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INVASION NOTE

Observations on the invading gastropod *Rapana venosa* in Punta del Este, Maldonado Bay, Uruguay

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Abstract We report on the first sightings of the invasive Rapa Whelk *Rapana venosa* in Maldonado Bay (Punta del Este Harbor and Gorriti Island) using in vivo, underwater observations and video surveys. The species was first detected in the Río de la Plata (Uruguay and Argentina) in 1999, and by 2004 it had extended its local distribution to Punta del Este at the eastern boundary of the estuary. Observations performed by SCUBA diving showed that *R. venosa* is preying on native mussels *Mytilus edulis* and *Brachidontes* spp., and that formerly abundant mussel beds are being seriously depleted due to a combination of human extraction, habitat deterioration and predation by the Rapa Whelk.

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Introduction

Rapana venosa (Valenciennes 1846), a large predatory gastropod of the family Muricidae, is one of the most unwelcome and conspicuous invading mollusks. This species is native to the Sea of Japan, Yellow Sea, East China Sea and Gulf of Bohai. It has has been introduced in several parts of Eurasia (ICES 2004; Savini and Occhipinti-Ambrogi 2006). In 1998 it was found in the Chesapeake Bay, USA (Harding and Mann 1999). In the 1990s, this species was found for the first time in Uruguay/Argentina in the Río de la Plata estuary (Pastorino et al. 2000; Scarabino et al. 1999).

The Río de la Plata estuary is a large ecosystem formed by the drainage of the Río de la Plata Basin into the Southwestern Atlantic, extending for over 280 km from the head (25 km wide) to the 230-km-wide mouth between Punta Rasa and Punta del Este. The estuary has a mixohaline area of 38,000 km^2. Depth in the estuary ranges from 0 to 25 m and salinity values between 0 and 30, while in the adjacent marine zone the depth range is 25–40 m and salinity between 30 and 34. Maldonado Bay is located on the physical-ecological boundary of the Río de la Plata estuary, and includes Punta del Este

city, the most important tourist destination in Uruguay. The Bay has an area of ca. 6 km^2 (Milstein and Juanicó 1985) with a maximum depth of about 15 m. Water temperature fluctuates between 10.7°C in winter and 24.6°C in summer, while salinity varies between 6 and 34.90 (Burone and Bayseé 1985; Milstein and Juanicó 1985). *Rapana venosa* has been recorded in the region since, at least, 2004 (Scarabino et al. 2006a) and has caused increased concerns in the artisanal shellfishermen. In Maldonado Bay, the blue mussel *Mytilus edulis* forms large beds and has been exploited for over 60 years by divers in Lobos and Gorriti islands (Defeo and Riestra 2000; Niggenmayer and Masello 1992).

Materials and methods

During April 2009, SCUBA diving and video and photographic surveys for the presence of *R. venosa* were performed in Maldonado Bay (Punta del Este Harbor and Gorriti Island), in collaboration with artisanal fishermen. Prior surveys of mussels beds were done in 1988–1989 by INAPE (National Institute of Fisheries, current National Direction of Aquatic Resources, DINARA) and we returned to some of these same stations for comparison. At five stations established for seasonal surveys, in which mussels were previously identified as abundant, three divers explored the bottom searching for mussel beds and/or the presence of the Rapa Whelk. We used the same methods for measuring mussel beds as in the 1988–1989 surveys (i.e. manual scraping of randomly placed 0.33 × 0.33 quadrats), and additionally we collected all encountered specimens of *R. venosa*. We also surveyed ten dock pilings at Punta del Este Harbor, and counted the abundance and collected all Rapa Whelk. In each dock piling, we video-surveyed the randomly placed quadrats (described above) in order to estimate average densities of *R. venosa* in this artificial substratum. We measure the shell length of all Rapa Whelks collected (maximum linear dimension), weighed them, and then identified and counted the epibionts on their shells. Voucher material of *Rapana venosa* was stored at the Museo Nacional de Historia Natural y Antropología (MUNHINA, Montevideo, Uruguay). Anecdotic information on the effects of this species in the area was also obtained from fishermen working in Punta del Este harbor.

Results

Divers did not find mussel beds at 4 of the 5 stations in which mussels beds were previously described as abundant. However, guided by local fishermen, we located one station with some remnants mussel beds. While there were mussel beds, they appeared to be depleted, since most rocky surface showed bare rock and algae, with little or no mussel covert. The individual mussels were also small (mean = 17.15 mm). At this place, 74 adult specimens of *R. venosa* (mean size = 75.58 mm) were collected in about 30′, all exposed on the surface or in crevices. Many of the whelks were coupled in apparent reproductive activity. No Rapa Whelk egg capsules were observed. Nearly all specimens were covered all or in part with epibiota. In the samples from dock pilings, we collected 85 whelks (mean size = 84.92 mm), averaging 8.4 ind/piling. Where present, mussel covert in pilings showed the tracks produced by *R. venosa* feeding, and most of the whelks collected were actively feeding on mussels. Some piles showed a dense covert of mussel at shallow depths, but as depth increased only bare substrata with scattered flat oysters *Ostrea equestris*. In addition, local fishermen reported a severe depletion of mussel beds covert in Punta del Chileno and Punta Ballena areas associated to high densities of the Rapa Whelk.

Discussion

Here we confirm the expansion of *R. venosa* into the easternmost portion of the Río de la Plata Estuary reported in Scarabino et al. (2006a) and Lanfranconi et al. (2009) and provide the first in situ and population data for *R. venosa* in the Maldonado Bay. The widespread presence of *R. venosa* in that bay was first noticed in 2004, when many people—including fishermen—began to report the presence of the gastropod either as washed ashore shells or as live specimens in subtidal areas. Evidence for the potential presence of *R. venosa* in Maldonado Bay dates from 1998 in the form of several egg capsules collected in the beach, which are assumed to have been washed ashore from adjacent estuarine zones. Not a single adult whelk was reported or collected in the Bay prior to 2004, but these live invasive whelks are now found commonly (FS pers. obs.). In fact, some empty or decayed egg capsules have been found

in the Uruguay Atlantic coast as far east as La Paloma, Santa Teresa and La Coronilla some 100–200 km from the study location; Scarabino & Carranza, pers. obs. 2007–2009) although at present we have not observed adults of this conspicuous species at these sites. It appears that egg capsules and probably of larvae) are being dispersed by currents, which constitutes a likely mechanism facilitating the invasion of *R. venosa* along the Uruguayan Atlantic coast. However, local data are still scarce.

There has been no attempt to curtail the invasion and this represents a significant lapse in management for the future of artisanal mussel fisheries and these estuarine ecosystems. It is widely accepted that the only cost effective (and potentially successful) approach to stop invasive species is before they become fully established. After that, efforts are expensive and usually futile. However, the opening of a fishery directed to exploit the invasive whelk is a promissory mitigation tool.

Although previously reported to the inner and mid portion of the estuary (Carranza and Rodríguez 2007; Carranza et al. 2008; Cortelezzi et al. 2007), the Rapa Whelk is certainly preying on the mussel beds in Punta del Este area, as previously suggested (Carranza et al. 2009; Scarabino et al. 2006b). This may further contribute to the ongoing decline of native mussel beds, that have been fully exploited since, at least, 1991 (Defeo 1991). The combined effects of overexploitation and, likely, other human-induced impacts (e.g. pollution) may have caused the decline of mussel beds in the area prior to the appearance of the Rapa Whelk (Defeo and Riestra 2000).

Previous experimental results with Rapa Whelks from the Adriatic Sea showed very low per capita mussel consumption rates, which may mean that represent less threat to fisheries overall, not supporting the hypothesis of an economical threat posed by the gastropod (e.g. Savini and Occhipinti-Ambrogi 2006). However, we argue that even if per capita consumption rates are indeed low, the unusually high abundances of the Rapa Whelk still poses a threat to mussel beds. Further, at least in Gorriti Island and Punta del Este Harbor, mussels may well be the unique prey item for *R. venosa*, in contrast with the above mentioned study where three species were offered to the whelks. In addition, local fishermen reported a severe depletion of mussel beds covertt in Punta del Chileno and Punta Ballena areas associated to high densities of the Rapa Whelk, consistent with the hypothesis of mussel bed depletion at least partially caused by the gastropod.

In addition, *R. venosa* has already been show to reach very high densities and to constitute the highest benthic biomass in the inner and mid portion of Río de la Plata estuary (Cortelezzi et al. 2007). Further, the distribution of *R. venosa* within the estuary overlaps with the distribution of the clam *Mactra isabelleana* (e.g. Giberto et al. 2007). This is particularly alarming, since, given the densities reported, the Rapa whelk may be also causing a dramatic decrease in the main bivalve population in the Río de la Plata estuary (*Mactra isabelleana*), with several ecosystem-level consequences (Beck et al. 2009; Coen and Luckenbach 2000; Commito et al. 2005). However, until now, we lack of direct evidence on the magnitude of the impact of *R. venosa* on native bivalves for this area.

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References

Beck MW, Brumbaugh RD, Airoldi L, Carranza A, Coen LD, Crawford C, Defeo O, Edgar GJ, Hancock B, Kay M, Lenihan H, Luckenbach MW, Toropova CL, Zhang G (2009) Shellfish reefs at risk. A global analysis of problems and solutions. The Nature Conservancy, Arlington, p 52

Burone F, Bayseé C (1985) Diatomeas de la Bahía de Maldonado (Uruguay). II. Bidulphiacae y Chaetoceraceae. Contribuciones del Departamento de Oceanografía de la Facultad de Humanidades y Ciencias (Montevideo) 2:1–31

Carranza A, Rodríguez M (2007) On the benthic molluscs of Banco Inglés (Río de la Plata, Uruguay). Anim Biodivers Conserv 30:161–168

Carranza A, Scarabino F, Ortega L (2008) Distribution of large benthic gastropods in the Uruguayan continental shelf and Río de la Plata estuary. J Coast Res 24:161–168

Carranza A, Defeo O, Beck M, Castilla JC (2009) Linking fisheries management and conservation in bioengineering species: the case of South American mussels (Mytilidae). Rev Fish Biol Fish 19:349–366

Coen LD, Luckenbach MW (2000) Developing success criteria and goals for evaluating oyster reef restoration: ecological function or resource exploitation? Ecol Eng 15:323–343

Commito JA, Celano EA, Celico HJ, Como S, Johnson CP (2005) Mussels matter: postlarval dispersal dynamics altered by a spatially complex ecosystem engineer. J Exp Mar Biol Ecol 316:133–147

Cortelezzi A, Rodrigues Capítulo A, Boccardi L, Arocena R (2007) Benthic assemblages of a temperate estuarine system in South America: Transition from a freshwater to an estuarine zone. J Mar Sys 68:569–580

Defeo O (1991) El recurso mejillón *Mytilus edulis platensis* de Uruguay: situación actual y perspectivas. Tech Report INAPE, p 71

Defeo O, Riestra G (2000) El mejillón *Mytilus edulis* platensis en costas del departamento de Maladonado: propuesta para la ordenación de su pesquería. In: Rey M (ed) Recursos Pesqueros No Tradicionales: Moluscos Bentónicos Marinos, Proyecto URU/92/003. INAPE-PNUD, Montevideo, pp 58–72

Giberto DA, Bemec CS, Schejter L, Schiariti A, Mianzán H, Acha EM (2007) The invasive Rapa Whelk *Rapana venosa* (Valenciennes 1846): status and potential ecological impacts in the Río de la Plata estuary, Argentina-Uruguay. J Shell Res 25:919–924

Harding J, Mann R (1999) Observations on the biology of the Veined Rapa Whelk, *Rapana venosa* (Valenciennes, 1846) in the Chesapeake Bay. J Shell Res 18:9–17

ICES (2004) Alien Species Alert: *Rapana venosa* (veined welk). ICES Cooperative Research Report No. 264, p 14

Lanfranconi A, Hutton M, Brugnoli E, Muniz P (2009) New record of the alien mollusc *Rapana venosa* (Valenciennes 1846) in the Uruguayan coastal zone of Río de la Plata. Pan Am J Aq Sci 4:216–221

Milstein A, Juanicó M (1985) Zooplankton dynamics in Maldonado Bay (Uruguay). Hydrobiologia 126:155–164

Niggenmayer F, Masello A (1992) La pesquería de mejillón (*Mytilus edulis platensis*): análisis de los desembarques en el puerto de Punta del Este (Maldonado, Uruguay). Frente Marítimo 12:83–88

Pastorino G, Penchaszadeh PE, Schejter L, Bremec C (2000) *Rapana venosa* (Valenciennes, 1846) (Mollusca: Muricidae): a new gastropod in south Atlantic waters. J Shell Res 19:897–899

Savini D, Occhipinti-Ambrogi A (2006) Consumption rates and prey preference of the invasive gastropod *Rapana venosa* in the Northern Adriatic Sea. Helgoland Mar Res 60:153–159

Scarabino F, Menafra R and Etchegaray P (1999) Presencia de *Rapana venosa* (Valenciennes, 1846) (Gastropoda: Muricidae) en el Río de la Plata. Boletín de la Sociedad Zoológica del Uruguay (Actas de las V Jornadas de Zoología del Uruguay) 11 (Segunda Epoca)

Scarabino F, Zaffaroni JC, Carranza A, Clavijo C, Nin M (2006a) Gasterópodos marinos y estuarinos de la costa uruguaya: faunística, distribución, taxonomía y conservación. In: Menafra R, Rodríguez-Gallego L, Scarabino F, Conde D (eds) Bases para la conservación y el manejo de la costa uruguaya. VIDA SILVESTRE (Sociedad Uruguaya para la Conservación de la Naturaleza), Montevideo, pp 143–155

Scarabino F, Zaffaroni JC, Clavijo C, Carranza A, Nin M (2006b) Bivalvos marinos y estuarinos de la costa uruguaya: faunística, distribución, taxonomía y conservación. In: Menafra R, Rodríguez-Gallego L, Scarabino F, Conde D (eds) Bases para la conservación y el manejo de la costa uruguaya. VIDA SILVESTRE (Sociedad Uruguaya para la Conservación de la Naturaleza), Montevideo, pp 157–169