidus* are considered among the “worst” invasive alien species in the Mediterranean Sea (Streftaris and Zenetos 2006), but appropriate monitoring protocols do not exist for these species or for most marine invaders. Nevertheless, increasing efforts are being made to engage local communities in the process of detecting and reporting newcomers, representing examples of usefulness of both citizen science and local ecological knowledge (e.g. Azzurro et al. 2011). These participatory approaches provide new and complementary options to detect and investigate biological introductions while promoting awareness among local communities.

Acknowledgements

Thanks are expressed to Matteo Pierucci for detection, collection, preservation and timely reporting of the *P. gibbesi* specimen. We are grateful to the Lerici fishermen for reporting the finding of *C. sapidus*. Finally, we are indebted with the reviewers, for providing useful and highly constructive comments that greatly improved this manuscript.

References

- Azzurro E (2016) New species in the Adriatic Sea: what to do, how to recognize them. A guide for small-scale and sport fishing. ISPRA Quaderni – Ricerca Marina, 9 bis/. Accessible at: http://www.isprambiente.gov.it/en/publications/booklets/marine-research/new-species-for-the-adriatic-sea-what-to-do-how-to-recognize-them?set_language=en
- Azzurro E, Moschella P, Maynou F (2001) Tracking signals of change in Mediterranean fish diversity based on Local Ecological Knowledge. *PLoS ONE* 9: e24885, <https://doi.org/10.1371/journal.pone.0024885>
- Bellantoni N, Corazza C (2002) Segnalazione del granchio *Percnon gibbesi* (H. Milne Edwards, 1853) (Decapoda, Grapsidae) nello Stretto di Messina, versante calabrese. *Annali del Museo civico di Storia Naturale di Ferrara* 5: 129–130
- Bisconti M, Silvi E (2005) Prima segnalazione di *Callinectes sapidus* Rathbun, 1896 (Crustacea, Decapoda, Brachyura) nella provincia di Livorno. *Quaderni Museo di Storia Naturale di Livorno* 18: 1–6
- Catalano D (2004) Osservazioni su *Percnon gibbesi* (H. Milne Edwards, 1853) (Crustacea: Decapoda: Brachyura), nuova specie aliena nel litorale di Augusta (Sicilia Orientale). *Bollettino dell'Accademia Gioenia di Scienze Naturali* 37(364): 191–196
- Cavaliere A, Berdar A (1975) Presenza di *Callinectes sapidus* Rathbun (Decapoda Brachyura) nello Stretto di Messina. *Bollettino di pesca, piscicoltura e idrobiologia* 30: 315–322
- Cilenti L, Paziienza G, Scirocco T, Fabbrocini A, D'Adamo R (2015) First record of ovigerous *Callinectes sapidus* (Rathbun, 1896) in the Gargano Lagoons (south-west Adriatic Sea). *BiolInvasions Records* 4: 281–287, <https://doi.org/10.3391/bir.2015.4.4.09>
- Crocetta F, Colamonaco G (2010) *Percnon gibbesi* (Crustacea: Decapoda) and *Aplysia dactylomela* (Mollusca: Gastropoda) in the Taranto Gulf (Italy, Ionian Sea): new populations incoming. *Marine Biodiversity Records* 3: e88, <https://doi.org/10.1017/s1755267209990765>
- Daban IB, Özgür C, Tuncer S (2016) Further range expansion of the blue crab *Callinectes sapidus* (Rathbun, 1896) (Crustacea: Decapoda: Brachyura) in Turkish waters, Northern Aegean Sea: insight into distribution depth. *Cahiers de Biologie Marine* 57: 175–178
- Deudero S, Frau A, Cerda M, Hampel H (2005) Distribution and densities of the decapod crab *Percnon gibbesi*, an invasive Grapsidae, in western Mediterranean waters. *Marine Ecology Progress Series* 285: 151–156, <https://doi.org/10.3354/meps285151>
- Faccia C, Bianchi CN (2007) Prima segnalazione del granchio *Percnon gibbesi* (Milne H. Edwards, 1853) nella Calabria Ionica. *Thalassia Salentina* 30: 39–43
- Fanelli E, Azzurro E (2004) Notes on the biology of *Percnon gibbesi* (Brachyura, Grapsidae) in the central Mediterranean Sea. *Rapport Commission international Mer Méditerranée* 37: 519. Available at: http://ciesm.org/online/archives/abstracts/pdf/37/CIESM_Congress_2004_Barcelona_article_0519.htm
- 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*, Springer, 16. Berlin, pp 377–401, https://doi.org/10.1007/978-94-007-0591-3_13

- Galil B, Froglia C, Noel PY (2008) Atlas of Exotic Species in the Mediterranean. <http://www.ciesm.org/atlas/appendix2.html> (accessed 10 February 2017)
- Garcia L, Reviriego B (2000) Presència del cranc subtropical *Percnon gibbesi* (H. Milne Edwards, 1853) (CRUSTACEA, Decapoda, Grapsidae) a les Illes Balears. Primera cita a la Mediterrània occidental. *El Bolletí de la Societat d'Història Natural de les Balears* 43: 81–89
- Gennaio R, Scordella G, Pastore M (2006) Occurrence of blue crab *Callinectes sapidus* (Rathbun, 1896) (Crustacea, Brachyura), in the Ugento ponds area (Lecce, Italy). *Thalassia Salentina* 29: 29–39
- Giordani Soika A (1951) Il *Neptunus pelagicus* (L.) nell'alto Adriatico. *Natura* 42: 18–20
- Gravili C, Belmonte G, Cecere E, Denitto F, Giangrande A, Guidetti P, Longo C, Mastrototaro F, Moscatello S, Petrocelli A, Piraino S, Terlizzi A, Boero F (2010) Non indigenous species along the Apulian coast, Italy. *Chemistry and Ecology* 26: 121–142, <https://doi.org/10.1080/02757541003627654>
- Hill J, Fowler DL, Van Den Avyle MJ (1989) Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (mid-atlantic) blue crab. Georgia Cooperative Fishery and Wildlife Research Unit Athens 82 (11.100). U.S. Army Corps of Engineers. TR EL-82-4, 18 pp
- Katsanevakis S, Poursanidis D, Yokes MB, Mačić V, Beqiraj S, Kashta L, Sghaier YR, Zakhama-Sraieb R, Benamer I, Bitar G, Bouzaza Z, Magni P, Bianchi CN, Tsiakkios L, Zenetos A (2011) Twelve years after the first report of the crab *Percnon gibbesi* (H. Milne Edwards, 1853) in the Mediterranean: current distribution and invasion rates. *Journal of Biological Research-Thessaloniki* 16: 224–236
- Mancinelli G, Chainho P, Cilenti L, Falco S, Kapiris K, Katselis G, Ribeiro F (in press) The Atlantic blue crab *Callinectes sapidus* in southern European coastal waters: Distribution, impact and prospective invasion management strategies. *Marine Pollution Bulletin*, <https://doi.org/10.1016/j.marpolbul.2017.02.050>
- Manfrin C, Comisso G, Dall'Asta A, Bettoso N, Chung JS (2016) The return of the Blue Crab, *Callinectes sapidus* Rathbun, 1896, after 70 years from its first appearance in the Gulf of Trieste, northern Adriatic Sea, Italy (Decapoda: Portunidae). *Check List* 12: 1–7, <https://doi.org/10.15560/12.6.2006>
- Mori M, Vacchi M (2002) On a new occurrence of the alien flat crab, *Percnon gibbesi* (H. Milne Edwards), in the southern Sicily (Central Mediterranean Sea) (Crustacea, Brachyura, Grapsidae). *Annali del Museo Civico di Storia Naturale "Giacomo Doria"* 114: 295–302
- Nehring S (2011) Invasion history and success of the American blue crab *Callinectes sapidus* in European and adjacent waters. In: Galil BS, Clark PF, Carlton JT (eds), In the Wrong Place - Alien Marine Crustaceans: Distribution, Biology and Impacts. Springer, Netherlands, pp 607–624, https://doi.org/10.1007/978-94-007-0591-3_21
- Pipitone C, Badalamenti F, Sparrow A (2001) Contribution to the knowledge of *Percnon gibbesi* (Decapoda, Grapsidae), an exotic species spreading rapidly in Sicilian waters. *Crustaceana* 74: 1009–1017, <https://doi.org/10.1163/15685400152691061>
- Relini M, Orsi L, Puccio V, Azzurro E (2000) The exotic crab *Percnon gibbesi* (H. Milne Edwards, 1853) (Decapoda, Grapsidae) in the Central Mediterranean. *Scientia Marina* 64: 337–40, <https://doi.org/10.3989/scimar.2000.64n3337>
- Russo GF, Villani G (2005) Diffusione nel Tirreno centrale della specie alloctona *Percnon gibbesi* (Decapoda, Grapsidae). *Biologia Marina Mediterranea* 12: 329–330
- Sperone E, Giglio G, Abate M, Giglio S, Madeo E, Giglio A, Golia S, Sangermano I, Mauro G, Circosta V, Aceto M (2015) Contribution to the knowledge of the animal xenodiversity along Calabrian coasts (southern Italy, central Mediterranean). *Acta Adriatica* 56(2): 245–257
- Stasolla G, Bertuccio V, Innocenti G (2016) The end of the run? New evidence of the complete colonization of the Mediterranean Sea by the Atlantic invader crab *Percnon gibbesi* (Crustacea: Decapoda: Percnidae). *Journal of Mediterranean Ecology* 14: 63–39
- 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. *BioInvasions Records* 3: 39–43, <https://doi.org/10.3391/bir.2014.3.1.07>
- Strefitaris N, Zenetos A (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>
- Thessalou-Legaki M, Zenetos A, Kambouroglou V, Corsini-Foka M, Kouraklis P, Dounas C, Nicolaidou A (2006) The establishment of the invasive crab *Percnon gibbesi* (H. Milne Edwards, 1853) (Crustacea: Decapoda: Grapsidae) in Greek waters. *Aquatic Invasions* 1: 133–136, <https://doi.org/10.3391/ai.2006.1.3.6>
- Tortonese E (1965) La comparsa di *Callinectes sapidus* Rath. (Decapoda, Brachyura) nel Mar Ligure. *Annali del Museo civico di storia naturale di Genova* 4(165): 1–3

Supplementary material

The following supplementary material is available for this article:

Table S1. Records of *Percnon gibbesi* in the Mediterranean Sea.

Table S2. Records of *Callinectes sapidus* in the Mediterranean Sea.

This material is available as part of online article from:

http://www.reabic.net/journals/bir/2017/Supplements/BIR_2017_Suarria_et_al_Supplement.xls