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Short Communication

The use of georeferenced underwater TV devices for the study of the exotic invasive species *Branchiomma luctuosum* (Grube, 1869) (Polychaeta, Sabellidae) in ports from the Eastern Iberian coast (Western Mediterranean Sea)

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Abstract

Ports are believed to be key factors in the process of dissemination of exotic marine species. However, direct sampling is very difficult in such areas due to their elevated turbidity and/or the danger related to shipping traffic. Within this study we propose the use of georeferenced TV underwater devices with high sensitivity for the inspection and monitoring of the exotic invasive species (EIS) *Branchiomma luctuosum* (Polychaeta, Sabellidae) in several ports from the Eastern Iberian coast (Western Mediterranean Sea, Spain). Many ports with different shipping activities were surveyed, from Cases d'Alcanar Port (Tarragona) to Santa Pola Port (Alicante). The use of this methodology contributed to the expansion of knowledge concerning the distribution and abundance of this species in the Eastern Iberian coast. This study proved the efficiency of this large scale sampling method and the possibility of its use in early detection and monitoring of this species and other conspicuous marine EIS which can be photo-identified.

Key words: *Branchiomma luctuosum*; polychaetes; early detection; exotic invasive species (EIS); ports; underwater TV

Introduction

The Mediterranean Sea is one of the major recipients of non-indigenous species (NIS) (Streftaris et al. 2005; Gollasch 2006) with 955 taxa of which 535 are considered to be established (Zenetos et al. 2010). This larger number may be a synergistic result between geological history, environmental factors and anthropogenic activities (Galil 2000). Colonisation with NIS is proportionally more successful in environments with low biodiversity (Zibrowius 1992; Galil 2000; Occhipinti-Ambrogi et al. 2011) where the stress induced by anthropogenic disturbance is causing trouble to autochtonous biota and therefore vacant niches are open for colonisation (Occhipinti-Ambrogi and Savini 2003).

In this sense ports can be described as highly anthropogenically modified systems; they are unstable, habitually with a low biodiversity compared to their natural surroundings, and frequently exhibit manmade negative ecological impacts e.g., episodes of eutrophication and hypoxia. In addition, they are initial sites of introduction for species translocation to new countries and these sites are relatively more susceptible to marine invasions than other costal environments. For this reason study of marine biota in harbour systems constitutes an important tool for the control and management of species translocation, including an evaluation of invasive potential to further establish measures of protection from any associated environmental risks. However, these environments are generally difficult to prospect by the traditional methods of direct sampling (e.g. scuba diving) because of their elevated turbidity and/or the danger related to their traffic, as well as operational permissions.

Within this study we propose the use of georeferenced TV underwater devices with high sensitivity for the inspection and monitoring of the exotic invasive species (EIS) *Branchiomma luctuosum* (Grube, 1869) (Polychaeta, Sabellidae) in several ports from the Eastern Iberian

Figure 1. Georeferenced image of *Branchiomma luctuosum* from Santa Pola Port. Photograph by Vicente Tasso Bermell.

coast (Western Mediterranean Sea). In the Mediterranean Sea, *Branchiomma luctuosum* is well established in both Western and Eastern basins (Zenetos et al. 2010) and currently is one of the one of the most abundant species along the Italian coasts (Licciano and Giangrande 2008). This species is a conspicuous sabellid polychaetes (approx. 6-7 cm and with a 3-4 cm long branchial crown), whose tubes protrudes from the substrate on hard bottoms and in fouling communities. The species was originally described by Grube (1869) from Red Sea specimens encountered in madreporarian corals and sponges. It was firstly detected in the Mediterranean Sea in the Lago Lucrino (euhaline lagoon, Naples) in 1978-79 (Giangrande 1989; Sordino and Gambi, 1992). Currently, it is found in both Oriental and Occidental basins of the Mediterranean Sea. It also was recorded from the coast of Brazil (Rossi and Nogueira 2004). More information about its ecology and distribution along the Spanish coast can be found in El Haddad et al. (2008).

Material and methods

Eighteen ports with different activities were prospected from the area extended between Cases D´Alcanar port (Tarragona) to Santa Pola port (Alicante) (Table 1). Valencia Port is one of the most important in the Mediterranean Sea in terms of commercial traffic, having a dense network throughout many ports in the world, while Alicante Port is one of the most important ports in Spain for cruises. Castellon Port and Gandia Port have relatively less commercial importance than the previous.

A visual survey was initially planned to detect the presence/absence of this species at sub-superficial level by the realization of an inspection on throughout the port contour along the docks. Randomly, vertical transects of georeferenced TV underwater devices (Inspecam Diver) with high sensitivity were established from the surface to the bottom (maximum depth 15 m) for 10-20 minutes. This device consists in a remote video-camera controlled from the surface via a cable and able to capture clear images under very low illumination. Careful handling is necessary to avoid any disturbance that may cause the withdrawal of the branchial crown of worms. When the trouble occurs it is necessary to wait for a few minutes until the animal re-extends its branchial crown. The geographic coordinates were acquired by a GPS receptor (Garmin GPSMAP 60 Cx). The information for position and image are combined by an On Screen Display (OSD) (Figure 1). All data and images were processed with GIS software (GvSIG) and classified in three semi-quantitative ranges of abundances: high (more than 100 individuals/m^2), medium (20-100 individuals/m^2) and low (less than 20 individuals/m^2).

Table 1. List of prospected ports and results on the occurrence of *Branchiomma luctuosum*. Activities: A, aquaculture; C, commercial; Sp, Sportive; F, Fishing (fisheries); D, dry dock. Presence: +, present; -, absent. Abundance: H, high; M, medium; L, Low.

Provence	Port	Activities	Presence	Abundance	Orientation	Geographic coordinates
Tarragona	Cases d'Alcanar	F	+	L	W, S	40º33,1′N; 0º31,9′E
	Vinaroz	Sp, F	+	L	SE, E	40º27,8′N; 0º28,5′E
	Benicarló	Sp, F	+	L	S, E	40º24,9′N; 0º26,0′E
Castellon	Peñiscola	Sp, F	+	L	S	40º21,4′N; 0º24,3′E
	Castellon	C, Sp, F, D	-		N, E	39º58,2′N; 0º00,9′E
	Burriana	Sp, F, D	+	L	N	39º51,8′N; 0º04,3′W
	Sagunto	C, F, D	-			39º39,1′N; 0º12,4′W
	Pobla Farnals	Sp	-			39º33,7′N; 0º16,9′W
	Port Saplaya	Sp,	-			39º30,7′N; 0º19,2′W
Valencia	Valencia Port	C, F, D, A	+	M, H	N, S, E, W	39º27,3′N; 0º19,6′W
	Valencia Royal Nautical Club	S, D	-			39º25,7′N; 0º19,9′W
	Gandía	C, Sp, D	-			38º59,6′N; 0º09,6′W
	Denia	C, Sp, F	-			38º50,5′N; 0º06,8′E
	Moraira	Sp	-			38º41,2′N; 0º08,2′E
Alicante	Calpe	Sp, F	-			38º38,3′N; 0º04,1′E
	Altea	Sp, A	-			38º35,4′N; 0º03,2′E
	Alicante	Sp, C	-			38º20,4′N; 0º29,2′W
	Santa Pola	Sp, F, A	+	L, M	S, W	38º11,4′N; 0º33,5′W

Specimens of this worm were collected manually by Scuba diving from all the stations and were checked in the laboratory to complete the determination of the species. All specimens collected belong to the species *Branchiomma luctuosum*.

Results and discussion

Branchiomma luctuosum was detected in seven ports from the total of 18 surveyed. Abundance of this species was low, except in Santa Pola port and Valencia port where it can reach medium and high abundances respectively. All the ports, where this species was detected, have at least fishing activity and five of them have, in addition, recreational activity (Table 1). *B. luctuosum* was detected in all orientations, but is more abundant in south and/or east orientations. The species was encountered as part of biofouling from floating structures (e.g. buoys), dock wall and pilings but was not observed on ships' hulls. This can be explained by the structure of the worm, which has a membranous tube that can easily be removed from the hull of ships and boats during navigation.

Fishing activity in the prospected ports is usually associated with an increase of organic matter in the water column due to the decomposition of residues generated by fishing, a common phenomenon registered in these ports. However, we did not detect this species in zones with both high levels of organic matter and turbidity in the water column. The increase of organic matter in suspension in the water column represents an increase of food availability for this filter-feeding organism. Nonetheless, an increase in the concentration of inorganic particles could be unfavourable because these organisms have to use energy when dealing with more particles of low nutritional value, and also since large increases in organic or inorganic particles can be negative for these species by congesting feeding processes, damaging feeding structures or smothering organisms (Cole et al. 1999).

Although *B. luctuosum* is a Red Sea species, its first detection far from the Suez Canal (Italy coast, Western Mediterranean) indicates that it probably is not a lessepsian species *sensu stricto*, and its wide and discontinuous distribution indicates that its introduction, at a large scale, was related to maritime transport, probably by ballast waters (El Haddad et al. 2008). For Spanish waters, it was firstly detected in the Eastern Iberian coast (Valencia Port, Vinaroz and Cullera) and in the Balearic Islands at Mallorca (El Haddad et al. 2008). In this study, we extend the distribution of *Branchiomma luctuosum*, by our detection of the species, in five additional ports from the Spanish Eastern Iberian coast (Cases d´Alcanar, Benicarló, Peñiscola, Burriana and Santa Pola) indicating that this species is now expanding in this area of the Mediterranean Sea.

From the Eastern Iberian coast we can distinguish two types of colonisation patterns:

i) On the northernmost coast the expansion of this species from Valencia Port to all the prospected ports, which lack infrastructures to receive ships with ballast waters, may have occurred mainly without direct human implication, probably by its planktonic larvae. *B. luctuosum* have a lecitotrophic larva that can last three days in plankton before settlement (Licciano et al. 2002). This circumstance can facilitates its expansion to neighbouring ports with favourable conditions for settlement (high levels of organic matter but with low levels of turbidity). However, it was detected there as a biofoulant (e.g. on buoys and chains) and the role of these structures in its introduction/ dissemination can also be envisaged.

ii) On the southernmost coast, its introduction to Santa Pola Port would be likely linked to maritime transport, mainly as fouling carried from the northernmost ports.

The use of the georeferenced underwater TV devices with high sensitivity can be considered as an efficient tool in its early detection and for estimates of abundance. The methodology can also be applicable for the detection and monitoring of many other conspicuous species that can be identified by photos, including other NIS species. However, certain groups of species as Polychaeta are particularly difficult to record (e.g. sabellids and serpulids generally withdraw the branchial crown when disturbed) and to identify from video records. Prior to surveys, workers should be experienced with the device and also familiar with the species to be monitored; it is recommended that they are shown the image of the species in advance to familiarise themselves in recognition and monitoring. Subsequent, laboratory examination of specimens is also mandatory for a correct identification.

Other congeneric species as *Branchiomma boholense* (Grube, 1878) and *B. lucullanum* (Delle Chiaje, 1828) can be confused with *B. luctuosum*. Although *B. luctuosum* is larger than the two other species (El Haddad et al. 2008), it is imperative to check the species at least under a stereoscopic microscope to have a correct taxonomic assignation. To date, *B. bohelense* was registered in the Iberian Peninsula (Román et al. 2009) only in the Mar Menor lagoon (100 km away from Santa Pola Port), however its correct identification is doubtful (Cinar 2009; Arias et al. 2012; Giangrande A, pers. comm.). This species, as well as the other co-generic *B. bairdi*, another alien recently reported in the Western Mediterranean (Arias et al. 2012; Giangrande et al. 2012) is distinguished from *B. luctuosum* by the presence of differently-shaped macrostyloids, which are not detectable in the images. All the specimens checked by us and collected after the imaging, belonged to *B. luctuosum*. During this research we have also corroborated the efficiency of this methodology in the detection of the invasive alga *Caulerpa racemosa* var. *cylindracea* (Sonder) Verlaque, Huisman et Boudouresque, 2003 and the alien coral *Oculina patagonica* De Angelis, 1908 in some zones in the Eastern Iberian coast.

We think that this methodology can be considered as an important tool to the field surveys. It can be used in early detection and monitoring of *B. luctuosum* and other conspicuous marine EIS which can be photo-identified.

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