

**Rapid Communication****First confirmed record of the ragged sea hare *Bursatella leachii* Blainville, 1817 in Libyan waters**Jamila Rizgalla<sup>1,\*</sup> and Fabio Crocetta<sup>2</sup><sup>1</sup>Department of Aquaculture, Faculty of Agriculture, University of Tripoli, Tripoli, Libya<sup>2</sup>Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Villa Comunale, I-80121 Napoli, ItalyAuthor e-mails: [jamilarizgalla@gmail.com](mailto:jamilarizgalla@gmail.com) (JR), [fabio.crocetta@szn.it](mailto:fabio.crocetta@szn.it) (FC)

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**Citation:** Rizgalla J, Crocetta F (2020) First confirmed record of the ragged sea hare *Bursatella leachii* Blainville, 1817 in Libyan waters. *BioInvasions Records* 9(2): 183–188, <https://doi.org/10.3391/bir.2020.9.2.02>

**Received:** 26 February 2019**Accepted:** 25 March 2020**Published:** 20 April 2020**Thematic editor:** Stelios Katsanevakis**Copyright:** © Rizgalla and Crocetta

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**OPEN ACCESS****Abstract**

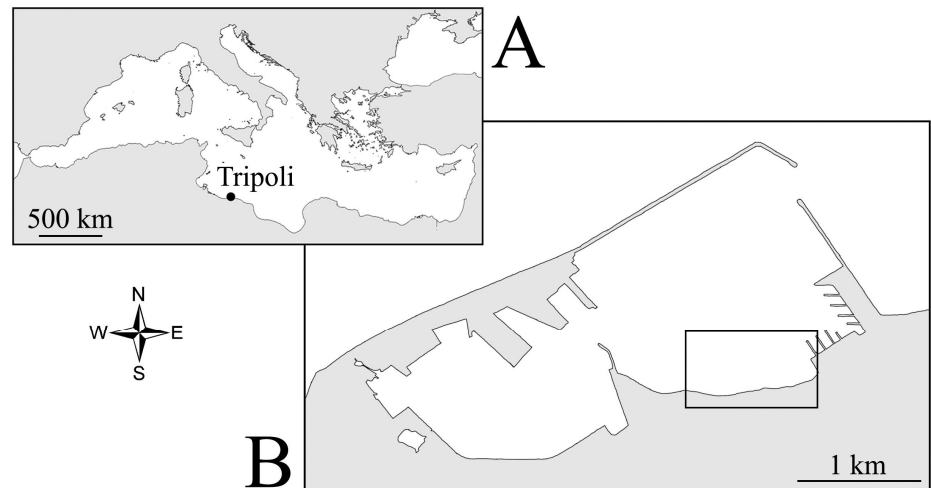
The ragged sea hare *Bursatella leachii*, a well-established cryptogenic species in the Mediterranean Sea, was found in the Tripoli Harbour within the framework of the Project “Snowball”, aiming at recording alien and cryptogenic species living along the Libyan coastline. The present record constitutes the first confirmed sighting of *B. leachii* in Libya. There are no certainties regarding possible pathway(s) of arrival of this species in the area. However, shipping or natural dispersal from nearby populations in the Mediterranean Sea constitute the most probable ones.

**Key words:** Mollusca, Heterobranchia, southern Mediterranean Sea, biological invasions, cryptogenic species

**Introduction**

Until recently, the ragged sea hare *Bursatella leachii* Blainville, 1817 (Gastropoda: Heterobranchia: Aplysiidae) has been considered a heterobranch sea slug with a circumtropical distribution, living in shallow and muddy substrates in protected estuaries and bays, that has invaded the Mediterranean Sea via Lessepsian migration from the Red Sea (Rudman 1998; Clarke 2006; Selfati et al. 2017). Bazzicalupo et al. (2018, 2020) recently reviewed its worldwide taxonomy suggesting that the genus *Bursatella* de Blainville, 1817 at large is composed of two morphologically similar but genetically distinct species: the worldwide-distributed species, *B. leachii*, that hypothetically entered the Mediterranean Sea via the Gibraltar Strait (Atlantic Ocean), and *Bursatella ocelligera* (Bergh, 1902), only known from the Central Pacific Ocean, from Gulf of Thailand to Philippines.

Uncertainties regarding the possible pathway of arrival of *B. leachii* in the Mediterranean Sea (whether via natural dispersal or with the aid of human activities) led Servello et al. (2019) to exclude it from lists of alien taxa in the Mediterranean Sea and Crocetta et al. (2020) to consider this species as cryptogenic (a species that cannot be included with confidence neither among native nor among introduced ones: see Carlton 1996).



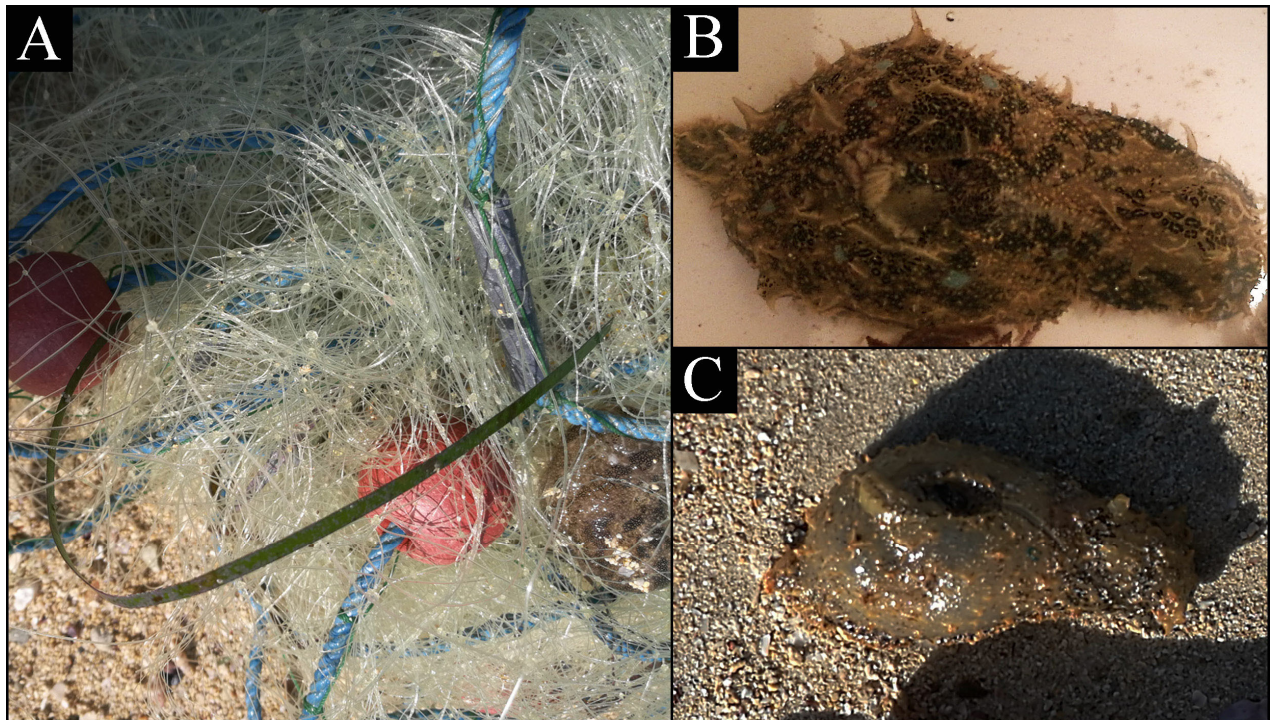
**Figure 1.** Study area. A. The location of Tripoli in the Mediterranean Sea. B. The Tripoli Harbour, with a black rectangle highlighting the sandy shore where *Bursatella leachii* was found washed ashore.

However, it still remains listed as an alien species by other authors (Petović et al. 2019; Katsanevakis et al. 2020). Notwithstanding such disputes, *B. leachii* is indeed one of the most successful recent colonizers of the Mediterranean Sea (Zenetos et al. 2016; Crocetta et al. 2017; Selfati et al. 2017; Travaglini and Crocetta 2019, among recent ones).

Selfati et al. (2017) recent review of its temporal spread in the Mediterranean Sea reported the presence of this species from 19 out of 23 countries surrounding the Mediterranean Sea. Libya is apparently one of those countries; however, its presence in the latter country was only based on the “Zgozi et al. (2002)” technical report, which was reported “*vide* Bazairi et al. (2013)” (see Selfati et al. 2017: Table S1). Further efforts to obtain a copy of the report from the putative authors (Zgozi SW, Haddoud D, Rough A) failed (see also discussions in Rizgalla et al. 2019b); moreover, according to Salem Zgozi and Daw Haddoud (*pers. communication*), the technical report in question “does not exist”, and the latter author also confirmed never seeing *B. leachii* in Libya so far. We thus hereby report the first confirmed record of this taxon in Libya, based on fieldwork within a research project aiming to investigate alien bioinvasions in Libya. We furthermore update the known spreading of *B. leachii* in the Mediterranean Sea.

## Materials and methods

The data reported in the present paper fall within the framework of the “Snowball” project that aims at monitoring the marine biodiversity in Libya by integrating information gained from field surveys and social media (citizen science projects and mining Facebook® posts). Among the various locations surveyed in Libya, particular attention was given to the Tripoli Harbour sandy shoreline (32.901140°N; 13.212579°E; Figure 1), frequently investigated so far from November 2018 to February 2019 and from October 2019 to February 2020 (see also Rizgalla et al. 2019b, c for the



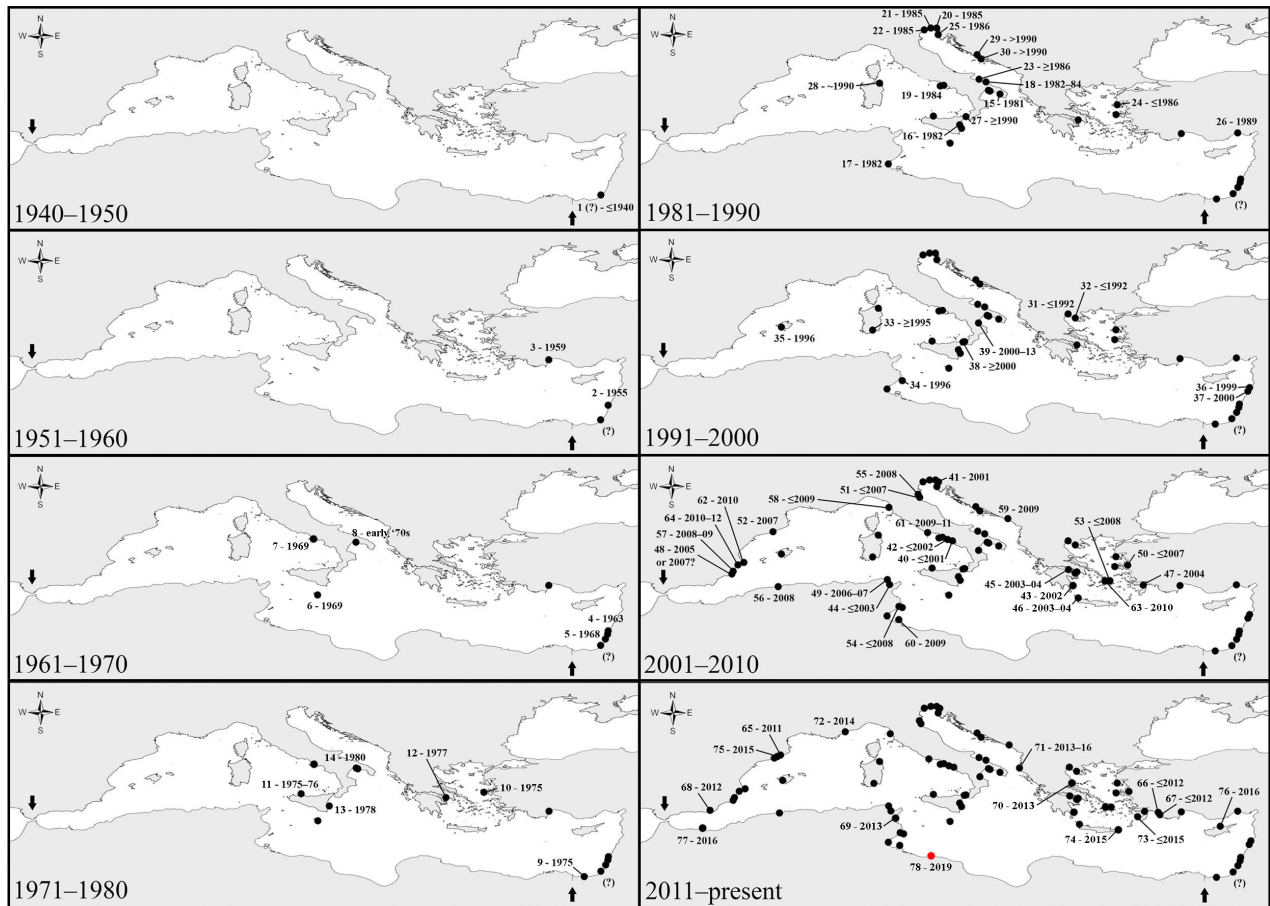
**Figure 2.** *Bursatella leachii* from the Tripoli Harbour. A–B. The specimen found entangled in a fishing net. C. One of the specimens found washed ashore. Photographs by Jamila Rizgalla.

description of the terrain). The harbour has a cosmopolitan nautical activity and is frequently used for exploiting fish and bivalves by both recreational and professional fishermen. Pictures were taken *in situ* using an Olympus G-4 Tough camera and a Huawei Honor smartphone. Samples mentioned in the present note were placed in 96% ethanol and kept at the first authors private collection (Jamila Rizgalla, Tripoli-Libya), and are available upon request.

An extensive search of the scientific literature was undertaken to amend and update the distribution of *B. leachii* in the Mediterranean previously published in Selfati et al. (2017). This resulted in the deletion of the previous record from Libya (Bazairi et al. 2013) and in the inclusion of ten additional papers (Supplementary material Table S1).

### Results and discussion

During the entire survey period, one specimen of *B. leachii* (~ 10 cm total length) was found in a fisherman's net on the 30<sup>th</sup> October 2019 (Figure 2A–B). The fisherman was fishing within the harbour at 1 m depth. Subsequently, 15 additional specimens (~ 3–5 cm total length) were found washed ashore on the 7<sup>th</sup> January 2020 (Figure 2C), following a spell of rough seas. These specimens constitute the first confirmed record of this species in Libya. Indeed, having already invaded wide parts of the Mediterranean basin (Selfati et al. 2017) it was just a matter of time before *B. leachii* reached Libyan shores. Thus, the discovery of the ragged sea hare at the Tripoli Harbour comes as no surprise. In addition, the Tripoli Harbour was already reported as a hub for alien species (Rizgalla et al. 2019a, b, c; Rizgalla and



**Figure 3.** Cumulative Mediterranean spreading of *Bursatella leachii* divided into decades from 1940 to present (1940–1950; 1951–1960; 1961–1970; 1971–1980; 1981–1990; 1991–2000; 2001–2010; 2011–present) (amended and updated from Selfati et al. 2017). Black arrows indicate the Strait of Gibraltar (left) and the Suez Canal (right). First record dates per main invaded areas highlighted. Red dot: present record from Libya. References in Table S1.

Crocetta in Dragičević et al. 2019; Rizgalla and Crocetta 2020), and the present record confirms previous statements. There are no certainties regarding possible pathway(s) of arrival of this species in the area. Indeed, finding *B. leachii* within a harbour suggests that shipping may have played a role in that. However, *B. leachii* could have easily been present in Libya for decades, but it simply passed unnoticed due to scarcity of field research, and thus may also have arrived via natural dispersal from nearby Mediterranean populations (see Figure 3).

Since the beginning of the project Snowball, over twelve alien and cryptogenic species have been newly recorded in Libya. However, the majority of them can be easily considered among those “well-established” in most Mediterranean countries. One in particular, the sea slug *Aplysia dactylomela* Rang, 1828, was first found during field surveys in 2018, but its arrival in Libya was backdated to four years prior to that date thanks to social media data mining (see Rizgalla et al. 2019a). All this potentially points towards the presence of yet undetected alien species along the Libyan coastline.

This is presumably due to the lack of projects aiming to provide a systematic inventory of native and alien local marine flora and fauna. This could be due to a combination of various factors, including lack of research

funding, remoteness of most of Libya's coastline, and almost 10 years of political unrest hindering the undertaking of substantial field surveys. Although part of these hurdles were possible to overcome with the help of social media and citizen scientist projects, that proved to be a complementary tool in the discovery of invasive species (e.g. Al Mabruk and Rizgalla 2019; Rizgalla et al. 2019a; Osca et al. 2020), and at the same time serving as a retrospective record of otherwise lost information (Rizgalla et al. 2016), they cannot replace systematic surveys that would bring the list of invasive species in Libyan waters up to date.

## Acknowledgements

We wish to thank Mr. Mehdi Nailay and Mr. Adam Sahata for the technical assistance, Mahmoud Al Basha, Anes, and Moied for allowing the bycatch analysis and the information on the fishing method used and the two anonymous reviewers for their comments. This work was conducted in the framework of project "Snowball", a research project aiming to investigate alien bioinvasions in Libya.

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### Supplementary material

The following supplementary material is available for this article:

**Table S1.** Published records of *Bursatella leachii* Blainville, 1817 from the Mediterranean Sea.

**Appendix 1.** References for Supplementary table S1.

This material is available as part of online article from:

[http://www.reabic.net/journals/bir/2020/Supplements/BIR\\_2020\\_Rizgalla\\_Crocetta\\_SupplementaryMaterial.xlsx](http://www.reabic.net/journals/bir/2020/Supplements/BIR_2020_Rizgalla_Crocetta_SupplementaryMaterial.xlsx)