GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Gemma gemma***

Gemma gemma 正體中文

System: Marine

Kingdom	Phylum	Class	Order	Family
Animalia	Mollusca	Bivalvia	Veneroida	Veneridae

Common name Amethyst gem clam (English), gem clam (English)

Synonym
Venus gemma , (Totten, 1834)
Totteniana gemma , (Totten, 1834)
Cyrena purpurea , (Lea, 1842)
Venus manhattensis , (Jay, 1852)
Gemma fretensis , (Rehder, 1939)
Gemma totteni , (Simpson, 1860)
Parastarte concentica , (Dall, 1889)

Similar species *Transennella tantilla*

Summary Gemma gemma, commonly known as the gem clam or amethyst gem clam, is a small benthic organism found in marine, brackish and freshwater environments along the Atlantic coast. The gem clam has been introduced to the California and Washington coasts of the United States. It is not competively aggressive against native populations and has minimal impact, but is oppurtunistic. An extraneous factor, such as increased predation on native fauna, will allow it to competively increase its population.

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Species Description
The amethyst gem clam, *Gemma gemma* is a small clam whose size ranges from 350 µm as a juvenile to 5mm as an adult (Selmer, 1956). The shell of the clam is white to pale reddish-purple to dark reddish-purple with a glossy, smooth surface and fine concentric growth rings (Wilber *et al*. undated).

Lifecycle Stages
The gem clam does not have a planktonic or larval stage that is free-floating. Instead miniature adults are retained in the mantle of the mother clam until they are mature enough to survive independently in the environment. Both the juvenile stage and adult stage are sedentary, unless transported by passive mechanisms, like tides, water currents, or natural disturbances, erosion, or sediment deposition. Once juveniles are released they form a byssus thread that helps to anchor them to the coastal floor and assists them in burrowing into fine-grained sands and sediments (Narchi, 1971). The typical lifespan is two years, but some reports have indicated up to three years (Wilber *et al*. undated).

Uses
Gemma gemma is not commercially harvested as a food source due to its small size at maturity and is therefore economically unimportant (Wilber *et al*. undated).

Habitat Description
G. gemma habitat ranges from estuaries and bays to intertidal and subtidal coastal mudflats, composed of fine-grained silt-sand to muddy-sand sedimentation. The gem clam can survive in a range of salinities from 13- 28 practical salinity units (psu) (Wilber *et al*. undated). The gem clam is part of benthic communities which are characterized by suspension and deposit feeders (LoCicero *et al*. 2006). The gem clam dispersion is highly dependent on sediment bedload transport, a passive transport mechanism which can result from many different causes. Another dispersal mechanism can result from high-density pressures leading to passive migration from tidal cycles that disperse juveniles to local low-density areas (Commito *et al*. 1995).

Reproduction
The amethyst gem clam is dioecious. The male clam releases its gametes into the environment during two different points in the year, from April-May and from October-November (Wilber *et al*. undated). The female takes up the gametes through its incurrent siphon for internal fertilization. The female clam can hold up to three hundred eggs in its mantle. The female retains juveniles in its mantle until mature enough for release. The female has one to two broods per year, with the first brood released near the end of the summer. If the female has a second brood in the fall, she will carry the eggs through the winter for release in the spring (Driscoll, 2006). The juveniles can sexually mature within 4-5 months (Wilber *et al*. undated).

Nutrition
The gem clam is a benthic organism that feeds on diatoms, detritus and phytoplankton filtered from the water through the use of siphons (Driscoll, 2006).

General Impacts
The gem clam population in its introduced range has gone from a benign introduction to a dramatic increase in recent years compared to native clam populations. The native clams *Nutricola tantilla* and *Nutricola confusa* once had such high population numbers that the gem clam did not pose any serious competitive threat to their populations (Grosholz, 2005). However with the introduction of the European green crab, *Carcinus maenas*, a highly invasive species, the predation on the native clams has reduced the populations; allowing the gem-clam, an oppurtunistic competitor, to increase in number displacing the native clams (Grosholz, 2005). Since native populations have been reduced the primary mechanism for controlling phytoplankton biomass is through introduced clams, like the gem clam, redirecting the energy flow in these habitats away from native populations into introduced ones (Cohen & Carlton, 1995).
The gem clam has also shown under a variety of labaratory conditions to increase the larval settlement of another species of clam, *Mercenaria mercenaria* (Ahn, 1993). Preferential settlement of *M. mercenaria* increased with increasing density of *G. gemma* in the sediment, suggesting that the gem clam alters the environment in some way that benefits larval settlement of other species (Ahn, 1993).

Management Info
Management of the gem clam is not a high priority since it does not negatively affect native clam populations unless native clams have been placed under predation selection pressure, in which case the population of the gem-clam can increase to highly abundant levels (Nichols, 1985).
Preventive measures: Preventive measures include a focused approach on estuarine habitats in California, and not on entire coastal sections of the state. This recommendation comes from a study that cataloged the comparative numbers of exotic species in open coast habitats to estuarine habitats and found that the greatest exotic species diversity and minimal native species diveristy was found in estaurine sites (Wasson, 2005). Some ways for prevention of further introduction is minimizing human impacts in estuarine ecosystems by reducing the number and frequency of artificial land formations, like jetties, docks, gravel bars, *etc*. (Wasson, 2005). Other preventive options include stronger regualtions on mariculture operations like oyster farming, and the introduction of new species that could potentially transmit other invasive species. Antifoulling and ballast water regulations need to be strictly enforced (Wasson, 2005).
Cultural: Increased education and research on the biology and habitat of the gem-clam and its effects in marine and freshwater ecosystems is needed, to better understand the dynamics of these ecosystems in order to manage them in ways that is beneficial to the environment and native populations (Wasson, 2005).
Integrated management: A possible effective way of stabilizing gem clam populations so that they do not overwhlem native populations is through control of introduced invasive predators like the European green crab. If the green crab population was kept low enough to ward off some predation on the native species, then native populations may return to normal status (Grosholz, 2005).

Pathway
Accidentally introduced along with Atlantic oysters (Boyd *et al*. 2002) from the Chesapeake Bay in 1899 (Narchi, 1971).First Pacific coast report was in 1893, with the introduction occuring from the crop of a duck that was brought to San Fransico Bay (Boyd *et al*. 2002).

Principal source: Wilber, P., Iocco, L. E., Diaz, R. J., Clarke, D. G., & Will, R. J., undated, Benthic Habitats in NY/NJ Harbor, Army Corp. of Engineers (USACE), National Oceanic and Atmospheric Administration (NOAA),

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

Review:

Pubblication date: 2007-05-14

ALIEN RANGE

[9] UNITED STATES

BIBLIOGRAPHY
18 references found for **Gemma gemma**
Managment 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 is available from http://www.cefas.co.uk/media/118009/fisk_guide_v2.pdf [Accessed 13 January 2009].
Nichols, F.H., & Thompsson, J.K., 1985. Persistence of an introduced mudflat community in South San Fransioc Bay, California, *Marine Ecology series, Oldendorf, Vol. 24, no.1-2, pp.83-97.*
Summary: *Biological Sciences and Living Resources, a database with journals and abstracts on marine, brackish and freshwater organisms. This abstract discusses in brevity the niche of the gem-clam in a estuarine ecosystem and how it can displace native populations if native species are highly predated upon.*
Wasson, K., Fenn, K., & Pearse, J.S., 2005, Habitat differences in marine invasions of central California, Biological Invasions, 7:935-948.
Summary: This journal article gives the only real management options available on possible ways of preventing introductions of exotic species into California and similar estuarine and coastal sites.
Grosholz, E. D. 2005. Recent biological invasion may hasten invasional meltdown by accelerating historical introductions. Proceedings of the National Academy of Sciences U.S.A. 102: 1088-1091.
Summary: Reviews and discusses how native clam populations have decreased due to a rise in predation from the green crab, which resulted in a rise in the population of the introduced gem clam. It also goes into detail on possible solutions to post-invasion.
Available from: http://www.pnas.org/cgi/content/full/102/4/1088 [Accessed 18 January 2007].

General information

Ahn, I-Y., Malouf, R., & Lopez, G., 1993, Enhanced larval settlement of the hard clam *Mercenaria mercenaria* by the gem clam *Gemma gemma*, Marine Ecology progress series, Vol. 99, no. 1-2, pp.51-59.
Summary: Accessed through ASFA 1: Biological Sciences and Living Resources, a database with journals and abstracts on marine, brackish and freshwater organisms. The abstract could only be retrieved and gives supporting evidence that *G. gemma* plays an important ecological role in benthic communities by altering sedimentation and assisting in larval settlement.
Boyd, M.J. *et al*, 2002, A Survey of Non-Indigenous Species in the Coastal and Estuarine Waters of California, CA Dept. of Fish & Game, Humboldt State Univeristy.
Summary: Distribution information on *G. gemma* s introduced range in some of the counties and estuaries in California.
Carlton, J.T., 1992, Introduced Marine and Estuarine Mollusks of North America: An End-of-the 20th-Century Perspective, *Journal of Shellfish Research*, Vol. 11, no. 2, 489-505.
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Available from: http://sgnis.org/publicat/papers/jsr11_2.pdf [Accessed 18 January 2007].
Cohen, A.N. & Carlton, J.T., Dec. 1995, Nonindigenous Aquatic Species in a United States Estuary: A Case Study of the Biological Invasions of the San Fransico Bay and Delta, United States Fish & Wildlife Service, The National Sea Grant College program, Conneticut Sea Grant.
Summary: Discusses energy transfer in benthic communities with respect to invasive aquatic organisms in the San Fransico Bay and Estuary and its potential to alter native communities.
Available from: http://www.anstaskforce.gov/Documents/sfinvade.htm [Accessed 18 January 2007].
Commito, J.A., Currier, C.A., Kane, L.R., Reinsel, K.A., and Ulm, I.M., 1995, Dispersal Dynamics of the Bivalve *Gemma gemma* in a Patchy Environment, *Ecological Monographs*, Vol. 65, No. 1, pp. 1-20.
Summary: Very good information on the local dispersion of the clam *G. gemma* through passive mechanisms.
Driscoll, B., 2006, Mollusks of Great Bay Estuary, Arm of the Sea website.
Summary: Lifecycle, reproduction, habitat, and general biology information on *G. gemma*.
Available from: http://www.armofthesea.info/siteinfo/siteinfo.htm [Accessed 18 January 2007].
Friday Harbor Labs, Aug., 2004, False Bay: Species Description, Univeristy of Washington,.
Summary: A description and common name of a species similar to *G. gemma*, *Transennella tantilla* briefly mentioned.
Available from: http://depts.washington.edu/fhl/zoo432/falsebay/fbspecies/fbspecies.htm [Accessed 18 January 2007].
ITIS (Integrated Taxonomic Information System), 2007. Online Database *Gemma gemma*
Summary: An online database that provides taxonomic information, common names, synonyms and geographical jurisdiction of a species. In addition links are provided to retrieve biological records and collection information from the Global Biodiversity Information Facility (GBIF) Data Portal and bioscience articles from BioOne journals.
Available from: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=81511 [Accessed 18 January 2007].
LoCicero, P.V., Goodbred, S.L., & Cerrato, R., Sep. 2006, Molluskan Response to Shifts in the Sedimentary Regime of a Coastal Lagoon Through Time, EOS, Transactions, American Geophysical Union, Vol. 87, no. 36.
Summary: Accessed through ASFA 1: Biological Sciences and Living Resources, a database with journals and abstracts on marine, brackish and freshwater organisms. The abstract could only be retrieved and gives brief information on the types of communities associated with *G. gemma*.

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Summary: Biological Sciences and Living Resources, a database with journals and abstracts on marine, brackish and freshwater organisms. This particular abstract gives information on distribution range, and some morphology.
Non-indigenous Aquatic Species (NAS) U.S. Geological Survey, 2005.
Summary: Distribution information on some of the introduced ranges of *G. gemma*.
Available from: http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=147 [Accessed 18 January 2007]
Selmer, G. P., 1956, A Method for the Separation of Small Bivalve Molluscs from Sediments, *Ecology*, Vol. 37, No.1.
Summary: Gives a brief and more accurate information on the size ranges of the clam from juvenile to adult. Not a lot of useful information for invasive species purposes, but instead a method of seperating bivlaves for population studies.
The Academy of Natural Sciences, 2006. Malacolog 4.1.0: A Database of Western Atlantic Marine Mollusca Bivalvia: Heterodonta: Veneroidea: Gemminae *Gemma gemma* (Totten, 1834)
Summary: Information on the distribution of *G. gemma* and the taxonomic synoyms that are found cross-referenced in the literature.
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Summary: Information on the physical description, native ranges along the east coast of the United States, and reproductive cycles.
Available from: http://www.csc.noaa.gov/lcr/nyharbor/html/gallery/sggemma.html [Accessed 18 January 2007].