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## Rapid Communication

**First record of the gastropod *Stramonita haemastoma* (Linnaeus, 1767) in the English Channel**Jean-Philippe Pezy<sup>1,\*</sup>, Aurore Raoux<sup>1</sup>, Francis Kerckhof<sup>2</sup> and Jean-Claude Dauvin<sup>1</sup><sup>1</sup>Normandie Univ, UNICAEN, UNIROUEN, Laboratoire Morphodynamique Continentale et Côtière, CNRS UMR 6143 M2C, 24 rue des Tilleuls, 14000 Caen, France<sup>2</sup>Royal Belgian Institute of Natural Sciences, Operational Directorate Natural Environment, Aquatic and Terrestrial Ecology, Marine Ecology and Management, 3de en 23ste Linieregimentsplein, 8400 Oostende, Belgium

\*Corresponding author

E-mail: [jean-philippe.pezy@unicaen.fr](mailto:jean-philippe.pezy@unicaen.fr)

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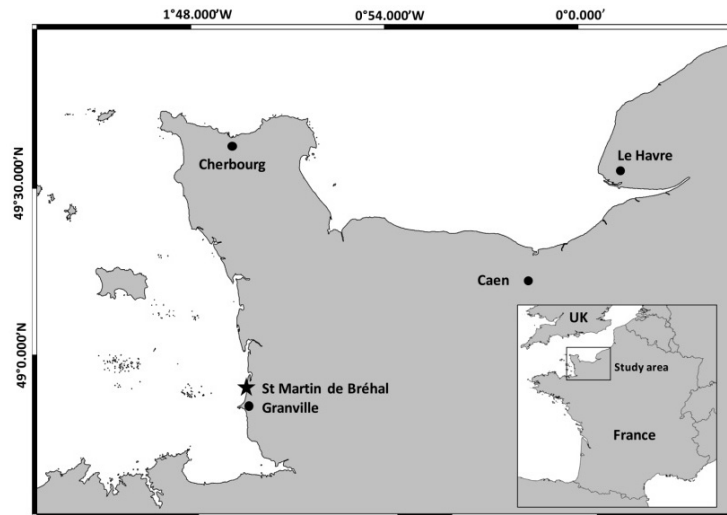
## OPEN ACCESS

**Abstract**

Here we report the first record of the red mouthed rock shell *Stramonita haemastoma* (Linnaeus, 1767) (Gastropoda, Muricidae) a predatory gastropod newly introduced to the English Channel. This species originally lives in the western Atlantic, eastern Pacific and Mediterranean Sea. Three specimens were collected on *Pecten maximus* at St-Martin-de-Bréhal, Normandy, France, on 2 February 2018. We present some hypotheses about the mode of introduction of *S. haemastoma* and its potential impact on the ecosystem in the English Channel.

**Key words:** introduced species, Muricidae, first record, Normandy, non-native species, *Pecten maximus***Introduction**

Species of the oyster drill *Stramonita haemastoma* complex (several subspecies are recognised) are widespread in warm-temperate and tropical latitudes of the western Atlantic and eastern Pacific Oceans, as well as in the eastern Mediterranean Sea (Butler 1985; Claremont et al. 2011). However, the species is under threat in the latter locations, the population in the southeastern Mediterranean collapsed due to too high seawater temperatures (Rilov 2016). Commonly named the red mouthed rock shell, *Stramonita haemastoma* has a large protoconch, a character typical for gastropods with a long pelagic larval duration (Claremont et al. 2011; Scheltema 1971; Richter and Thorson 1975). They are predatory snails (Clench 1947) commonly found in the intertidal zone of rocky shores, preferentially in the midlittoral (Ramírez et al. 2009) and subtidal (Rilov et al. 2001). The European species is *Stramonita haemastoma* (Claremont et al. 2011). *Stramonita haemastoma* is potentially the only amphi-Atlantic species, in the complex and the one with the broadest range, including the eastern Atlantic the continental coastline of the Mediterranean and West



**Figure 1.** Map showing location of records of *Stramonita haemastoma* in the English Channel at the Saint-Martin-de-Bréhal site.

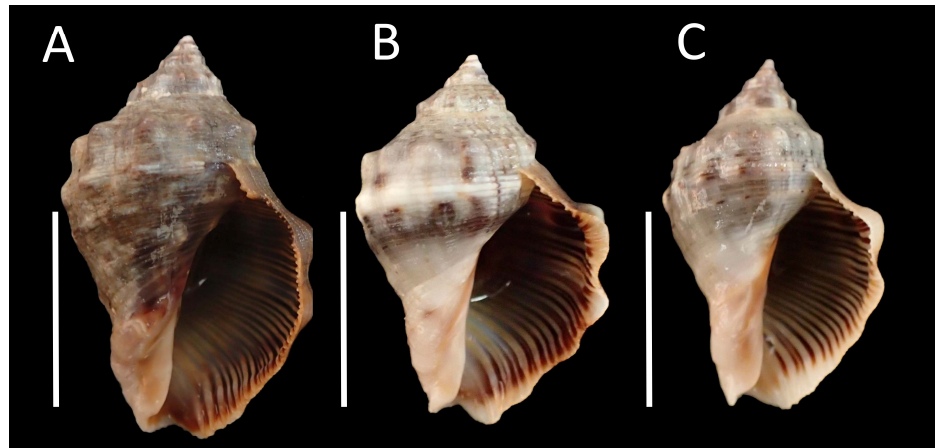
Africa and the oceanic islands of the Azores, Canaries and Cape Verde (Clench 1947; Claremont et al. 2011). Along the European Atlantic coast the northern species range boundary of *S. haemastoma* is thought to be situated in the southern part of the Bay of Biscay (de Casamajor et al. 2015).

*Stramonita* can be an extremely successful predator, because it has almost no natural predators in adulthood (Butler 1985). For example species of the *S. haemastoma* complex are important predators of oysters and mussels in shellfish aquaculture along the coast of Santa Catarina in Brazil (Ferreira and Magalhães 2004; Nascimento and Pereira 2004; Poli 2004). In the Mediterranean Sea, *S. haemastoma* is a widely distributed top consumer that adopts opportunistic strategies to consume a large number of species (Basedow 1994). For example, in the Mediterranean, it was an important predator of the native mussel *Mytilaster minimus* (Poli, 1795), but prefers now to prey on the invasive Lessepsian migrant mussel *Brachidontes pharaonis* (Fischer, 1870) where that species occurs (Giacoletti et al. 2016).

## Material and methods

In the framework of the REGENI project (REalisation d'un Guide des Espèces Non Indigènes) in Normandy (France) we performed field research/ surveys in search of introduced species and to document the status of already present introductions. One of the main goals of the REGENI project is to produce an inventory of all Non-Native Species (NNS) along the 600 km of the Normandy coast. This project offers the opportunity to increase the discovery of unknown introduced species and recently discovered NNS (Pezy et al. 2017a, b).

On 2 February 2018, three individuals of a hitherto unknown gastropod were caught at low tide at Saint-Martin-de-Bréhal along the western coast of the Cotentin (Normandy) in the western part of the English Channel (coordinates: latitude 48.905429; longitude:  $-1.597425$ ) (Figure 1). The



**Figure 2.** Entire *Stramonita haemastoma* individuals (IM-2014-6901). Scale bar for the total length: 25 mm. (A: 50.6 mm; B: 41.4 mm; C: 39.2 mm). Photographs by Jean-Philippe Pezy.

specimens were found on a rocky shore at low tide in the infralitoral fringe zone. When found they were alive and still attached on the shells of three living king scallops *Pecten maximus* stranded after a storm. The specimens were preserved in a 10% formaldehyde solution and taken to the laboratory for identification. We identified the snails using Claremont et al. (2011).

## Results

We identified the snails as *S. haemastoma*, a member of the *S. haemastoma* complex that consists of six subspecies. *Stramonita haemastoma* is a typical representative of the gastropod family Muricidae with a medium-sized solid shell that commonly reaches between 70–80 mm in size with a prominent pointed spire and a nearly straight columella. The aperture is oval with a short, open siphonal canal and between 23–34 crenulations at the edge of the outer lip. An anal notch and parietal tubercle are present. Adults have between 5–7 whorls, that can be smooth or with a double row of pronounced knobs on the shoulder of the whorls, so-called sculptured forms sensu Claremont et al. (2011). The sculpture of the shell is highly variable and consists of very fine incised spiral lines. The suture between the whorls is usually very prominent. The colour of the shell is variable and consists usually of shades of dull greyish brown, while the interior of the smooth aperture is of a more orange-reddish colouration. The three *S. haemastoma* specimens measured 39.2 mm, 41.4 mm and 50.6 mm in length respectively and are adult. All individuals belonged to the sculptured form sensu Claremont et al. (2011) (Figure 2).

The sea temperature at the sampling station was 7.2 °C, with a salinity of 34 psu corresponding to fully marine conditions.

The *P. maximus* width shells measured 74 mm, 86 mm and 81 mm and are considered as young individuals (approximately two years). As such, they fell below the minimum landing size fixed at 110 mm in the EC. The three specimens of *S. haemastoma* are lodged in the mollusc reference

collection of the National Museum of Natural History in Paris under collection number IM-2014-6901.

## Discussion

*Stramonita haemastoma* is a voracious predator of many bivalve species. It adds, to the known number of predatory sea snails that are already present on the western coast of the Cotentin peninsula such as the native Dogwhelk *Nucella lapillus* (Linnaeus, 1758) and European Sting Winkle *Ocenebra erinaceus* (Linnaeus, 1758) that preferentially consume blue mussels *Mytilus edulis* Linnaeus, 1758 and the introduced Japanese Oyster Tingle *Ocenebrellus inornatus* (Récluz, 1851). The latter is also a NNS that predated one the introduced Pacific oyster *Crassostrea gigas* (Thunberg, 1793) and on the introduced Manila clam or Japanese littleneck *Ruditapes philippinarum* (Adams and Reeve, 1850) (Bouget et al. 2001). In fact, these gastropod predators can affect all bivalve populations in the intertidal and shallow waters of the subtidal zone. It appears necessary to learn about their predation behaviour in order to anticipate their impact on ecosystem functioning. These predators have almost no natural competitors or predators, apart from humans, especially if they are located on isolated structures such as those used for the so-called “bouchot” (wooden pole) mussel culture or *C. gigas* tables.

The natural northern distribution range limit of *S. haemastoma* along the European Atlantic coast was thought to be the southern Bay of Biscay, including Biarritz and Arcachon Bay (Fischer 1865; Dautzenberg 1897; El Ayari et al. 2017). Until our findings there were no records further north along the French Atlantic coast, for example the species is not mentioned by de Montaudouin and Sauriau (2000) in their synoptic overview of the marine fauna of the Pertuis Charentais Sea, the region next to Arcachon Bay in the south. The species does not occur in the English Channel and is therefore not mentioned in the usual publications and guides dealing with Gastropods for this region such as Graham (1988) and Hayward and Ryland (2017). There is apparently an old record from the region of Brest by Collard des Cherres (1830) who found alive specimens amongst whelks on the fish market in Brest. This record was repeated by Fischer (1865) now stating “that it has been dredged off Brest”. However, Dautzenberg (1897) did not mention this older record not having observed the species. The true origin of these specimens is; therefore uncertain as they could have been imported from elsewhere. The same holds true for 3 specimens, two live and one dead, that were found by Edgard Macculloch in the St Peter Port harbour in the 19<sup>th</sup> century – exact date unknown. The discovery triggered an extensive search for further specimens, but none were found (see Chambers 2008).

### *Possible mode of introduction*

The individuals observed in St Martin-de-Bréhal, could have brought in by oyster farming activities that involve numerous exchanges—both legal and illegal—of oysters and other shellfish between the different French oyster farming regions, including Arcachon basin in the Bay of Biscay but also the Mediterranean. Rafting of adults is another possibility, for *Stramonita* spp. have been found at sea on floating logs (Clench 1947) and on the backs of turtles (Frazier et al. 1985). Recently, in the winter of 2015–2016 ten *S. haemastoma* were found on beaches in Cornwall, Dorset and Kent in southern England (Fenwick 2017). However, given the origin of the accompanying marine debris and other flotsam and jetsam that stranded in the same period, most likely these all belonged to the American species *S. floridana* and in fact the Cornish specimens were subsequently identified as *S. floridana* (Fenwick 2018).

Another possibility is a natural range expansion, as this species has a long teleplanic larval dispersal stage (Vermeij 2001; El Ayari et al. 2017). Despite this fact, until our finding, this species has never been recorded further north than Arcachon, hence some other factors may be inhibiting a further northward expansion. Therefore, an introduction through human activities seems the most likely introduction scenario.

### *Possible effects*

Our observation of *S. haemastoma* on *Pecten maximus* is alarming due to the high economic importance of *P. maximus* populations in the English Channel, including in the Bay of Granville, that supports a very important king scallop fishery representing a valuable economic activity. However, as this species lives at shallow depths, the impact may be limited to intertidal and shallow waters outside the location of the abundant *P. maximus* population. If this predator were able to reproduce and expand its distribution along the coasts of the English Channel, other bivalve fisheries could be affected. The western coast of the Cotentin corresponds to an important fishing area (recreational and professional) for shellfish (Sécuela 2011; Basuyaux et al. 2018), where several other commercial bivalves are present and harvested, such as *M. edulis*, *C. gigas*, the warty venus *Venus verrucosa* Linnaeus, 1758, *R. philippinarum*, the Chequered carpet shell *Ruditapes decussatus* (Linnaeus, 1758) and the European flat oyster *Ostrea edulis* Linnaeus, 1758 forming important economic resources. The warty venus *V. verrucosa* for example, is very abundant in the low intertidal levels and *S. haemastoma* could be a potential threat to this species in the Bay of Granville, which is the main fishery area for this target species of high economic value (Navon and Dauvin 2013).

If established, *Stramonita* would join the ranks of other rock snails already present in Normandy that have almost no natural predators

(except humans). They can have an impact on local economic resources by feeding on bivalve shellfish in aquaculture facilities and can also modify the structure and functioning of rocky intertidal ecosystems (Edwards et al. 1982; Liu et al. 1991; Rilov et al. 2001).

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