Rapana venosa 正體中文

System: Marine

Kingdom	Phylum	Class	Order	Family
Animalia	Mollusca	Gastropoda	Neogastropoda	Muricidae

Common name veined whelk (English), Asian rapa whelk (English), rapa whelk (English), veined rapa whelk (English)

Synonym *Rapana thomasiana* , (Crosse, 1861)
Rapana pontica , (Nordsieck, 1969)

Similar species *Rapana bezoar, Rapana rapiformis*

Summary Rapana venosa is a predatory marine snail which may impact both natural and cultivated populations of oysters, mussels and other molluscs. In areas where it has been introduced it has caused significant changes to the ecosystem. It has a high ecological fitness as evidenced by its high fertility, fast growth rate and tolerance to low salinity, high and low temperatures, water pollution and oxygen deficiency. Long distance dispersal is facilitated by ship ballast water, in which the larvae of the snail is found in its plankton phase.

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Species Description
Rapana venosa is a member of the Muricidae, a family of predatory marine snails (Kerckhof *et al*. 2006). It has a large and heavy shell with a short spire. A very distinctive feature is the deep orange colour of the inside of the shell. The outer colour is variable from dull grey to red brown, with more or less conspicuous dark brown dashes on the spiral ribs, which tend to make an interrupted vein-like pattern throughout the entire shell.\r\n
It has a large inflated body whorl and a deep umbilicus. The aperture is large and ovate, and the columella broad and smooth. The edge of the outer lip has small, elongate teeth. Smooth spiral ribs develop regular blunt knobs at the shoulder and the periphery of the body whorl. Fine spiral ridges are crossed by low vertical riblets. Spiral, vein-like colouration, varying from black to dark blue, occasionally occurs internally, originating at the individual teeth at the outer lip of the aperture (Mann and Harding 2000).

Lifecycle Stages
Rapana venosa lays mats of eggs with 50–500 egg cases per mat (ICES 2004). Each case may contain 200–1,000 eggs (Ware *et al*., 2001). Egg capsules resemble small mats of yellow shag carpet; between 14 and 21 days later (depending on temperature and salinity) pelagic larvae hatch that eventually settle on the bottom where they develop into hard-shelled snails (ICES 2004; CIESM 2000). Pelagic larvae have a long planktonic phase which may last to a maximum of 80 days (Kerckhof *et al* 2006). Veligers larvae settle successfully on a wide range of attached macrofauna including bryozoans and barnacles. They grow quickly on mixed algal diets, reaching shell lengths in excess of 0.5mm at 21 days (Harding and Mann In Prep.).

Uses
CIESM (2000) states that, \"In Japan, *R. venosa* has been sold as seafood on Japanese markets, and could be equivalent to other muricids consumed in countries of Mediterranean culture.\"
Liang *et al.* (2004) state that, \"*R. venosa* manifested the most bioaccumulation capacity of Cd (Cadmium). *R. venosa* and the short necked clam *Ruditapes philippinarum* were hopeful bioindicators for monitoring Cd and Ni (Nickle) pollution in waters, ...\"

Habitat Description
Rapana venosa is a prolific, extremely versatile species tolerating low salinities, water pollution and oxygen deficient waters. All larval stages exhibit 48-h tolerance to salinities as low as 15 ppt with minimal mortality. Below this salinity, survival grades to lower values. Percentage survival of *R. venosa* larvae is significantly less at 7 ppt than at any other salinity. There were no differences in percentage survival at salinities greater than 16 ppt (Mann and Harding 2003). In its native Korean range *R. venosa* demonstrates large annual temperature tolerances (from 4°C to 27°C) (Chung *et al*. 1993, in Mann and Harding 2000). It may migrate to warmer, deeper waters in winter thereby evading cool surface waters (USGS-NAS Undated).\r\n
It favours sandy bottoms where the snails can burrow, thus, the seafloor of the southern North Sea is a very suitable habitat (Kerckhof *et al*. 2006), however, the species colonises hard substrates too.

Reproduction
Rapana venosa is dioecious with separate sexes (ICES, 2004).

Nutrition
Rapana venosa are carnivorous gastropods whose main diet consists of a variety of molluscs including native oysters (USGS-NAS Undated). Adult *R. venosa* are voracious predators of commercially valuable shellfish including oysters and hard clams (Harding and Mann 2002). Most marine predatory snails feed by drilling a hole into their prey, but *R. venosa* smothers its prey by wrapping around the hinged region of the shell and feeding between the opened valve. However *R. venosa* may also drill (Roger Mann, Pers. Comm. 2005).

General Impacts
Due to its predatory impact *Rapana venosa* is considered as one of the most unwelcome invaders worldwide. *R. venosa* is an active predator of epifaunal bivalves, and its proliferation is a serious limitation cultivated and natural populations of oysters and mussels (CEISM 2000). *R. venosa* are very voracious predators and Rapana is blamed in the Black Sea for the decline of the native, edible bivalve fauna (Zolotarev 1996, in Harding 2003). They have caused significant changes in the ecology of bottom-dwelling organisms and have resulted in the near extinction of the Gudaut oyster (Chukhchin 1984, in Harding 2003). (USGS-NAS Undated). Although scientists are still studying the impacts of *R. venosa*, they are very concerned about its potential damage to native species. \r\n
In Chesapeake Bay (Mid-Atlantic, USA) studies are currently under way to help determine *R. venosa* spread to develop a model to define potential impacts to the ecosystem. For example, vulnerable prey include infaunal shellfish such as *Mya arenaria*, *Ensis directus* and *Cyrtopleura costata*). In this region predation has also been demonstrated on a range of commercially valuable shellfish species. Another ecological change precipitated by the viened whelk is that the presence of large empty *R. venosa* shells in the area appears to increase population numbers of the local hermit crab *Clibanarius vittatus* (Harding and Mann 1999). It is already known that in this region the veined whelk is less susceptible to predation by seasonally migrating large predators (turtles) due to their thick broad shells when compared to large native gastropods such as Busycon and Busycotypus (Harding and Mann 1999). Once this predator refuge size is attained, it is suggested that Rapana venosa may remain as an unchallenged predator for up to a decade (ICES 2004).

Management Info
As with many introductions, the probability of observing the initial introduction event is minimal. The cryptic nature of the veined whelk contributes to the improbability of observing individuals until they are large and imposing members of the benthic community (ICES 2004). Attempts to target the species for control or eradication must choose the most susceptible lifecycle stage. Unfortunately egg case mats, although visible and concentrated, may be spread over vast areas represent considerable propagule pressure even in small numbers. Larval forms are too dispersed to be considered tractable target and while large epifaunal individuals are identified with comparative ease, their selective collection represents an enormous investment of diver time (ICES 2004).\r\n
Preventing the spread of marine invasives such as the veined whelk that are transported by ballast water could involve the sampling and treating of ballast water systems. International compliance with the Ballast Water Management Convention (prepared by the International Maritime Organization) is necessary. The GEF/UNDP/IMO Global Ballast Water Management Programme (GloBallast) is assisting developing countries to reduce the transfer of harmful aquatic organisms and pathogens in ships' ballast water, implement the IMO ballast water Guidelines and prepare for the new IMO ballast water Convention.\r\n
Knowing the potential spread of a marine invasive may highlight areas at risk of invasion and indicate appropriate areas to prioritise in terms of preventing its introduction into new locations. A study by Savini and collegues (2004) on the population structure of the veined whelk in Cesenatico, Northern Adriatic Sea (Emilia-Romagna coast), indicated that breakwaters could represent preferential sites for the maintenance of *R. venosa* as they are utilised as spawning and feeding grounds. In the USA an evaluation of the potential spread of the whelk indicates that the invader could colonise the higher salinity regions of most East Coast estuaries and survive on exposed shorelines from Cape Cod, MA to Charleston, SC (Mann and Harding 2000). \r\n
The probable habitat overlap between juvenile blue crabs and *R. venosa* in Chesapeake Bay and the predation by blue crabs on epifaunal *R. venosa* is a form of natural biological control which may be occurring in Chesapeake Bay, USA (Harding and Mann 2003). Blue crabs, mud crabs, and spider crabs (*Libinia emarginata*) also consume *R. venosa*. Howeve,r this is not an incentive to distribute crabs into estuarine habitats infested with the veined whelk as no host range testing has been conducted. In addition, this form of control is only likely to be effective for the first three to four years following settlement, as following this period crabs reach a large enough size to escape predation.

Pathway
Accidental introductions of veined whelk egg cases with acquaculture products is very likely (Kerckhof *et al*. 2006).Accidental introductions of veined whelk egg cases in hull fouling is very plausible (Kerckhof *et al*. 2006).

Principal source: ICES. 2004 Alien Species Alert: *Rapana venosa* (veined whelk). Edited by Roger Mann, Anna Occhipinti, and Juliana M. Harding. ICES Cooperative Research Report No. 264. 14 pp.
USGS-NAS, UNDATED Veined Rapa Whelk, Asian Rapa Whelk, *Rapana venosa*
CIESM, 2000 *Rapana venosa* (Valenciennes, 1846)

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

Review: Roger L. Mann Professor of Marine Science & Juliana M. Harding, Ph.D. Virginia Institute of Marine Science Department of Fisheries Science College of William & Mary USA

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ALIEN RANGE

[2] ATLANTIC - NORTHEAST
[4] MEDITERRANEAN & BLACK SEA
[1] URUGUAY
[1] FRANCE
[1] UNITED STATES

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Managment information

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Summary: The electronic tool kits made available on the Cefas page for free download are Crown Copyright (2007-2008). As such, these are freeware and may be freely distributed provided this notice is retained. No warranty, expressed or implied, is made and users should satisfy themselves as to the applicability of the results in any given circumstance. Toolkits available include 1) FISK- Freshwater Fish Invasiveness Scoring Kit (English and Spanish language version); 2) MFISK- Marine Fish Invasiveness Scoring Kit; 3) MI-ISK- Marine invertebrate Invasiveness Scoring Kit; 4) FI-ISK- Freshwater Invertebrate Invasiveness Scoring Kit and AmphISK- Amphibian Invasiveness Scoring Kit. These tool kits were developed by Cefas, with new VisualBasic and computational programming by Lorenzo Vilizzi, David Cooper, Andy South and Gordon H. Copp, based on VisualBasic code in the original Weed Risk Assessment (WRA) tool kit of P.C. Pheloung, P.A. Williams & S.R. Halloy (1999).

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