

Rhithropanopeus harrisii

System: Brackish

| Kingdom | Phylum | Class | Order | Family |
|----------|------------|--------------|----------|------------|
| Animalia | Arthropoda | Malacostraca | Decapoda | Panopeidae |

Common name Brackwasserkrabbe (German), Zuiderzeekrabbetje (Dutch), Zuiderzee crab (English), white-fingered mud crab (English), estuarine mud crab (English), Harris mud crab (English), krabik amerykanski (Polish), Zuiderzeekrabbe (German), Østamerikansk brakvandskrabbe (Danish)

Synonym *Pilumnus harrisii* , (Gould, 1841)
Pilumnus tridentatus , (Maitland, 1874)
Heteropanope tridentata , De Man J. G. (1892)
Rhithropanopeus harrisii , ssp. *tridentatus* (Buitendijk and Holtuis 1949)

Similar species

Summary *Rhithropanopeus harrisii* is a small estuarine crab native to the Atlantic Coast of North America. It has invaded many locations in Europe and North America and is presumed to have dispersed mainly via oyster translocations and shipping. Anecdotal reports indicate that it can alter food webs, compete with native species, foul pipe systems, and be a vector of the white spot baculovirus.



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

Species Description

Rhithropanopeus harrisii, or the Harris mud crab, is a small euryhaline crab. It reaches approximately 2cm in carapace width as an adult and is greenish-brown or olive in colouration. It has white-tipped claws, unequal in size and dissimilar. The front of its carapace is almost straight, slightly notched, with its margin transversely grooved, appearing double when viewed from the front. Four anterolateral teeth (spines) line the side of its carapace between the eyestalks and the widest portion of the carapace. Its four walking legs are long, slender and sparsely hairy. (Williams 1984; Perry, 2007).

Notes

In Europe, Maitland (1874) initially described *Rhithropanopeus harrisii* as a native species, *Pilumnus tridentatus*. In 1949, Buitendijk and Holthuis recognized the exotic origins of this crab and reclassified it as *Rhithropanopeus harrisii* ssp. *tridentatus*, a synonym which has often been used to designate this species in Europe (Christiansen, 1969; Wolff, 2005).

Lifecycle Stages

Eggs remain attached to the mother's pleopods until they hatch. Ovigerous females exhibit a rhythmic pumping behaviour when hatching begins, which helps synchronize hatching and facilitates larval release (Forward and Lohmann, 1983). *Rhithropanopeus harrisii* develops in four zoeal larval stages and a megalopal post larval stage before reaching adulthood. Development averages 16 days (Cripe *et al.*, 2003). Sexual maturity can be reached as early as the breeding season following birth, at a carapace width of 4.5mm for males and 4.4 to 5.5mm for females (Ryan, 1956; Turoboyski, 1973).

Uses

Rhithropanopeus harrisii has been used as a study organism in many developmental and physiological studies (e.g. Christiansen and Costlow, 1975; Kalber and Costlow, 1966). The crab has also been used to examine the effects of various pesticides on non-target crustacean species (Clare *et al.* 1992), including juvenile hormone analogues (JHA's), a pest control agent which mimics insect larval hormones (Cripe *et al.* 2003).

Habitat Description

Rhithropanopeus harrisii can be found in estuaries and quasi-freshwater lakes with salinities as low as 0.4 ppt (Keith, 2006). It prefers brackish waters and commonly inhabits shores with muddy or sandy substrates. It usually associates with structures providing shelter such as oyster reefs, vegetation, logs, or debris of some type. It is tolerant to a wide range of salinities rendering it capable of invading a variety of aquatic habitats (Williams 1984, Petersen, 2006, Roche and Torchin 2007).

Reproduction

Oviparous. Sexual. Males place spermatophores into the female's spermatheca. Unlike most other crab species, *Rhithropanopeus harrisii* females do not moult immediately before copulation, which usually takes place during the summer months. Approximately three to four days after copulation, females bury themselves up to the eye stalks to lay their eggs. This behaviour facilitates the attachment of the eggs to the pleopods. Oviparous females will then remain sheltered in debris, shells, or sediment. Females usually lay between 1200 and 4800 eggs at a time depending on their size. In the Kiel Canal, Germany, large females were observed to lay as many as 16,000 eggs (Turoboyski, 1973).

Nutrition

Rhithropanopeus harrisii is omnivorous and known to feed on mangrove and leaf detritus, bivalve molluscs, oligochaetes, and dead fish. Small crabs have been observed to feed on small crustaceans such as amphipods and copepods. (Williams, 1984; Karpinsky, 2005).

General Impacts

No study has yet quantified the impacts of *Rhithropanopeus harrisii*, but anecdotal reports in the scientific literature indicate that it can alter food webs, compete with and potentially displace native crabs, crayfish, as well as benthophagous fishes (reviewed in Roche and Torchin 2007). In the Caspian Sea, where it has reached very high densities, the crab is responsible for fouling water intake pipes and causes economic loss to fishermen by spoiling fishes in gill nets (Zaitsev and Öztürk 2001). In Texas, the crab has become very abundant in almost freshwater reservoirs and is reported to foul PVC intakes in lakeside homes and clog the cooling system of a nuclear powerplant in Glenrose (Keith, 2006; Hildebrand, pers. comm.). Payen and Bonami (1979) also identified *R. harrisii* as a carrier of the white spot baculovirus, which causes disease in penaeid prawn species and the blue crab (*Callinectes sapidus*).

Management Info

Preventative measures: Transport in ballast water is thought to be the main vector of introduction for *Rhithropanopeus harrisii*. The GloBallast Programme has been established to reduce introductions of non-native species (such as *R. harrisii*) by providing funding and assistance to less-industrialized countries in order to reduce the transfer of harmful aquatic organisms and pathogens in the ballast water of ships. Implemented by the International Maritime Organization (IMO) with funding by the Global Environment Facility (GEF) and the United Nations Development Program (UNDP), this programme will facilitate the implementation of the newly adopted IMO Ballast Water Convention in developing countries (GloBallast, undated).

Chemical: Diflubezuron, the active chemical in the pesticide Dimilin, has been experimentally used on *R. harrisii* (see McEnulty *et al.*, 2001). It is lethal to hatching larvae in concentrations of 7-10ppb. It works by inhibiting chitin synthesis and has been found to be an effective way of controlling arthropods. However, it lacks specificity and may take several weeks to degrade in brackish water environments (Christiansen and Costlow 1980).

Biological: The rhizocephalan barnacle *Loxothylacus panopaei* parasitizes *R. harrisii* in its native range. Parasitic barnacles infect their crab hosts at the larval stage (cyprid or cypris larva), develop as an endoparasite, and then produce an external reproductive body called the externa. Rhizocephalans stunt growth in their hosts and cause castration in both males and females, preventing future reproduction. Alvarez *et al.* (1995) experimentally infected *R. harrisii* from the Chesapeake Bay with *L. panopaei* and found that parasitism had a significant effect on the survival of infected hosts. However, further studies are necessary to determine whether *L. panopaei* is a viable candidate for biological control of *R. harrisii* in its introduced range.

Pathway

Although not confirmed, *Rhithropanopeus harrisii* is thought to have been introduced accidentally along with Atlantic oysters *Crassostrea virginica* to the San Francisco Bay (Roche, 2007). Although only confirmed on a few occasions, transport of decapods in ships' ballast water is considered the most common and effective means of introduction of exotic decapods including *Rhithropanopeus harrisii* (Rodriguez, 2001). *Rhithropanopeus harrisii* are known to have dispersed by attaching to the hulls of ships. This however has declined since the advent of metallic hulls and antifouling paints (Rodriguez, 2001).

Principal source: [Perry, 2007. *Rhithropanopeus harrisii*. USGS Nonindigenous Aquatic Species Database.](#)
[Keith, 2006. Harris mud crab. Tarleton State University.](#)

Turoboyski, 1973. Biology and ecology of the crab *Rhithropanopeus harrisii* ssp. *tridentatus*. Marine Biology 23: 303-313.

Williams, 1984. Shrimps, lobsters, and crabs of the Atlantic Coast of the Eastern United States, Maine to Florida. Smithsonian Institution Press, Washington, D.C.

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

Review: Dominique Roche MacGill University Canada

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ALIEN RANGE

[1] ARAL SEA
 [1] BULGARIA
 [1] DENMARK
 [1] GERMANY
 [1] JAPAN
 [2] MEDITERRANEAN & BLACK SEA
 [1] PANAMA

[1] ATLANTIC - NORTHEAST
 [1] CASPIAN SEA
 [1] FRANCE
 [1] ITALY
 [1] LITHUANIA
 [1] NETHERLANDS
 [1] POLAND

[1] PORTUGAL
[1] UNITED KINGDOM

[1] ROMANIA
[4] UNITED STATES

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53 references found for *Rhithropanopeus harrisii*

Management information

Alvarez, F., Hines, A.H., and Reaka-Kulda, M.L. 1995. The effects of parasitism by the barnacle *Loxothylacus panopaei* (Gissler) (Cirripedia: Rhizocephala) on growth and the survival of the host crab *Rhithropanopeus harrisii* (Gould) (Brachyura: Xanthidae). *Journal of Experimental Marine Biology and Ecology*. Vol. 192: 221-232.

Summary: This study consists of infection experiments in the laboratory to test the effects of the the barnacle parasite *Loxothylacus panopaei* on its host, *Rhithropanopeus harrisii*, from the Chesapeake Bay.

Carlton J.T 1985. Transoceanic and interoceanic dispersal of coastal marine organisms: the biology of ballast water. *Oceanography and Marine Biology. An Annual Review* 23: 313-371

Carlton J.T and Geller J.B 1993. Ecological roulette - the global transport of nonindigenous marine organisms. *Science* 261: 78-82

[Centre for Environment, Fisheries & Aquaculture Science \(CEFAS\), 2008. Decision support tools-Identifying potentially invasive non-native marine and freshwater species: fish, invertebrates, amphibians.](http://www.cefasc.org/Decision%20support%20tools-Identifying%20potentially%20invasive%20non-native%20marine%20and%20freshwater%20species%20fish%20invertebrates%20amphibians)

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

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

[Global Ballast Water Management Programme, undated. GloBallast Programme.](http://www.globallastwatermanagementprogramme.org/)

Summary: This websites outlines the directives of a program with the objectives of promoting the Removal of Barriers to the Effective Implementation of Ballast Water Control and Management Measures in Developing Countries

Available from: http://globallastwatermanagementprogramme.org/index.asp?page=gef_interw_project.htm&menu=true [Accessed 10 December 2007]

[McEnnulty, F.R., Jones, T.E., and Bax, N.J. 2001. The web-based rapid response toolbox.](http://www.marine.csiro.au/crimp/nimpis/controlDetail.asp?ID=84)

Summary: This database offers information on pesticides which may be used to control arthropods, including the Harris mud crab.

Available from: <http://www.marine.csiro.au/crimp/nimpis/controlDetail.asp?ID=84> [Accessed 13 December 2007]

General information

Aladin, N.V. 1995. Ecological State of the Fauna of the Aral Sea during the last 30 years. *GeoJournal*. Vol. 35, No. 1: 29-32.

Summary: This article discusses the ecology of the Aral Sea and how it has been impacted by the introduction of nonindigenous species, including the Harris mud crab.

[Aladin, N.V. and Plotnikov, I.S. 1995. Anthropogenic changes of the Aral Sea ecosystem. Zoological Institute Russian Academy of Sciences, Universitetskaya nab. 1, 199034, St. Petersburg, Russia.](http://www.icef.eawag.ch/abstracts/aladinaral.pdf)

Summary: This publication cites the introduction of *Rhithropanopeus harrisii* to the Aral Sea.

Available from: <http://www.icef.eawag.ch/abstracts/aladinaral.pdf> [Accessed 26 November 2007].

Aladin, N.V. and Potts, W.T.W. 1992. Changes in the Aral Sea ecosystems during the period 1960-1990. *Hydrobiologia*. Vol. 237: 67-79.

Summary: A publication reporting competition between introduced species, including *Rhithropanopeus harrisii*, and native benthic invertebrates and fishes in the Aral Sea.

Andreyev, N.I and Andreyeva, S.I. 1988. A crab *Rhithropanopeus harrisii tridentatus* (Decapoda, Xanthidae) in the Aral Sea. *Zoologicheskij Zhurnal*. Vol. 67, No. 1: 135-136

Summary: This article (in Russian) cites the introduction of the Harris mud crab to the Aral Sea.

Bacescu M.C 1967. Fauna Republicii Socialiste Romania. Crustacea Decapoda. Editura Academiei Republicii Socialiste Romania 4(9): 1-351

Christiansen M.E and Costlow Jr. J.D 1975. The effect of salinity and cyclic temperature on larval development of the mud-crab

Rhithropanopeus harrisii (Brachyura: Xanthidae) reared in the laboratory. *Marine Biology* 32: 215-221

Christiansen M.E and Costlow Jr. J.D 1980. Persistence of the insect growth regulator Dimilin? in brackish water: a laboratory evaluation using larvae of an estuarine crab as indicator. *Helgoland Marine Research* 33: 327-332

Clare A.S, Costlow J.D, Bedair H.M, Lumb, G 1992. Assessment of crab limb regeneration as an assay for developmental toxicity. *Canadian Journal of Fisheries and Aquatic Sciences* 49: 1268-1273

Cohen A.N and Carlton J.T 1995. Nonindigenous aquatic species in a U.S. estuary: a case study of the biological invasions of the San Francisco Bay and delta. A Report for the US fish and wildlife service, Washington D.C.

CONABIO. 2008. Sistema de información sobre especies invasoras en México. Especies invasoras - Crustáceos. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Fecha de acceso.

Summary: English:

The species list sheet for the Mexican information system on invasive species currently provides information related to Scientific names, family, group and common names, as well as habitat, status of invasion in Mexico, pathways of introduction and links to other specialised websites. Some of the higher risk species already have a direct link to the alert page. It is important to notice that these lists are constantly being updated, please refer to the main page (<http://www.conabio.gob.mx/invasoras/index.php/Portada>), under the section Novedades for information on updates.

Invasive species - crustaceans is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Crust%C3%A1ceos [Accessed 30 July 2008]

Spanish:

La lista de especies del Sistema de información sobre especies invasoras de México cuenta actualmente con información acerca de nombre científico, familia, grupo y nombre común, así como hábitat, estado de la invasión en México, rutas de introducción y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la página de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualización, por favor consulte la portada (<http://www.conabio.gob.mx/invasoras/index.php/Portada>), en la sección novedades, para conocer los cambios.

Especies invasoras - Crustáceos is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Crust%C3%A1ceos [Accessed 30 July 2008]

Cripe, G.M., McKennedy Jr., C.L., Hoglund, M.D., and Harris, P.S. 2003. Effects of fenoxycarb exposure on complete larval development of the xanthid crab, *Rhithropanopeus harrisii*. Environmental Pollution, Vol. 125: 295-299.

Summary: This study uses *Rhithropanopeus harrisii* to test the effects of fenoxycarb, a juvenile control hormone analogue, on non-target crustacean species.

Demel K 1953. Nowy gatunek w faunie Bałtyku. Kosmos 2: 105-106

Elkhorn Slough Research. Undated. Least wanted aquatic invaders: Harris mud crab (*Rhithropanopeus harrisii*). Elkhorn Slough National Estuarine Research Reserve.

Summary: This site offers a brief profile of the Harris mud crab with a short list of invaded areas (focusing on the Pacific coast of the US) and impacts.

Available from: <http://www.elkhornslough.org/research/aquaticinvaders/aquatic10.htm> [Accessed 3 December 2007].

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Forward Jr., R.B., and Lohman, K.J. 1983. Control of egg hatching in the crab *Rithropanopeus harrisii* (Gould). Biology Bulletin. Vol. 165: 154-166.

Summary: This article documents the egg hatching process and life cycle of the Harris mud crab.

García-Berthou, E., Boix, D. and Clavero, M. 2007. Non-indigenous animal species naturalized in Iberian inland waters. In: Gerardi, F. Biological invaders in inland waters: profiles, distribution, and threats. Springer, Dordrecht, Netherlands. pp.123-140

Summary: This book chapter examines introductions to the Iberian peninsula, with mention of *Rhithropanopeus harrisii*.

Available from: http://ciencias.udg.es/w3/EGarcia/papers/GarciaBerthou_et al. Gherardi_ed_book.pdf [Accessed 10 December 2007]

Gollasch, S. and Nehring, S. 2006. National checklist for aquatic alien species in Germany. Aquatic Invasions. Vol. 1, Issue 4: 245-269.

Summary: A checklist of alien aquatic species in Germany

Available from: http://www.aquaticinvasions.ru/2006/AI_2006_1_4_Gollasch_Nehring.pdf [Accessed 5 December 2007]

Goncalves, F. Ribeiro, R., and Soares, A. M.V.M. 1995. *Rhithropanopeus harrisii* (Gould), an American crab in the estuary of the Mondego River, Portugal. Journal of Crustacean Biology, Vol. 15, No. 4: 756-762.

Summary: An analysis of the seasonal and spatial occurrence and tidal abundance of larvae of *R. harrisii* in the estuary of the Mondego River, Portugal.

Grabowski, M. Jazdzewski, K., and Konopacka, A. 2005. Alien crustacea in Polish waters - Introductions and Decapoda. Oceanological and Hydrobiological Studies. Vol. 34, Supp.1: 43-61.

Summary: This paper presents the biogeography, history, and some ecological consequences of the introduction of alien decapod species in Poland, with reference to other European countries.

Iseda, Masatsugu; Michio Otani and Taeko Kimura., 2007. First Record of an Introduced Crab *Rhithropanopeus harrisii* (Crustacea: Brachyura: Panopeidae) in Japan. Japanese Journal of Benthology 62: 39-44 (2007)

ITIS (Integrated Taxonomic Information System), 2005. Online Database *Rhithropanopeus harrisii* (Gould, 1841)

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=98790 [Accessed 3 December 2007]

Jazdzewski K and Konopacka A 1993. Survey and distribution of Crustacea Malacostraca in Poland. Crustaceana. 65: 176-191

Joint Nature Conservation Committee (JNCC), undated. *Rhithropanopeus harrisii*.

Summary: This brief profile offers information concerning the introduction of the Harris mud crab to Britain.

Available from: <http://www.jncc.gov.uk/page-1710> [Accessed 14 December 2007]

Kalber Jr. F.A and Costlow Jr. J.D 1966. The ontogeny of osmoregulation and its neurosecretory control in the decapod crustacean, *Rhithropanopeus harrisii* (Gould). American Zoologist 6:221-229

Karpinsky, M.G., Shiganova, T.A., and Katunin, D.N. 2005. Introduced species. Handbook of Environmental Chemistry. Vol. 5, Part P: 175-190.

Summary: A discussion of introduced species, including *Rhithropanopeus harrisii*, and their impacts in the Caspian Sea.

Keith, D.E. undated. Occurrence of the Estuarine Mud Crab, *Rhithropanopeus harrisii*, in Texas Reservoirs

Summary: Information on the occurrence of *R. harrisii* in almost freshwater reservoirs in Texas.

Available from: <http://www.tarleton.edu/~biology/MudCrab.html> [Accessed May 29 2008]

Kinzelbach, R. 1995. Neozoans in European waters - Exemplifying the worldwide process of invasion and species mixing. *Experientia*. Vol. 51: 526- 538.

Summary: This article discusses worldwide loss of biodiversity due to invasive species, such as the Harris mud crab.

Leppökoski, E. and Olenin, S. 2000. Non-native species and rates of spread: lessons from the brackish Baltic Sea. *Biological Invasions*. Vol. 2: 151-163.

Summary: This article discusses introductions of nonindigenous species to the Baltic Sea and provides a date for the discovery of *Rhithropanopeus harrisii*.

Makarov A.K 1939. Certain new elements in the composition of the fauna of the Black Sea Limans as an effect of maritime navigation. *C.R. (Doklady) Academy of Sciences of the USSR* 23: 819-822

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Milke, L.M., and Kennedy, V.S. 2001. Mud crabs (Xanthidae) in Chesapeake Bay: claw characteristics and predation on epifaunal bivalves. *Invertebrate Biology*. Vol. 120: 67-77.

Summary: A comparison of claw mechanical strength between *R. harrisii* and *E. depressus* in the Chesapeake Bay

Mizzan L and Zanella L 1996. First record of *Rhithropanopeus harrisii* (Gould, 1841) (Crustacea, Decapoda, Xanthidae) in the Italian waters. *Bolletino del Museo civico di Storia naturale di Venezia* 46: 109-120

Nehring, Stefan., 2000. Zur Bestandssituation von *Rhithropanopeus harrisii* (Gould, 1841) in deutschen Gewässern: Die sukzessive Ausbreitung eines amerikanischen Neozoons (Crustacea: Decapoda: Panopeidae). *Senckenbergiana maritima*, 30 (3/6) 115-122 Frankfurt am main, 27.7.2000

[North European and Baltic Network on Invasive Alien Species \(NOBANIS\), Undated. *Rhithropanopeus harrisii*.](#)

Summary: This database provides information about a few European introductions of the Harris mud crab.

Available from: <http://www.nobanis.org/speciesInfo.asp?taxalD=966v> [Accessed 14 December 2007]

Panov, V.E., Dgebuadze, Y.Y., Shiganova, A., Filippov, A.A., and Minchin, D. 2007. A risk assessment of biological invasions in the inland waterways of Europe: the Northern Invasion Corridor case study.

Summary: A discussion of introductions in Europe including *R. harrisii*

Payen G.G and Bonami J.R 1979. Mise en évidence de particules d'allure virale associées aux noyaux des cellules mésodermiques de la zone germinative testiculaire du crabe *Rhithropanopeus harrisii* (Gould) (Brachyura, Xanthidae). *Revue des Travaux de l'Institut des Pêches Maritimes* 43: 361-365

[Perry, H. 2007. *Rhithropanopeus harrisii*. USGS Nonindigenous Aquatic Species Database.](#)

Summary: The Nonindigenous Aquatic Species database offers much information on the Harris mud crab and its introductions.

Available from: <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=197> [Accessed 10 December]

Petersen, C. 2006. Range expansion in the northeast Pacific by an estuary mud crab - a molecular study. *Biological Invasions*. Vol. 8: 565-576.

Summary: A genetic study with goals of inferring the direction of range expansion and attempting to trace the source population for introductions of *R. harrisii* on the Pacific coast of the US.

[Roche, D.G. and Torchin, M.E. 2007. Established population of the North American Harris mud crab, *Rhithropanopeus harrisii* \(Gould, 1841\) \(Crustacea: Brachyura: Xanthidae\) in the Panama Canal. *Aquatic Invasions*. Vol. 2., Issue 3: 155-161.](#)

Summary: This source provides information on the invasion of *R. harrisii* in the Panama Canal and reviews previous introductions worldwide as well as reported impacts.

Available from: http://www.aquaticinvasions.ru/2007/AI_2007_2_3_Roche_Torchin.pdf [Accessed 14 December 2007]

Rodríguez, G. and Suárez, H. 2001. Anthropogenic dispersal of decapod crustaceans in aquatic environments. *Interciencia*. Vol. 26, No. 7: 282-288

Summary: Several decapod introductions are discussed in the article along with vectors of introduction.

Ruiz G.M, Carlton J.T, Grosholz E.D and Hines A.H 1997. Global invasions of marine and estuarine habitats by nonindigenous species: Mechanisms, extent, and consequences. *American Zoologist* 37(6): 621-632

Ryan E.P 1956. Observations on the life histories and the distribution of the Xanthidae (mud crabs) of Chesapeake Bay. *American Midland Naturalist*. 56: 138-162

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Schubert K 1936. *Pilumnopus tridentatus* Maitland, eine neue Rundkrabbe in Deutschland. *Zoologischer Anzeiger* 116: 320-323

Shiganova, T.A., Musaeva, E.I., Pautova, L.A., and Bulgakova, Y.V. 2005. The problem of invaders in the Caspian Sea in the context of the findings of new zoo- and phytoplankton species from the Black Sea. *Biology Bulletin*. Vol. 32, No. 1: 65-74.

Summary: The authors of this article examine several introduced species in the Caspian Sea, including the Harris mud crab.

Wolff, W.J. 2005. Non-indigenous marine and estuarine species in The Netherlands. *Zoologische Mededelingen*. Vol. 79, No. 1: 1-116.

Summary: A review of non-indigenous aquatic species in the Netherlands.

Zaitsev Y and Öztürk B 2001. Exotic species in the Aegean, Marmara, Black, Azov and Caspian Seas. *Turkish Marine Research Foundation*, Istanbul, Turkey. pp 125-126