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CONTRIBUTION TO THE KNOWLEDGE OF *BURSATELLA LEACHII* DE BLAINVILLE, 1817. DISTRIBUTION AND REPRODUCTION IN THE BOKA KOTORSKA BAY (MONTENEGRO)

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ABSTRACT

In this paper are presented findings on distribution and reproduction of invasive Lessepsian immigrant Bursatella leachii in the Boka Kotorska Bay (Montenegro).

Key words: *Bursatella leachii*, Adriatic Sea, alien, mollusk

INTRODUCTION

Species of flora and fauna which are found outside their known area of distribution are called non-native or alien species (also known as alochtonous, non-indigenous, introduced or exotic species). A number of definitions have been applied to describe the term Invasive Alien Species (IAS) and usually they are defined as species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity, or which are ecologically and/or economically harmful (Bern Convention, 1979; Barcelona Convention, 1995; UNEP-MAP-RAC/SPA, 2011). It is already known that IAS can produce substantial environmental and economic damage, so the issue of alien species in marine environment has been highlighted many times by the scientific community and different international organizations (CIESM, UNEP/MAP/RAC SPA, CBD, FAO, IUCN, etc.).

An increasing invasions rate has been documented for different marine environments, but it is very pronounced in the Mediterranean Sea (Zenetos *et al.* 2009; Galil, 2007). Almost 1000 non-native species have been counted by now in the Mediterranean and mollusks were found to be the most prominent invaders in term of number of taxa (216 species) (UNEP-MAP-RAC/SPA, 2011; Katsanevakis *et al.* 2011). The introduction of non-native species is permanent and complex process with accelerating trend, so the numbers of introduced species probably are just partially assessed. Furthermore, more prominent negative impact of IAS on biodiversity is expected not just because of increased number of species involved, but also because of more expressed vulnerability of ecosystems (which results from habitat degradation, fragmentation and climate change) (Zenetos *et al.* 2009).

Various national and international legal tools exist with intention to prevent the introduction of non-native species, but preventing alien species introductions is a task which needs scientific, administrative and political coordination at the international level (Bern Convention, 1979; Barcelona Convention, 1995; EU Marine Strategy Framework Directive, 2008, Galil, 2007; Sl. list Crne Gore, 2009). Regulative related to biological invasions is mostly partially enforced and different activities aimed to stop or suppress introduction and spreading of non-indigenous taxa are very often insufficient or late and ineffective. In Montenegro, unfortunately, there is no national data base officially organized for inventory of marine alien species, so needs of the regulatory requirements and environmental management options are fragmented and mostly unknown. Specific environments, endangered and protected species and habitats are usually the most threatened, so we should pay a special attention at least to them.

The Boka Kotorska Bay is particular area in the Mediterranean Sea, similar to the fiords and with significant inflow of the fresh water, creating specific habitats supporting high biodiversity. Because of all that inner part of the bay (Kotor-Risan Bay) is under UNESCO protection and also it is Emerald site (Badalamenti *et al.* 2008). Unfortunately, inner part of the bay is also under high anthropogenic pressure, so additional management activities are needed for protection of the Bay of Boka Kotorska. In the current EU Marine Strategy Framework Directive (2008) the descriptor: "Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems" is actually one of the eleven qualitative descriptors (and closely related to six other descriptors) for determining Good Environmental Status. The aim of this work is to contribute to the knowledge on distribution and reproduction of IAS *Bursatella leachii* De Blainville, 1817 in the Bay of Boka Kotorska (South East Adriatic Sea).

MATERIAL AND METHODS

Data on distribution and reproduction of *B. leachii* are collected during diving and snorkeling in the Bay of Boka Kotorska and presence of this alien mollusk is photo-recorded. Locations of *B. leachii* findings are presented in the Figure 1.

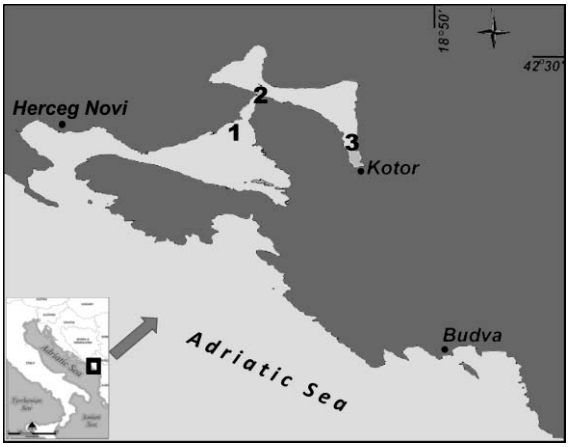

Figure 1. Findings of *B. leachi* in the Boka Kotorska Bay (South East Adriatic Sea): 1. Sv. Nedelja (N 42° 27' 31.48", E 18° 40' 20.28')'; 2. Verige (N 42° 28' 28.12', E 18° 41' 13.65"); and 3. Institute of marine biology (Kotor) (N 42° 26' 11.89", E 18° 45' 48.78")

RESULTS AND DISCUSSION

For the coast of Montenegro *B. leachii* was observed for the first time in July 2009 on location Sv. Nedelja (Boka Kotorska Bay) (Mačić & Kljajić, 2012). One specimen laying eggs was recorded on the sandy-muddy bottom, at 5m depth in the area inhabited by *Mytilus galloprovincialis*. Further, *B. leachii* was recorded in April 2013 on the sandy bottom, 6m depth, on location Verige (one specimen) and June 2013 near Dobrota settlement (40 individuals, in the vicinity of Institute of Marine Biology, Kotor). All sites are located in the Boka Kotorska Bay. Many of specimens of *B. leachii* on site Dobrota were distributed in line of two (Figure 2). Their spaghetti-like egg strings were numerous on different materials (stones, plastic waste and ropes).

Mollusk *B. leachii* is the ragged sea hare, usually from 50 to 100mm (up to 150mm) (Zenetos *et al.* 2004) covered all over with simple and compound villi (papillae) of unequal size, giving it a ragged appearance

(Fig. 2). Color is brown or greenish brown with reticulate markings and different black spots, sometimes with blue ocellus. It is circumtropical species found nearly worldwide in warm temperate to tropical marine environments and it is common in intertidal and subtidal sheltered bay and estuarine habitats with sandy or muddy bottom (Zenetos *et al.* 2004; Masterson, 2008).

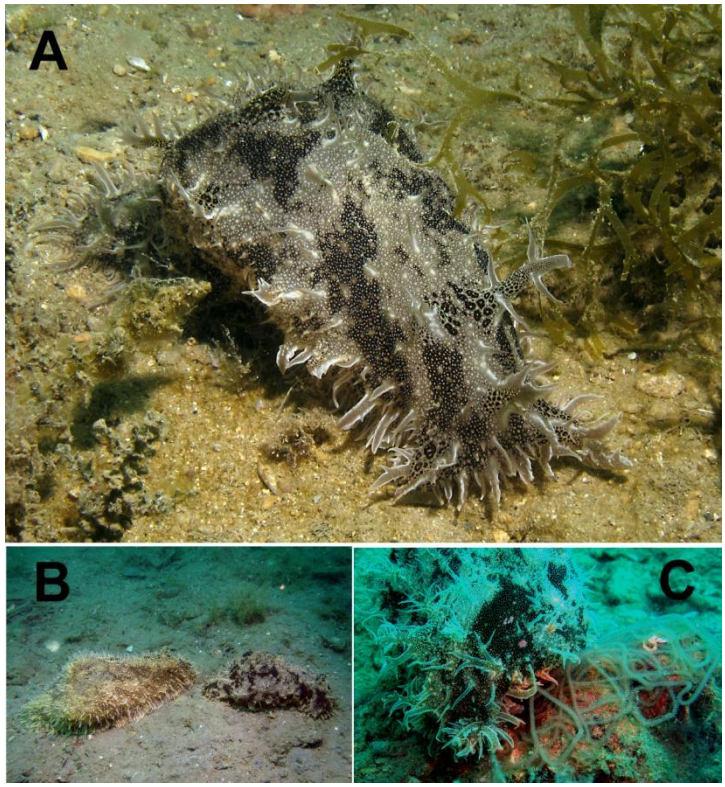

Figure 2. *B. leachii* in the Boka Kotorska Bay: A. Site Verige April 2013; B. in pairs, site Dobrota, June 2013; and C. Site Sv. Nedelja, eggs , July 2009.

B. leachii is usually considered as true Lessepsian migrant (dispersing from the Red Sea via Suez Canal to Mediterranean), recorded first from Palestine in 1940 and later in Turkey, Malta, Israel, Sicily, Tunisia, Greece, Lebanon and others (Zenetos *et al.* 2004.). In the Adriatic

Sea it was recorded for the first time for south Adriatic (Bari) in 1983 and successively in the northern part (lagoon of Venice, Trieste and Rovinj) in 1986 and 1989 (Zenetos *et al*. 2004; Despalatović *et al.* 2008). In the last two decades *B. leachii* was occasionally observed in the area of the middle Adriatic (around Split and island Hvar), but in the north Adriatic it was observed in many locations and also in high densities (Lipej *et al.* 2012). After first record for Montenegro in 2009 in the Boka Kotorska Bay (Mačić & Kljajić, 2012), *B. leachii* was not recorded in the area until 2013, probably due to the low population density and/or migration behavior.

Interesting is that 40 days after copulation (August 2013) the species was not recorded at same sites, as well as several additional locations with similar characteristics, e.g. depth and dominant bottom type). This finding indicates that the species migrate to shallow habitats (around 5m depth) with sandy and muddy bottom for spawning supports the hypothesis of breeding migration of *B. leachii*.

It is well known that population numbers of this species fluctuate and thousands of individuals can be present in a small area of a lagoon, in a very dense aggregations, but may be entirely absent a few weeks later (Zanetos *et al.* 2004, Tanrikul & Akyol, 2012). There are a number of hypotheses as a why populations of sea hare exhibit this dynamic. One of hypothesis is a response to hydrological condition, the second is that the sea hare settle in a range of habitats and migrate to areas of highly dense conspecifics for the purpose of breeding, the third hypothesis is that it occurs where food is localized (Clark, 2006). Furthermore, in north Adriatic Sea (Slovenia) it is found mainly in shallow waters in rather devastated environments, such as harbors, enclosed shallow bays and coastal wetlands (Lipej *et al.* 2012).

Copulation occurs mainly in late summer and autumn (Zanetos *et al.* 2004), but also in December (e.g. in Urla, Izmir bay, Turky, Tanrikul & Akyol 2012). This indicates that at least in some parts of its range, the species appears to undergo continuous recruitment with no well-defined reproductive season.(Masterson 2008).

B. leachii is included in the 100 "worst invasives" in the Mediterranean, having a very strong impact to the biodiversity (Streftaris & Zenetos, 2006).

Biology and population dynamics of *B. leachii* is still not studied in detail and it is not possible to assess the impact to the autochthonous ecosystems in the Boka Kotorska Bay. Furtehrmore, it is expected that the impact of alien species will intensify in the future and brackish waters are considered as environments where invasive species are the most successful from the aspect of colonization (Katsanevakis *et al.* 2011, Lipej *et al.* 2012). Because of that Bay of Boka Kotorska is particularly sensitive and monitoring of IAS should be more intensive, while this report with information on distribution and reproduction of *Bursatella leachii* could be used as a baseline for future assessments.

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