

*Rapana venosa* 正體中文

**System:** Marine

Kingdom	Phylum	Class	Order	Family
Animalia	Mollusca	Gastropoda	Neogastropoda	Muricidae

<b>Common name</b>	veined whelk (English), Asian rapa whelk (English), rapa whelk (English), veined rapa whelk (English)
<b>Synonym</b>	<i>Rapana thomasi</i> , (Crosse, 1861) <i>Rapana pontica</i> , (Nordsieck, 1969)
<b>Similar species</b>	<i>Rapana bezoar</i> , <i>Rapana rapiformis</i>
<b>Summary</b>	<i>Rapana venosa</i> 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.



[view this species on IUCN Red List](#)

## 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.  
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).

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.

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 veined 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).

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.

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 colleagues (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).

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*. However, 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 aquaculture 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

**Publication date:** 2006-07-13

## ALIEN RANGE

[2] ATLANTIC - NORTHEAST

[4] MEDITERRANEAN & BLACK SEA

[1] URUGUAY

[1] FRANCE

[1] UNITED STATES

## BIBLIOGRAPHY

### 40 references found for *Rapana venosa*

#### Management information

[Centre for Environment, Fisheries & Aquaculture Science \(CEFAS\), 2008. Decision support tools-Identifying potentially invasive non-native marine and freshwater species: fish, invertebrates, amphibians.](#)

**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).

The decision support tools are available from:

<http://cefas.defra.gov.uk/our-science/ecosystems-and-biodiversity/non-native-species/decision-support-tools.aspx> [Accessed 13 October 2011]

[The guidance document](http://www.cefas.co.uk/media/118009/fisk_guide_v2.pdf) is available from [http://www.cefas.co.uk/media/118009/fisk\\_guide\\_v2.pdf](http://www.cefas.co.uk/media/118009/fisk_guide_v2.pdf) [Accessed 13 January 2009].

Harding, J. M. 2003. Predation by blue crabs, *Callinectes sapidus*, on rapa whelks, *Rapana venosa* possible natural controls for an invasive species?. *Journal of Experimental Marine Biology and Ecology* 297:161- 177.

**Summary:** Scientific study on the causes of species invasiveness and current research regarding species.

Harding, J. M and Mann, R. 2003. Current status and potential establishment range for veined rapa whelks *Rapana venosa* on the U.S. East Coast. *Aquatic Invaders*. 14(2):1-7.

[Harding, J.M. and Mann, R. 2003. Rapa whelks \(\*Rapana venosa\*\) as prey items for Chesapeake Bay fauna: Natural controls for an invasive species? In Abstracts: Third International Conference on Marine Bioinvasions, March 16-19, 2003. Scripps Institution of Oceanography La Jolla, California](#)

**Summary:** Investigation into the possibility of using native predators to control *Rapana venosa*.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2003/MBI2003abs5.pdf> [Accessed 25 Nov 2004]

Harding, J. M., and R. Mann. 2002. Current status and potential establishment range for the predatory marine gastropod *Rapana venosa* on the U.S. East Coast. Presentation at the American Fisheries Society Annual meeting, Baltimore, MD. August 2002. From: *Veined rapa whelk (*Rapana venosa*) research in North America: Summary of research activity through February 2002*.

**Summary:** Scientific study on the causes of species invasiveness and current research regarding species.

[Hewitt, C.L, Campbell, M.L. and Gollasch, S. 2006. Alien Species in Aquaculture. Considerations for responsible use. IUCN, Gland, Switzerland and Cambridge, UK. viii + 32 pp.](#)

**Summary:** This publication aims to first provide decision makers and managers with information on the existing international and regional regulations that address the use of alien species in aquaculture, either directly or indirectly; and three examples of national responses to this issue (New Zealand, Australia and Chile).

Available from: <http://data.iucn.org/dbtw-wpd/edocs/2006-036.pdf> [Accessed 22 September 2008]

[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.](#)

[International Commission for the Scientific Exploration of the Mediterranean Sea \(CIESM\), 2000. \*Rapana venosa\* \(Valenciennes, 1846\). CIESM Atlas of Exotic Species in the Mediterranean Sea Volume 2.](#)

**Summary:** Information on description, economic importance, distribution, habitat, history, growth, and impacts and management of species.

Available from: <http://www.ciesm.org/atlas/Rapanavenosa.html> [Accessed 25 March 2004]

Mann, R. 1999. The current status of the Rapa Whelk in the Chesapeake Bay. Presentation at the ICES Working Group on Introductions and Transfers of Marine Organisms, Conwy, North Wales, April 12-16, 1999. From: *Veined rapa whelk (*Rapana venosa*) research in North America: Summary of research activity through February 2002*.

**Summary:** Scientific study on the causes of species invasiveness and current research regarding species.

Mann, R., and J. M. Harding. 2000. Coming soon to a restoration site near you: The invading, predatory oriental gastropod *Rapana venosa*. Presentation at the 5th International Shellfish Restoration Conference, Hilton Head, South Carolina, November 17-20, 2000. From: *Veined rapa whelk (*Rapana venosa*) research in North America: Summary of research activity through February 2002*.

**Summary:** Scientific study on the causes of species invasiveness and current research regarding species.

Mann, R & Harding, Juliana M., 2000. Invasion of the North American Atlantic coast by a large predatory Asian mollusc. *Biological Invasions* 2: 7-22

Mann, R & Harding, Juliana M., 2003. Salinity Tolerance of Larval *Rapana venosa*: Implications for Dispersal and Establishment of an Invading Predatory Gastropod on the North American Atlantic Coast. *Biol. Bull.* 204: 96-103.

Savini, D; M. Castellazzi, M. Favruzzo and A. Occhipinti-Ambrogi., 2004. The alien mollusc *Rapana venosa* (Valenciennes, 1846; Gastropoda, Muricidae) in the Northern Adriatic Sea: population structure and shell morphology. *Chemistry and Ecology* Vol: 20 Issue: S1 PP: 411-424 [The ChesapeakeBay.com. 1999. The Veined Rapa Whelk \(\*Rapana venosa\*\).](#)

**Summary:** Information on description, economic importance, distribution, habitat, history, growth, and impacts and management of species.

Available from: [http://thechesapeakebay.com/veined\\_rapa.shtml](http://thechesapeakebay.com/veined_rapa.shtml) [Accessed 25 March 2004]



# GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Rapana venosa*

[USGS-NAS \(Nonindigenous Aquatic Species\). UNDATED. Veined Rapa Whelk, Asian Rapa Whelk, \*Rapana venosa\*. USGS Florida Integrated Science Center - Gainesville.](#)

**Summary:** Information on description, economic importance, distribution, habitat, history, growth, and impacts and management of species.

Available from: [http://cars.er.usgs.gov/Nonindigenous\\_Species/Rapa\\_whelk/rapa\\_whelk.html](http://cars.er.usgs.gov/Nonindigenous_Species/Rapa_whelk/rapa_whelk.html) [Accessed 25 March 2004]

## General information

Chukchin, V. 1984. Ecology of the gastropod molluscs of the Black Sea. Acad. Sc. USSR, Kiev Naukova Dumka, 175 pp. (in Russian).

Chung, E., Kim, S., and Y. Kim. 1993. Reproductive ecology of the purple shell, *Rapana venosa* (Gastropoda: Muricidae), with special reference to the reproductive cycle, depositions of egg capsules and hatchings of larvae. Korean J. Malacol. 9(2): 1-15.

[DAISIE \(Delivering Alien Invasive Species Inventories for Europe\) 2006. DAISIE News Two new invasive species arrived the North Sea basin.](#)

**Summary:** DAISIE is a project supported by the European Commission under the Sixth Framework Programme for Research, Technological Development and Demonstration Activities, contributing to the Specific Programme Integrating and Strengthening the European Research Area, area of Policy-oriented research, Sub-priority 1.1.6.3 Call 2 Global Change and Ecosystems, Topic III.4.3 Create an inventory of invasive species. The DAISIE Portal provides access to: The DAISIE Home Page with information about the DAISIE project and participants; The European Expertise Registry provides information about experts on invasive alien species; The European Alien Species Database (under construction, delivery date November 2006); The Invasive Alien Species Accounts (under construction, delivery date June 2007); Distribution Maps and Spatial Analysis (under construction, delivery date August 2007)

DAISIE is available from: <http://www.europe-aliens.org/>

This page available from: <http://www.daisie.se/News/NewsII.doc>

D Asaro, C. 1991. Gunner Thorson's world-wide collection of prosobranch egg capsules: Muricidae. Ophelia 35(1):1-101.

[Gensler, A.L., Mann, R. and Graves, J.E. 2001. The genetics of invasion: A study of the Asian Veined Rapa whelk, \*Rapana venosa\*. In](#)

[Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Report into using genetic identification tools as a means of determining the origins of invasive populations of *Rapana venosa*.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2001/MBI2001abs4.pdf> [Accessed 25 November 2004]

[Green, R., Mann, R. and Harding, J.M. 2001. Morphological variation between three populations of the veined Rapa whelk, \*Rapana venosa\*, a recent gastropod invader of the Chesapeake Bay. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Study into the differences in morphology of *Rapana venosa* from three different areas.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2001/MBI2001abs5.pdf> [Accessed 25 November 2004]

[Harding, J.M. and Mann, R. 1999. Habitat and prey preferences of veined rapa whelks \(\*Rapana venosa\*\) in the Chesapeake Bay: Direct and indirect trophic consequences. In Abstracts: First National Conference on Marine Bioinvasions, January 24 -27, 1999. Massachusetts Institute of Technology, Cambridge, MA](#)

**Summary:** Study into both the direct and indirect affects of the rapa whelk invasion.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/1999/MarineAbs5.pdf> [Accessed 25 November 2004]

[Harding, J.M. and Mann, R. 2001. Growth rates of larval and juvenile veined Rapa whelks \*Rapana venosa\* from Chesapeake Bay, U.S.A. from hatch through age 1. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Report into the growth rates of the invasive whelk in Chesapeake Bay.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2001/MBI2001abs5.pdf> [Accessed 25 November 2004]

Hwang D. F; Lu, S. C, and Jeng, S. S 1991. Occurrence of tetrodotoxin in the gastropods *Rapana rapiformis* and *R. venosa*. Marine Biology. 111(1): 65-69.

Ito, K., M. Asakawa, R. Beppu, H. Takayama, & K. Miyazawa. 2004. PSP-toxicification of the carnivorous gastropod *Rapana venosa* inhabiting the estuary of Nikoh River, Hiroshima Bay, Hiroshima Prefecture, Japan. Marine Pollution Bulletin 48:1116 -1121.

**Summary:** Study on PSP toxicity of species

[Kerckhof, F., Vink, R.J., Nieweg, D.C. and Post, J.N.J. 2006. The Veined Whelk \*Rapana venosa\* has Reached the North Sea, \*Aquatic Invasions\* 1\(1\): pp 35-37 \[Accessed 29 March 2006, from: <http://www.aquaticinvasions.ru/2006/index.html>\]](#)

[Kingsley-Smith, P.R., Mann, R. and Harding, J. 2003. A predation signature-based key to attribute predation upon bivalves to native versus invasive gastropods. In Abstracts: Third International Conference on Marine Bioinvasions, March 16-19, 2003. Scripps Institution of Oceanography La Jolla, California](#)

**Summary:** Investigation into a new detection and monitoring method for *Rapana venosa* based on the drill holes produced.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2003/MBI2003abs7.pdf> [Accessed 25 November 2004]

Liang, L. N., B. He, G. B. Jiang, D. Y. Chen, and Z. W. Yao. 2004. Evaluation of mollusks as biomonitors to investigate heavy metal contaminations along the Chinese Bohai Sea. Science of the Total Environment 324:105-113

**Summary:** A report that investigates the use of species as biomonitors of bioaccumulation.

[Mann, R. and Harding, J.M. 1999. \*Rapana venosa\* in the Chesapeake Bay: Current status and prospects for range extension based on salinity tolerance of early life history stages. In Abstracts: First National Conference on Marine Bioinvasions, January 24 -27, 1999. Massachusetts Institute of Technology, Cambridge, MA](#)

**Summary:** Study on salinity tolerances of *R. venosa* in the hope that the findings will allow the prediction of a possible spread path.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/1999/MarineAbs7.pdf> [Accessed 25 November 2004]

[Mann, R. and Harding, J.M. 2001. Salinity tolerance of larval \*Rapana venosa\*: Implications for dispersal and establishment range on the U.S. East Coast. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Prediction into patterns of spread for *Rapana venosa* in Chesapeake Bay with reference to salinity and circulation patterns.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2001/MBI2001abs7.pdf> [Accessed 25 November 2004]



# GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: *Rapana venosa*

---

[Mann, R. and Harding, J.M. 2003a. Complex life history and the dynamics of range extension in a novel environment: Lessons from 5 years of observation of invading gastropod \*Rapana venosa\*. In Abstracts: Third International Conference on Marine Bioinvasions, March 16-19, 2003. Scripps Institution of Oceanography La Jolla, California](#)

**Summary:** Study into the expansion patterns of *Rapana venosa*.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2003/MBI2003abs8.pdf> [Accessed 25 November 2004]

[Mann, R and J. M. Harding., 2003b. Salinity Tolerance of Larval \*Rapana venosa\*: Implications for Dispersal and Establishment of an Invading Predatory Gastropod on the North American Atlantic. Biol. Bull. 204: 96-103.](#)

**Summary:** Available from: <http://www.biolbull.org/cgi/content/full/204/1/96> [Accessed 25 November 2004]

[O'Neill Jnr, C.R. 2001 Salinity tolerance of larval \*Rapana venosa\*: Implications for dispersal and establishment range on the U.S. East Coast. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** The invasion of *Rapana* maybe limited by water salinity.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2001/MBI2001abs8.pdf> [Accessed 25 November 2004]

[Page, J. UNDATED. Veined Rapa Whelk. Georgia Department of Natural Resources: Coastal Resource Division.](#)

**Summary:** Information on similar species.

Available from: <http://crd.dnr.state.ga.us/content/displaycontent.asp?txtDocument=433> [Accessed 29 July 2004]

[Pastorino G., P.E. Penchaszadeh, L. Schejter and C. Bremec. 2000. \*Rapana venosa\* \(Valenciennes, 1846\) Mollusca: Muricidae: a new Gastropod in South Atlantic Waters. Journal of Shellfish Research, 19 \(2\): 897-899.](#)

[Savini, R. Harding, J.M. and Mann, R. 2001. Experimental evaluation of \*Rapana venosa\* feeding rates preying on the bivalve \*Mercenaria mercenaria\* in the lower Chesapeake Bay, U.S.A. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Report into the feeding rates of *Rapana* on a commercially important clam.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2001/MBI2001abs9.pdf> [Accessed 25 November 2004]

[Ware, C., Harding, J.M. and Mann, R. 2001. Temporal and spatial variation in egg cases of the \*Rapana venosa\* from the Chesapeake Bay, U.S.A. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Study into the reproductive behaviour and successes of *Rapana venosa*.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2001/MBI2001abs11.pdf> [Accessed 25 November 2004]

[Wescott, E., Mann, R. and Harding, J.M. 2001. Reproductive biology of Chesapeake Bay, U.S.A. veined Rapa whelks \*Rapana venosa\*. In Abstracts: Second International Conference on Marine Bioinvasions, March 9-11, 2001. New Orleans, LA](#)

**Summary:** Study into the reproductive behaviour and successes of *Rapana venosa*.

Available from: <http://massbay.mit.edu/resources/pdf/MarinePDF/2001/MBI2001abs11.pdf> [Accessed 25 November 2004]

[Wu, Y. 1988. Distribution and shell height-weight relation of \*Rapana venosa\* Valenciennes in the Laizhou Bay. Marine Science/Haiyang Kexue 6:39-40.](#)

[Zolotarev, V. 1996. The Black Sea ecosystem changes related to the introduction of a new mollusc species. Mar. Ecology. 17\(1-3\):227-236.](#)