

## First record of *Trunculariopsis trunculus* (Linnaeus, 1758) (Mollusca: Gastropoda) from the basin of Arcachon (Gironde): the second exotic muricid on the French Atlantic coast

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**Abstract:** The species *Trunculariopsis trunculus* (Linnaeus, 1758) is first recorded in the basin of Arcachon (Gironde, France). Eight living specimens, of which three are illustrated here, were collected in 1996/1997, 2002, 2003 and 2004, at 3 to 5 meters deep in the Courbey channel, close to the city of Lège-Cap-Ferret. They reach a large size (84-105 mm in height) and correspond to adult individuals. Thus, this record shows the occurrence of a second exotic muricid on the French Atlantic coast, the first one being *Ocenebrellus inornatus* (Recluz, 1851). The geological history of *Trunculariopsis* (Cossmann, 1921) shows that *T. trunculus* disappeared from the French Atlantic coast from the Late Pliocene to the Quaternary, but still persists in the Mediterranean Sea and in the Algarve. The *T. trunculus* from the basin of Arcachon, which is a place of commercial exchanges of molluscs, probably come from these areas.

**Résumé :** Première observation de *Trunculariopsis trunculus* (Linnaeus, 1758) dans le Bassin d'Arcachon (Gironde) : une deuxième espèce de Muricidae exotique sur les côtes atlantiques françaises. L'espèce *Trunculariopsis trunculus* (Linnaeus, 1758) (Gastropoda : Muricidae) est signalée pour la première fois dans le Bassin d'Arcachon (Gironde, France). Huit spécimens vivants, dont trois sont figurés ici, ont été trouvés en 1996/1997, 2002, 2003 et 2004, entre 3 et 5 m de profondeur, dans le chenal Courbey, près de la commune de Lège-Cap-Ferret. Ils atteignent une grande taille (84-105 mm de hauteur) et correspondent à des individus adultes. Cette signalisation met donc en évidence la présence d'une seconde espèce allochtone de Muricidae sur la côte atlantique française, la première étant *Ocenebrellus inornatus* (Recluz, 1851). L'histoire géologique de *Trunculariopsis* (Cossmann, 1921) montre que *T. trunculus* a disparu de la côte atlantique française pendant le Pliocène supérieur et le Quaternaire, mais qu'il persiste encore en Méditerranée et dans l'Algarve. Les *T. trunculus* du bassin d'Arcachon, qui est le siège d'échanges commerciaux de mollusques, proviennent probablement de ces régions.

**Keywords:** *Trunculariopsis trunculus*, Muricidae, Arcachon, Exotic species.

**Abbreviations:** MNHN: Muséum National d'Histoire Naturelle, collection du domaine des Sciences de la Terre.  
P1 : shoulder spine (see Merle, 2001).

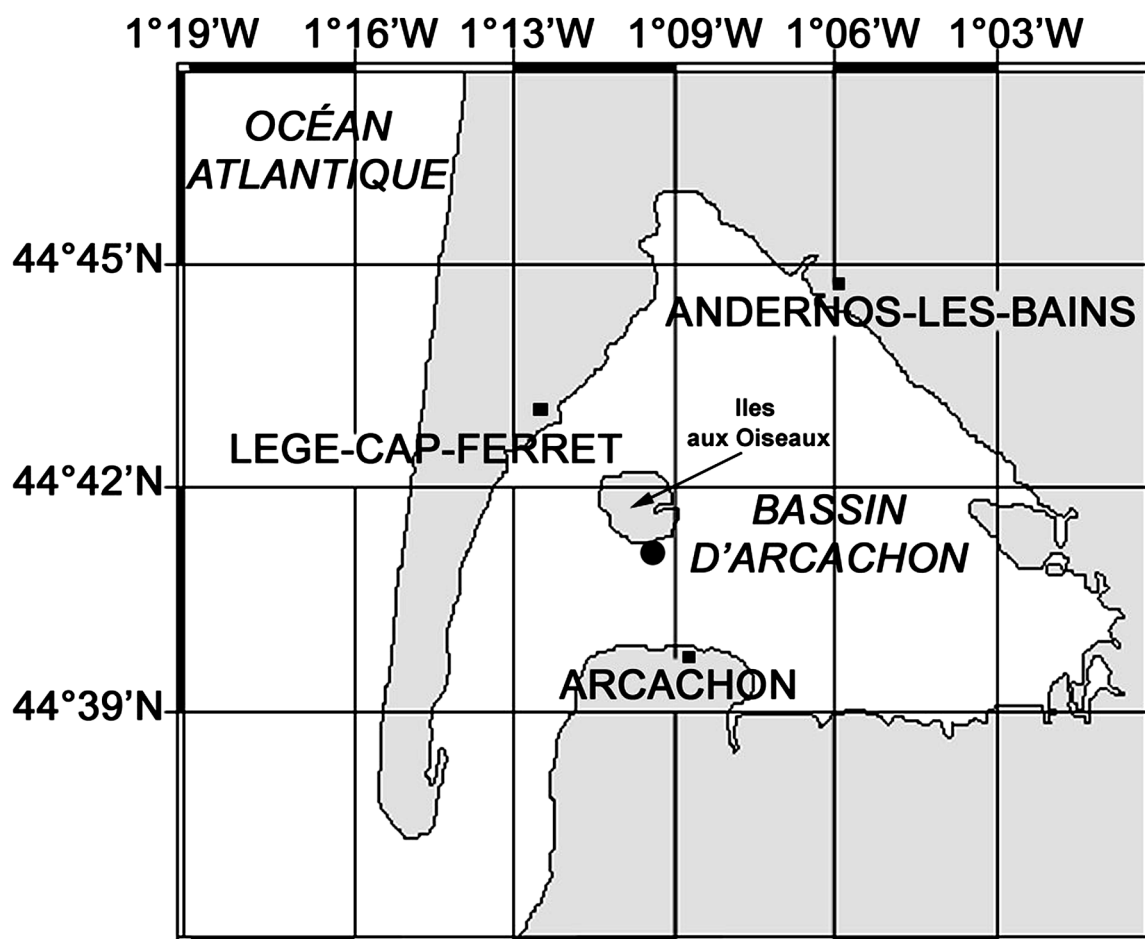
## Introduction

The non native species introduced by the human represent an important ecological problem by causing potential risks of proliferation and local disappearances of native species. Thus, recording the occurrence of these exotic species becomes fundamental for the control and the durable management of environmental factors. For marine environments, the development of aquaculture increases these risks, in spite of preventions, containments and monitoring of ecologically harmful species, suggesting little national or international oversight (Naylor et al., 2001). In France, the station Ifremer at Arcachon represents an example of institution intended for the prevention of the littoral and exotic species. However, in the Arcachon basin (Gironde, France), recent examples of introduction of marine molluscs are already known: *Crassostrea gigas* (Thunberg, 1793) for oyster farming and more recently *Ocenebrellus inornatus*

(Recluz, 1851), *Crepidula fornicata* (Linnaeus, 1758) and *Cyclope neritea* (Linnaeus, 1758) (Grizel & Héral, 1991; Blanchard, 1995; Bachelet et al., 2004; Martel et al., 2004). The record of living *Trunculariopsis trunculus* in the Arcachon basin (Fig. 1) on the French Atlantic coast suggests the appearance of a new introduced species. With *O. inornatus*, an invasive oyster driller (Pigeot et al., 2000), *T. trunculus* is the second introduced muricid, a member of a family of active predators.

## Geological history and biogeography of *T. trunculus*

The geological history of the genus *Trunculariopsis* takes root in the European Miocene with several species (Hoernes & Auinger, 1879-1891; Cossmann & Peyrot, 1924; Montanaro, 1935; Glibert, 1952 and personal obser-



**Figure 1.** *Trunculariopsis trunculus*. Geographical location of *T. trunculus* (black circle) in the Arcachon basin (Gironde, France).

**Figure 1.** *Trunculariopsis trunculus*. Localisation géographique de *T. trunculus* (cercle noir) dans le Bassin d'Arcachon (Gironde, France).

ventions). In the Late Miocene, *T. trunculus* is clearly attested in different parts of the Mediterranean Sea (Montanaro, 1935; Stchepinsky, 1938; Merle et al., 1990). It is also recorded in the French Atlantic Miocene (Redonian), with the form *conglobatus* Michelotti, 1841 (Brébion, 1964), which has a short shape, a wide P1 spine and a large pseudombilicus. *T. arietinus* (Millet, 1866) from the Redonian may represent a nanic population of this form and should be regarded as a younger synonym of *T. trunculus*. The form *conglobatus* is very common in the Mediterranean Pliocene, in which the shells may reach a large size (95 mm in height). However, *T. trunculus* is not recorded in the Upper Pliocene of the French Atlantic coast and seems to disappear of this sector during the Quaternary. In the Recent, *T. trunculus* is very common in the Mediterranean Sea. In the Atlantic Ocean, Houart (2001) recorded it as far north as Lagos (Portugal), the Canary Islands and Madeira. The map of Houart (2001, fig. 43) showed details of its geographic range. It demonstrated that *T. trunculus* remained unrecorded in the Aquitaine basin. According to Houart (1996, 2001), *T. trunculus* is very similar to young specimens of *T. duplex* (Röding, 1797) from West-Africa, a probable sister species.

**Table 1.** *Trunculariopsis trunculus*. Origin and measurements of the shells of *T. trunculus* collected in the channel Courbey (Arcachon basin, Gironde, France).

**Tableau 1.** *Trunculariopsis trunculus*. Origine et mesures des coquilles de *T. trunculus* récoltées dans le chenal Courbey (bassin d'Arcachon, Gironde, France).

| MATERIAL                              | HEIGHT  | WIDTH   |
|---------------------------------------|---------|---------|
| Spm MNHN A24242 – Oct. 2003           | 105 mm  | 70 mm   |
| Spm MNHN A24243 – Mar. 2004           | 86 mm   | 53 mm   |
| Spm Filippozzi collection – Mar. 2002 | 98 mm   | 59.9 mm |
| Spm Garrigues collection.- Jun. 2004  | 88 mm   | 49 mm   |
| Spm Poppe collection - Jun. 2004      | 84.5 mm | 50.7 mm |

### Material from the basin of Arcachon

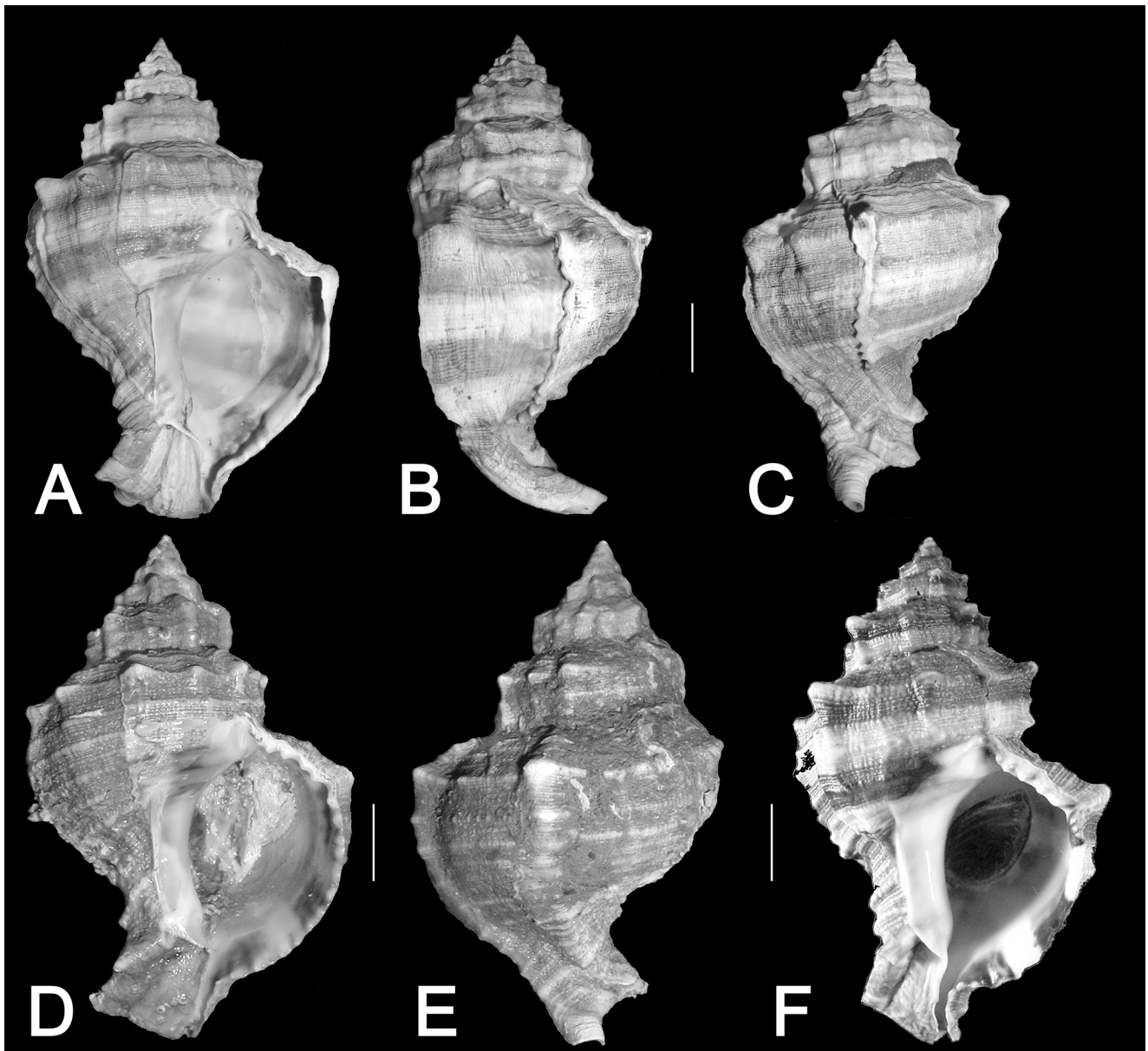
Two living specimens of *T. trunculus* from the basin of Arcachon were first discovered in 1996/1997, precisely in the chenal Courbey just near the south of the Ile aux Oiseaux (Fig. 1), at 3-5 meters deep. In 2002, 2003 and 2004, further field investigations in the same place allowed to collect 6 new living specimens [2 specimens (MNHN) (Fig. 2A-E), 1 specimen (Filippozzi coll.), 1 specimen (Garrigues coll.) (Fig. 2F), 2 specimens (Poppe coll.)]. Therefore, a total of 8 living specimens has been observed

between 1996/1997 and 2004. Among them, one specimen (MNHN) is preserved with its soft part in absolute alcohol in order to give the possibility of a molecular analysis. We had the opportunity to measure the size of 5 specimens (Table 1) and we figure 3 specimens (Fig. 2). The mean height (92.3 mm) is relatively large for the species and the greatest specimen (105 mm) is close to the highest published size for the species (108.1 mm, Houart 2001, fig. 36). This obviously indicates that the material corresponds to adult specimens. With the exception of the size, their shape is very similar to living specimens from the Golfe du Lion (France), Vinaroz (Spain), Vasto (Italy), Gabes (Tunisia) and Malte in the Mediterranean Sea and, particularly with thin specimens having very short P1 spines and low varices.

### Discussion

*T. trunculus* disappeared from the French Atlantic coast during the Late Pliocene and has never been recorded in the Quaternary, likely because of the global cooling event. Thus, for the first time, living specimens of *T. trunculus* are recorded in the Arcachon basin. This new record raises two questions. The first one concerns the survival of the species in the basin and the second concerns the circumstances of its introduction. Firstly, all specimens, sampled in 1996/1997, 2002, 2003 and 2004, were in age to reproduce. We still have very few information on the survival conditions of this species in the Arcachon basin, but it is important to stress once that it has been regularly sampled during an interval of time long of 7 or 8 years. Young individuals would be however necessary to check the continuity of a reproductive cycle. Moreover, rocky, sandy-muddy and mud substrata in a bay or a lagoon corresponds to the life environment of many *T. trunculus* in the Mediterranean Sea. Therefore, for these reasons (living individuals in age to reproduce collected during eight years even in winter and a life environment similar to that of the Mediterranean Sea), we highly suspect that *T. trunculus* is probably able to survive in the Arcachon Basin and exclude the hypothesis of recurrent human introductions of adult specimens, but we cannot exclude introductions of young specimens.

Secondly, the protoconch of *T. trunculus* is paucispiral which indicates a small potential of dispersal (lecithotrophic stage), in comparison to species having a multispiral protoconch (planktotrophic stage). This observation makes poorly credible the hypothesis of a quick natural propagation of 1100 kilometres, the distance corresponding to the nearest point (Lagos, Portugal; Houart, 2001) from the Arcachon basin in respect to the known range of *T. trunculus*. On the other hand, the Arcachon basin is reputed for its oyster farming and exchanges with other areas are numerous. For many years, exchanges occurred with the Thau



**Figure 2.** *Trunculariopsis trunculus*. Specimens (spm) of *T. trunculus* collected in the Arcachon basin (Gironde, France). **A-C**: spm MNHN A24242 (sample October 2003), **D-E**: spm MNHN A24243 (sample March 2004), **F**: spm Garrigues coll. (sample June 2004). Scale bar: 20 mm.

**Figure 2.** *Trunculariopsis trunculus*. Spécimens (spm) de *T. trunculus* provenant du Bassin d'Arcachon (Gironde, France). **A-C** : spm MNHN A24242 (récolte octobre 2003), **D-E** : spm MNHN A24243 (récolte mars 2004), **F** : spm coll. Garrigues (récolte juin 2004). Echelle : 20 mm.

lagoon where *T. trunculus* has been collected (observations on the collection of the Muséum National d'Histoire Naturelle, Paris). Several examples of species introduction between these basins are known. In the Arcachon-Thau direction, Blanchard (1995) attributes the introduction of *Crepidula fornicata* (Gastropoda, Crepidulidae) in the Thau lagoon to massive transports of the Japanese oysters in

1982. In the direction Thau-Arcachon, Bachelet et al. (2004) suggest, using genetic data, that *Cyclope neritea* (Gastropoda, Nassariidae) could be introduced from the Thau lagoon. Nevertheless, they also indicate other probable areas, as Faro (Portugal) where oysters are farmed, or as the Adriatic Sea because of commercial exchanges of the bivalve *Tapes philippinarum* (Adams & Reeve, 1850). The

locality of Faro is placed in the geographic range of *T. trunculus* presented by Houart (2001). In conclusion, it is still difficult to precisely determine the Mediterranean origin of *T. trunculus* from Arcachon and genetic investigations would be useful to clarify this problem.

This short paper on the record of *T. trunculus* would be incomplete without some words on its potential impact in the basin. First, *T. trunculus* is a shell predator with *O. inornatus* and *Stramonita heamastoma* (Linnaeus, 1767), which also live in this basin. As noted by Staglišić et al. (2005), although it is one of the most common muricids in the Mediterranean Sea, relatively little is known about its ecology, especially its feeding behaviour. Staglišić et al. (2005) indicated that the species may marginally chip the valves of the mussel *Mytilus galloprovincialis* Lamarck, 1819 or drill them. Observations on shell drill-holes in the western Mediterranean and Crete suggest that the whelks *T. trunculus* and *S. haemastoma* feed on 18 different gastropods and bivalves (Basedow, 1994 & 1996; Rilov et al., 2002). Thus, the first consequence of the introduction of *T. trunculus* in the Arcachon basin could probably be an increase of the predation pressure on other molluscs including commercial species.

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