

Rapid Assessment Survey of two contrasting marinas near Lisbon: Ascidiacea (Chordata: Tunicata)

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INTRODUCTION

Since ascidians are a representative taxonomic group of marine biofouling on ship hulls and aquaculture bivalves; thus, they have been introduced worldwide via these anthropogenic vectors [1,2]. Therefore, harbours and marinas are gateways for non-indigenous species (NIS), through commercial and recreational ships [2,3]. In order to ensure an early warning, it has been developed the Rapid Assessment Survey (RAS), it is a standard worldwide method used to ensure an early warning for the detection of NIS by collecting fouling specimens from artificial substrates [4,5,6]. Some works have carried out on NIS ascidians at the mainland coast of Portugal [6,7,8,9,10]. The present study aimed at comparing the occurrence of ascidians in two marinas with different environmental conditions, located at the Tagus estuary (Alcântara and Oeiras) in Portugal.



Fig. 1. Location of the Alcântara and Oeiras marinas, Tagus estuary.

Table 1. Characteristics of the marinas and hydrological parameters (03/03/2016): (HT) high tide; (LT) low tide; (SD) Secchi Disk.

Marinas	Water surface	Nº boats	Depth (m)	T°C (-1m)		S psu (-1m)		SD (m)
				HT	LT	HT	LT	
Alcântara	5,55 ha	450	9	13.14	13.80	23.02	22.67	2,5
Oeiras	2 ha	230	6	13.42	13.82	28.9	26.92	2,5

RESULTS AND DISCUSSION

The dominant fouling species in both marinas were the mussel *Mytilus galloprovincialis* and the non-indigenous bryozoans *Watersipora subtorquata* and *Tricellaria inopinata*. The cnidarians *Ectopleura crocea* and *Actinothoe sphyrodeta* were very abundant at the Oeiras marina, and very few ascidians were recorded. On the other hand, a high abundance of ascidians were found at the Alcântara marina, with *Styela plicata*, *S. clava*, *Microcosmus squamiger* and *Botrylloides leachi* as the dominant species.

A total of 326 ascidians were identified (Table 2, Fig. 3), corresponding to 9 species and 5 families. Styelidae were the dominant family, with 5 spp., (55,6% of the total), and 211 individuals (≈65%). Four species have been assigned as NIS (*Corella eumyota*, *Botrylloides cf. violaceus*, *Styela clava*, *Microcosmus squamiger*); other 3 species were considered as native (*Asciidiella aspersa*, *Botrylloides leachi*, *Botryllus schlosseri*); and 2 spp. have been classified as cryptogenic (*Styela plicata*, *Molgula* group *manhattensis*).

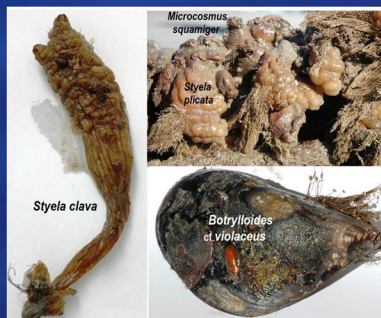


Fig. 3. NIS Ascidians collected in the Tagus estuary (Alcântara)

MATERIAL AND METHODS

A sampling survey was carried out in February 2016, following the RAS protocol in two recreational marinas with different sizes and environmental characteristics, located in the Tagus estuary (Fig. 1, Table 1): Alcântara (N38°42'04.14"-W09°10'07.44") and Oeiras (N38°40' 33.77"-W09°19'03.62").

Different pontoon floats were sampled at each marina during nearly 90', by scrapping the surfaces with distinct orientations (east, south and west) and submerged artificial substrates, such as hanging ropes, buoys, chains and fences, were also surveyed (Fig. 2). Ascidians were separated, identified and counted.

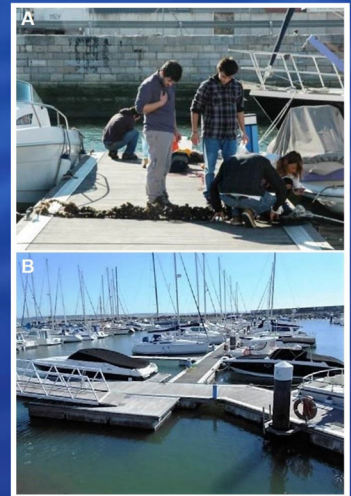


Fig. 2. Rapid Assessment Surveys carried out at the Alcântara (A) and Oeiras (B) marinas

Table 2. Ascidians species identified at the recreational marinas (A - Alcântara; O - Oeiras), pontoon surface orientation (E,S,W) and ropes (R). Population status of the NIS: (E) established, (U) undetermined. Year and reference (RP) of the first record of NIS ascidians in Portugal.

TAXON/SPECIES	A-E	A-S	A-W	A-R	O-E	O-S	O-W	Status	Year	RP
Order PHLEBOBRANCHIA										
Family Corellidae										
<i>Corella eumyota</i> Traustedt, 1882	-	-	-	-	1	-	-	Introduced (U)	2008	8
Family Ascidiidae										
<i>Asciidiella aspersa</i> (Müller, 1776)	-	1	-	2	-	-	-	Native		8
Order STOLIDOBRANCHIA										
Family Styelidae										
<i>Botrylloides leachi</i> (Savigny, 1816)	3	7	13	17	-	-	-	Native		11
<i>Botrylloides cf. violaceus</i> Oka, 1927	1	2	2	-	-	-	-	Introduced (U)	2008	8
<i>Botryllus schlosseri</i> (Pallas, 1766)	-	-	-	2	-	-	-	Native		11
<i>Styela clava</i> Herdman, 1882	1	-	-	23	-	-	-	Introduced (E)	2003	6
<i>Styela plicata</i> (Lesueur, 1823)	1	10	11	118	-	-	-	Cryptogenic	?	8
Family Pyuridae										
<i>Microcosmus squamiger</i> Michaelsen, 1927	-	-	3	106	-	-	1	Introduced (E)	2005	7
Family Molgulidae										
<i>Molgula gr. manhattensis</i> (De Kay, 1843)	-	-	-	1	-	-	-	Cryptogenic	<1928	12
Total	6	20	29	269	1	0	1			

Whereas ascidians have been dominant in Alcântara (324 specimens: 55 on pontoons and 269 on ropes/buoys), only 2 specimens have been collected in Oeiras in shallow fouling zones (Table 2). Although Nagar *et al.* [8] reported *Corella eumyota* as frequent in Oeiras marina in July 2009, a single specimen has been collected in the present study. An immature specimen of *Molgula* sp., with 6 branchial folds on each side and smooth dorsal lamina, was assigned to *Molgula manhattensis* group [13]. The absence of species present in the winter fouling, as *Ciona intestinalis* and *Clavelina lepadiformis* is noteworthy. The NIS ascidians *Perophora japonica* and *Didemnum vexillum*, reported in the Spanish North-Atlantic coast [8], were also not found in these marinas. While this work does not provide new records for mainland Portugal NIS ascidians [6,7,8,9,10], it is interesting to check the abundance of *S. clava*, *S. plicata* and *M. exasperatus* in estuarine waters (22-23 psu).

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