

Non-indigenous Japanese oyster drill *Pteropurpura (Ocinebrellus) inornata* (Récluz, 1851) (Gastropoda: Muricidae) on the South-west coast of Portugal

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Abstract

The Japanese oyster drill or rock snail *Pteropurpura (Ocinebrellus) inornata* (Récluz, 1851), a marine mollusc, belonging to the family Muricidae, is reported from Portugal for the first time. This non-indigenous species, most likely introduced accidentally from French oyster rearing areas into mainland Portugal, has been regularly sampled in shellfish-culture and nearby environments in Sagres, Algarve, South-west Portugal since 2005–2008. Detailed studies are urgently needed in order to assess whether or not it has become an invasive species due to a range expansion beyond its point of initial introduction. Outputs should provide information to decision-makers to predict and limit further spread which might result in biodiversity loss and negative economical consequences in locally species-rich areas.

Key words: Muricidae, *Pteropurpura (Ocinebrellus) inornata*, non-indigenous, invasive species, oyster aquaculture

Introduction

Pteropurpura (Ocinebrellus) inornata (Récluz, 1851) a marine gastropod belonging to the family Muricidae and also known as the Japanese oyster snail or Japanese rock snail, originates from the NW Pacific region and was first accidentally introduced in 1924 with cultured oysters in North America. This alien invasive species is now widespread along the coasts of Oregon, Washington and British Columbia, particularly in Puget Sound (Radwin and D'Attilio 1976; Carlton 1992; Houart and Sirenko 2003). The first record of this species on the European Atlantic coast is from spring 1995 in Marennes-Oléron Bay, France, where it has regularly been sampled since (de Montaudouin and Sauriau 2000; Pigeot et al. 2000). Later, the Japanese oyster drill extended its geographical distribution to southern Brittany, France (Gouletquer et al. 2002; Martel et al. 2004a, 2004b, 2004c). In 2007 the species was first reported from the SW Netherlands where it is now well established and flourishing (Faasse and Ligthart 2007; Faasse and Ligthart 2009; Delongueville and Scaillete 2010). A survey carried out along the coastline of Sagres in the

SW Algarve (Portugal) revealed the presence of significant numbers of adult and sub-adult individuals, sampled from local shellfish-culture as well as from nearby rocky environments.

Material and methods

Oyster culture and rock environments in the fishing harbour of Sagres (37°0.565'N, 8°55.546'W) in the Algarve region in the SW coast of Portugal (Figure 1) were investigated in 1999, then between 2005 and 2008. In January 1999, a single sub adult specimen was obtained from rocky shore at the nearby vicinity of the oyster cleaning facility area. At that time, the species identification was uncertain in spite of the help of several mollusc taxonomists. The closest match found for a European species was *Hadriana craticulata* Bucquoy, Dautzenberg and Dollfus, 1882. Nevertheless, clear morphological differences were noticed between those two different muricid species. Between 2005 and 2008 a considerable amount of live specimens were sampled and preserved in 98% alcohol solution. For correct identification of *Pteropurpura (Ocinebrellus) inornata* the publication by Houart and Sirenko (2003) was used.

Figure 1. Point of initial arrival of *Pteropurpura (Ocinebrellus) inornata* (Récluz, 1851) in the fishing harbour of Sagres, Algarve in the South-west coast of Portugal (See Table 1 for additional information).

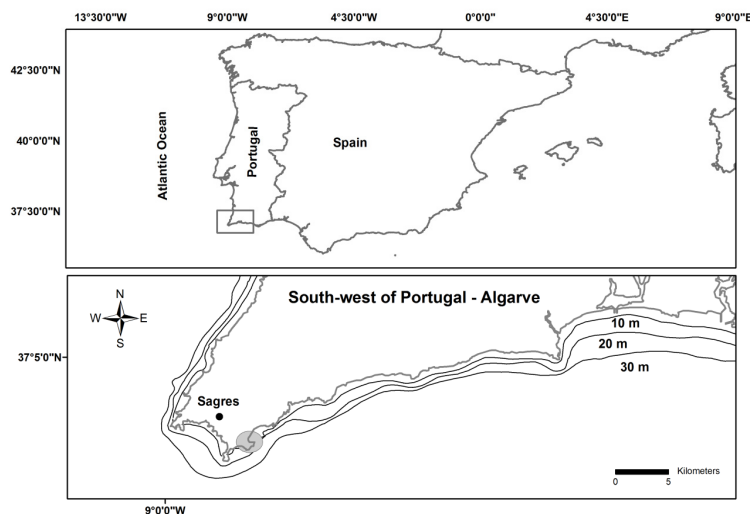


Table 1. Records of *Pteropurpura (Ocinebrellus) inornata* (Récluz, 1851) (Gastropoda: Muricidae) in the South-west coast of Portugal.

Location	Geographic coordinates		Record date day/month/year	N° of specimens	Reference
	Latitude	Longitude			
Sagres	37°0.565'N	8°55.546'W	18 Jan. 1999	1	Present study
Sagres	37°0.586'N	8°55.537'W	21 Nov. 2005	12	Present study
Sagres	37°0.565'N	8°55.546'W	15 Feb.2007	≥100	Present study
Sagres	37°0.565'N	8°55.546'W	14 Oct. 2008	≥100	Present study

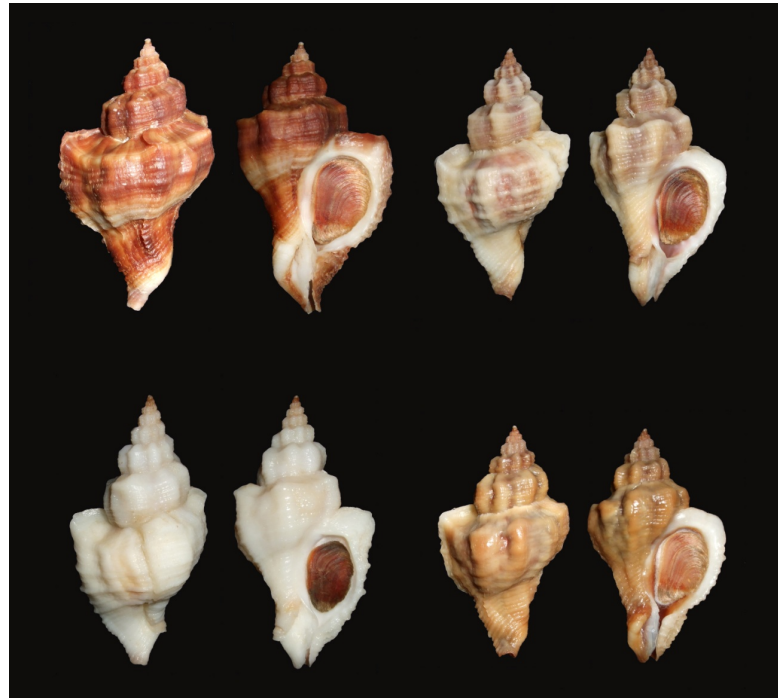
Results and discussion

A single specimen was sampled from hard rock substrate in the fishing harbour of Sagres in 1999 but little attention was given to it at that time. Poor knowledge of non-indigenous species led to a gap of data between January 1999 and October 2005 with no additional sampling carried out at the point of initial introduction. It was only between 2005 and 2008 that a significant amount of specimens were obtained from the shellfish culture rearing areas and from the fishing harbour rock environments (See Table 1 for additional information). All samples were positively identified as *Pteropurpura (Ocinebrellus) inornata*. This non-indigenous species is now so common in the oyster grow-out facilities that some workers responsible for oyster cleaning gather significant quantities of drill snail for their own consumption. Oyster cultures have been operating in SW Portugal since 1996. Juvenile *Crassostrea gigas* (Thunberg, 1793) oysters of 5–10mm in length are imported from oyster rearing grounds located

in Brittany to Portugal and are grown over a 9 month period in suspended offshore cages, deployed at 7.5 meters depth, before they are harvested and marketed. A few years after the implementation of this oyster culture in Portugal, the non-indigenous species *Pteropurpura (Ocinebrellus) inornata* (Figure 2) became present in grow-out facilities as well as in the nearby environment. Since this muricid gastropod has a direct mode of development, lacking a swimming larval stage (Carlton 1992, Martel et al. 2004b), the only reasonable hypothesis to explain its introduction in SW Portugal waters is the unintentional co-transport of eggs, larvae and/or juveniles of the species by the commercial oyster culture via France. This pathway of introduction via shellfish culture is a well known vector for the spread of invasive species (e.g. Martel et al. 2004a; Faasse and Lighthart 2009).

It is well known that the intentional or unintentional introduction of non native species can lead to the establishment of new invasive species, but under certain conditions may also

Figure 2. Different morphotype colour variation of non-indigenous *Pteropurpura (Ocinebrellus) inornata* (Récluz, 1851) sampled from the SW coast of Portugal (length between 39.76 mm and 47.23 mm). Photograph by Carlos M. L. Afonso (Algarve, Portugal).



have side effects on the local marine fauna with important consequences on coastal ecosystems, biodiversity and fisheries around the world (Carlton 1989; Grosholz 2002). The Japanese oyster drill is considered an economically significant pest of oyster cultures once they show an invasive pattern. This is characterised particularly by their predation on juvenile (seed) oysters. In addition to affecting oysters, “drills” also consume barnacles, mussels and other native bivalves (Gouletquer et al. 2002; Buhle and Ruesink 2009).

Non-indigenous species are generally defined as invasive only if they are able to spread by expanding their range beyond their points of initial arrival or introduction (Martel et al. 2004a; Richardson et al. 2000; Rehage and Sih 2004). Thus, dispersal ability is generally expected to be a key factor determining invasion success (Ehrlich 1986; Sakai et al. 2001). The Japanese oyster drill has shown a high establishment success with negative economical and ecological impacts in areas it has invaded (Gouletquer et al. 2002; Martel et al. 2004b; Buhle and Ruesink 2009). Therefore, detailed monitoring of establishment, colonization/expansion and impact are urgently needed for

proper management as well as mitigation studies necessary to contain/eradicate the species. In order to assess that non-indigenous species introduced by human activities are at levels that do not adversely alter ecosystems, the Japanese oyster drill should be listed in the species monitoring network program of the Marine Framework Strategy Directive (MFS) to be defined by 2014. It should also be monitored by the Water Framework Directive (WFD) sampling programs, so that it could be accounted for as an example of both biological pressure and impact. Portuguese policy and decision-makers should also study the best way to output and legislate management measures to deter the import of invasive species and foreign “genetic races” of native existing species. In the case of oyster transfers to Portugal, oyster batch cleaning and shell sterilization measurements should be undertaken and certified before the import of juveniles from France to cultivation sites in Portugal.

If this non-indigenous species has the ability to flourish and expand its range by invading the nearby Alvor coastal lagoon (Ramsar site; Site of Community Importance), Arade estuary (Special Protection Area under the Habitat Directive; Site

of Community Importance) or in the worst case scenario, the dynamic but fragile ecosystem of Ria Formosa (Natural Park; Ramsar site; Special Protection Area under the Habitat and Bird Directive; Site of Community Importance), a coastal lagoon formation located in the central Algarve region in south Portugal, this could be the first step of a negative cascading effect that could affect species-rich ecosystems, with direct consequences to biodiversity and economy in a relatively short term time scale. Particular attention should be given to Ria Formosa which comprises a large portion of the Algarve central coast line and the largest national production area of native bivalves, mainly *Cerastoderma edule* Linnaeus, 1758, *Ostrea edulis* Linnaeus, 1758, *Ruditapes decussatus* (Linnaeus, 1758) and *Venerupis aurea* (Gmelin, 1791). The area also accommodates high densities of other mollusc species essential for the survival and recruitment of many fish and bird species.

The main aim of this report is to alert interested parties about the importance of carefully assessing new observations of this non-indigenous species in the wild, with a special focus on its increasing expansion range in order to predict the impacts it may cause. Another aim is to update the knowledge of the Portuguese malacofauna by reporting, for the first time, the occurrence of *Pteropurpura* (*Ocenebrellus*) *inornata*, a non-indigenous species in Portuguese waters.

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