GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Eriocheir sinensis***

Eriocheir sinensis 简体中文 正體中文

System: Freshwater

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Malacostraca	Decapoda	Grapsidae

Common name Kinijos krabas (Lithuanian), krab welnistoszczypcy (Polish), villasaksirapu (Finnish), Kinesisk ullhandskrabba (English), Kitajskij mokhnatorukij krab (Russian), Kinas cimdinkrabis (Latvian), Shanghai crab (English), Kinesisk ullh&#65533;ndskrabbe (English), Chinese mitten crab (English), Chinese freshwater edible crab (English), Chinese river crab (English), crabe Chinois (French), hiina villk&#65533;pp-krabi (Estonian), Chinesische Wollhandkrabbe (German), Chineesche Wolhandkrab (Dutch)

Synonym *Eriocheir japonicus* , de Haan
Eriocheir leptognathus , Rathbun

Similar species *Eriocheir japonicus, Eriocheir leptognathus, Eriocheir rectus*

Summary *Eriocheir sinensis (the Chinese mitten crab) is a migrating crab which has invaded Europe and North America from its native region of Asia. During its mass migrations it contributes to the temporary local extinction of native invertebrates. It modifies habitats by causing erosion due to its intensive burrowing activity and costs fisheries and aquaculture several hundreds of thousands of dollars per year by consuming bait and trapped fish as well as by damaging gear.*

view this species on IUCN Red List

Species Description
The square shaped carapace clearly distinguishes this invasive species from other European brachyuran crabs. It can reach a carapace width of 5cm to 7cm, but the maximum carapace width of the adult mitten crab is approximately 10 cm (Czerniejewski *et al*. 2003, in Gollasch 2006). One key identification feature is the hair-like covering on the claws, especially well developed in male individuals. The colour varies from yellow to brown, rarely purple. After reaching a size exceeding approximately 1cm to 2cm in carapace width, the male and female crabs can be differentiated by the shape of the abdomen which in the female is rounded and occupies most of the area of the thorax. In the male, the abdomen is narrower and shaped like an inverted funnel. (Description notes from Gollasch 2006).

Notes
Taxonomy of mitten crabs has been problematic and confusing. *Eriocheir* was considered to comprise four species (*E. japonica*, *E. sinensis*, *E. recta*, and *E. leptognathus*) (Chu *et al*. 2003). However, recent taxonomic revision has recognised five species and three genera, Eriocheir being restricted to *E. sinensis*, *E. japonica*, and *E. hepuensis*, and the establishment of two genera for *Neoeriocheir leptognathus* and *Platyeriocheir formosa*, however, Chu and colleagues (2003) believe the genetic divergence among the crabs provides no support for separating *Eriocheir* s.l. into three different genera. They suggest to retain the mitten crabs in a single genus until more evidence is available. A sixth species, *E. ogasawaraensis*, was recently identified by Komai and colleagues (2006, in Veilleux & de Lafontaine 2007).
Eriocheir sinensis has hairy claws with white tips which make the crab appear to be wearing \"mittens\", hence its common name (Gollasch, 2006). Its scientific name *Eriocheir sinensis* means \"\"Chinese woolen hand\"\" (The Natural History Museum, 2005).
Native European crabs lack the mitten crab's dense hairy claw covering and square-shaped carapace; no similar species occurs in Europe (Gollasch, 2006).

Lifecycle Stages
The Chinese mitten crab spends most of its life in fresh or brackish waters (Veilleux & de Lafontaine 2007). Mature adults migrate downstream during the fall to reproduce in brackish or salt waters (Veilleux & de Lafontaine 2007). Both males and females are thought to die following reproduction (Panning 1938, in Veilleux & de Lafontaine 2007). Females brood the eggs and, upon hatching, larvae are planktonic for one to two months. During this marine free-swimming phase, larvae pass through a series of developmental stages: a brief non-feeding pre-zoea stage, five zoea stages and one megalopea stage (Anger 1991, Montú *et al*. 1996, in Veilleux & de Lafontaine 2007). Following the megalopal stage, the larvae metamorphose into juvenile crabs that settle to the bottom, usually in late summer or early fall (Rudnick < i>et al. 2005a, in Veilleux & de Lafontaine 2007).

Uses
The Chinese mitten crab is a traditional food source in China, where it supports an important aquaculture industry yielding high annual production (200 000 tons in 2000; Chen & Zhang, 2006 in Veilleux & de Lafontaine, 2007), worth approximately $1.25 billion (Hymanson *et al*., 1999 in Veilleux & de Lafontaine, 2007). The reproductive tissues are the most prized parts of the crab, although the muscles are also consumed. The preferred crabs are those captured during the fall, as they have full gonads prior to reproduction and stored energy for the coming winter (Hymanson *et al*., 1999). A positive effect of the crabs is their market value as they were and continue to be sold for 1 to 3 € /kg for industrial use and for direct human consumption to Asian markets. During 1994 to 2004 crabs in the value of approximately 3 to 4.5 million € were sold in Germany (Gollasch & Rosenthal, 2006).
Crab specimens have also been used as bait for eel fishing, food for cattle and chicken, fertiliser for agriculture and material for the production of cosmetics (Gollasch 1999, in Veilleux & de Lafontaine 2007).

Habitat Description
The Chinese mitten crab is a large, catadromous crab, moving from freshwater habitats where it spends its juvenile years to saltwater habitats in order to reproduce (Rudnick Halat & Resh 2000). Estuaries supporting large mitten crab populations are all characterised by large brackish waters for embryonic and larval development and large shallow productive waters for the growth of juveniles (Cohen and Weinstein 2001, in Veilleux & de Lafontaine 2007). The Yangtze River, one of the major rivers of the mitten crab in its native China, is an ideal habitat for the crab, characterised by a long freshwater drainage with warm, slow moving water and a large estuary (Hymanson *et al*. 1999, in Veilleux & de Lafontaine 2007).
Throughout its life, the Chinese mitten crab will occupy different ecosystems depending on its life stage (Veilleux & de Lafontaine 2007). Adult crabs are found in fresh, brackish and salt waters, but oviparous females are normally found in greatest number in saltwater (Rudnick *et al*. 2003, Veilleux & de Lafontaine 2007). Larval stages are found in the open water of bays and estuaries. Juvenile crabs are uncommon in open water but are found in tidal tributaries within a few kilometres of open water and in freshwater (Rudnick *et al*. 2003, in Veilleux & de Lafontaine 2007). Around the world, the highest densities of crabs are principally found within estuaries and the lower part of rivers (Cohen & Weinstein 2001, Rudnick *et al*. 2003, in Veilleux & de Lafontaine 2007).

Reproduction
Although the Chinese mitten crab spends most of its life in freshwater, it needs saltwater to reproduce (Veilleux & de Lafontaine 2007). The reproduction involves a succession of events occurring at various times of the year and at different water salinities (Veilleux & de Lafontaine 2007). The development of gonads seems to be quite variable (Panning 1938, Rudnick *et al*. 2005a, in Veilleux & de Lafontaine 2007). So far, the smallest reproductive crabs observed in various populations ranged between 30 and 42 mm (Jin *et al*. 2001, Rudnick *et al*. 2000 2003, in Veilleux & de Lafontaine 2007). Ovigerous females can brood between 250 000 to 1 million eggs (Cohen & Carlton 1997, in Veilleux & de Lafontaine 2007). Mating usually takes place during late fall and winter and varies little between geographic regions. It occurs in November to March in Chinese rivers, from October to January in the Elbe River in Germany and from October to February in the United Kingdom (Panning 1938, Zhang *et al*. 2001, Herborg *et al*. 2006, in Veilleux & de Lafontaine 2007). In the San Francisco Bay estuary, the majority of ovigerous females are usually caught between November and March, with a small proportion between April and June (Rudnick *et al*., 2003, in Veilleux & de Lafontaine 2007).

Nutrition
Chinese mitten crabs feed on a wide variety of plants, invertebrates, fishes and detritus (Gollasch 2006). The mitten crab is known to be predominantly omnivorous, although feeding habits may shift throughout the life cycle (Rudnick Halat & Resh 2000). The larvae feed on phytoplankton and zooplankton, while the diet of newly settled juveniles consists mostly of aquatic plants (Veilleux & de Lafontaine 2007). As they grow, crabs become more carnivorous (Hymanson *et al*. 1999, in Veilleux & de Lafontaine 2007). A feeding study on crabs from San Francisco Bay using stable isotopes, mesocosms experiments and gut content analysis demonstrated that algae and detritus were the major components of the species' diet (Rudnick and Resh 2005, in Veilleux & de Lafontaine 2007). This was consistent with previous gut content analyses showing that freshwater crabs relied mostly on the plant kingdom for food (Panning 1938, in Veilleux & de Lafontaine 2007). The major vegetation types consumed were filamentous algae, *Potomogeton*, *Elodea* and *Lemna* (Veldhuizen and Stanish, 1999, in Veilleux & de Lafontaine 2007). In its native range in Asia the crab shifts toward a more carnivorous diet as it ages, incorporating items such as shrimp and other benthic invertebrates into its diet (Dan *et al*. 1984, Zhao 1999, in Rudnick Halat & Resh 2000). Panning's (1938, in Rudnick Halat & Resh 2000) statement that mitten crabs \"eat whatever they can get\" is probably an accurate description of the plasticity of this crab's eating habits. It is likely that the crab's eating habits are dominated by scavenging and detritivory (Rudnick Halat & Resh 2000).

General Impacts
For a detailed account of the environmental impacts of *E. sinensis* please read: *Eriocheir sinensis* (Chinese Mitten Crab) Impacts Information. The information in this document is summarised below.
Ecosystem Change: Adult crabs migrate out of freshwater systems to reproduce and die in estuaries. This may constitute a substantial vehicle for exporting biomass out of the freshwater ecosystems, which may impact the food web, particularly when very large densities of crabs are migrating (Rudnick and Resh 2005)
Reduction in Native Biodiversity: is an opportunistic omnivore which will consume aquatic plants, algae, detritus, fish eggs and a variety of macroinvertebrates (Panning 1939; Hoestlandt 1948; Gollasch 1999; Rudnick *et al*. 2003).
Predation: The predation on fish eggs might be of concern (CMCWG 2003, in Veilleux & de Lafontaine 2007); however, given that fish material made up only 2.4 % of crab gut contents analyzed in Germany (Thiel 1938, in Veilleux & de Lafontaine 2007), the impact on adult fish populations is presumably low. *E. sinensis* could also reduce populations of native invertebrates through predation and alter the structure of benthic communities (Normant *et al*. 2002).
Competition: The crab's consumption of native species, including macroalgae, invertebrates and fish may result in significant declines in these species as well as in the crab's competitors (Gollasch 2006). Crayfish species, particularly rare or endangered ones, could be negatively affected by very abundant crab populations because of the freshwater habitat and diet shared by both species (Veldhuizen and Stanish 1999, Rudnick *et al*. 2000, in Veilleux & de Lafontaine 2007).
Threat to Endangered Species: The Chinese mitten crab's impact on endangered salmonids in California is of concern (IEP undated).
Physical disturbance: Burrowing activity of crabs results in damage to dikes and increased river embankment erosion (Gollasch 2006). The significant amount of sediment removed in areas with high densities of burrows can cause weakening and even collapse of banks (Panning 1938, D. Rudnick Pers. Obs., in Rudnick Halat & Resh 2000). This burrowing is of particular concern where waterways are controlled by human-made levees; weakening or destruction of such levees from extensive burrowing could pose serious threats to flood control and water supply efforts (Rudnick Halat & Resh 2000).
Economic/Livelihoods: The monetary impact caused by this invader in German waters is approximately 80 million Euro since 1912 (cost calculation adjusted from Fladung Pers. Comm., in Gollasch 2006). In general economic concerns arise over the stealing of bait by the crab and the damage to fishing gear (Panning 1939; Rudnick & Resh 2002). In California (USA) *E. sinensis* has become a major nuisance to anglers, taking a variety of baits including ghost shrimp and shad (Washington Sea Grant Program 2000). *E. sinensis* reproduces and migrates in such numbers as to block water intakes in irrigation and water supply schemes. Large numbers of downstream migrating crabs become trapped in holding tanks meant to keep fish out of turbines of water diversion plants. This has increased fish mortality and high costs are required to prevent the crabs' entry (Siegfried 1999).
Human Health: Effects on human health in Europe are not reported, however, the crab is the second intermediate host for human lung fluke parasite (*Paragonimus westermanii*) in Asia (Gollasch 2006).
Bioaccumlulation: *E. sinensis* has the potential to bioaccumulate inorganic and organic contaminants that then may be passed up the food chain (Rudnick Halat & Resh 2000). This type of bioaccumulation has been documented in *E. sinensis* populations in Asia (Che and Cheung 1998, in Rudnick *et al* 2000).

Management Info
Control of the Chinese mitten crab is difficult because of its abundance, ubiquity, high reproductive rate and wide range of physiological tolerances (Deborah *et al*. 2003). It seems that eradication programmes are unsuccessful once the crab has established self-sustaining populations (Gollasch 2006). The \"catch as many as you can\" strategy shows limited success (Gollasch 2006). Despite the best efforts, no effective management approach has been developed and all eradication efforts have shown limited efficiency (Gollasch 2006).\r\n
Preventative Methods:\r\nMethods to minimise future spread of the mitten crab are quite limited (Gollasch, 2006). Migration barriers and eradication programmes have shown limited success (Gollasch 2006). Certain guidelines and regulatory instruments may however be applied in areas where the species does not yet occur (Gollasch, 2006). For further details see the Ballast Water Management Convention of the International Maritime Organization (www.imo.org) and the Code of Practice for the Introduction and Transfer of Marine organisms of the International Council for the Exploration of the Sea (www.ices.dk).\r\n
Physical Control: Trapping of crabs has not been found effective in reducing the damage caused to river banks and the feeding on trapped fish (Gollasch, 2006). In order to prevent the migration of the crab up rivers in Germany electrical screens were installed on the river bottom in the 1930s to 1940s and pulses were used to disable and kill the crabs, but this met with little success (McEnnulty *et al*., 2001).\r\n
Information and awareness:\r\nThis invader has occurred in Europe for almost 100 years and this is why some believe it is a native species (Gollasch, 2006). Awareness raising initiatives have been so far limited to publications in journals (Gollasch, 2006). The general perception is that not much can be done to manage the mitten crab (Gollasch, 2006). \r\n
Knowledge and research: The first mass development of mitten crabs in Germany in the 1930s prompted many studies in the North Sea region, however, comprehensive studies in the Baltic are lacking (Gollasch, 2006). As the crab is only collected occasionally in Baltic waters no substantial research on the invader developed (Gollasch, 2006). However, invasion biology in general is a research topic in almost all Baltic countries (Gollasch, 2006). A network of researchers who deal with mitten crabs published a joint article on mitten crabs findings in the Baltic (Ojaveer *et al*., 2007).\r\n
Integrated Management: Zoologists at the Natural History Museum (London, UK) have suggested that commercial fishermen should target this species and export it to China where it is considered a delicacy (Owen, 2003). Clark *et al* (2009) also suggest commerical harvesting of the crab in the River Thames Estuary.

Pathway
Live Chinese mitten crabs are imported for aquarium purposes (Marquard 1926, Peters 1933, in Gollasch 2006).The Chinese mitten crab is introduced via shipping (ballast tanks and hull fouling of vessels) (Marquard 1926, Peters 1933, in Gollasch 2006).Fouling communities on ships are typically composed of sessile species, however sometimes mobile species can hitch a ride too. For example, specimens of *E. sinensis* have been reported in empty cirriped shells on ship hulls.The mitten crab is a delicacy and crabs have been imported live illegally to markets.

Principal source: Rudnick Halat & Resh 2000; Gollasch 2006; Veilleux & de Lafontaine 2007

Compiler: IUCN/SSC Invasive Species Specialist Group (ISSG)

Review: Dr. Stephan Gollasch, GoConsult, Grosse Brunnenstrasse 61, 22763 Hamburg, Germany

Pubblication date: 2009-08-03

ALIEN RANGE

[2] ATLANTIC - NORTHEAST
[1] BELGIUM
[1] CZECH REPUBLIC
[1] ESTONIA
[1] AUSTRIA
[2] CANADA
[1] DENMARK
[1] EUROPE

[1] FAROE ISLANDS
[1] FRANCE
[1] GREENLAND
[1] IRAN, ISLAMIC REPUBLIC OF
[1] ITALY
[1] LAKE SUPERIOR
[1] LITHUANIA
[1] NETHERLANDS
[1] POLAND
[1] ROMANIA
[1] SERBIA
[1] ST. LAWRENCE RIVER
[1] UKRAINE
[9] UNITED STATES

[1] FINLAND
[1] GERMANY
[1] ICELAND
[1] IRELAND
[1] LAKE ERIE
[1] LATVIA
[1] MEDITERRANEAN & BLACK SEA
[1] NORWAY
[1] PORTUGAL
[2] RUSSIAN FEDERATION
[1] SPAIN
[1] SWEDEN
[2] UNITED KINGDOM

BIBLIOGRAPHY

89 references found for **Eriocheir sinensis**

Managment information
Alien Species in Poland 2006 *Eriocheir sinensis*
Summary: Available from: http://www.iop.krakow.pl/ias/Gatunek.aspx?spID=1 [Accessed 18 March 2010]
Blumenshine, C. Steven, Brian Tsukimura, Ammon Rice, and Deborah A Rudnick, 2011. Environmental factors influencing the dynamics of Chinese mitten crab zoeae in the San Francisco Bay-Delta. Aquatic Invasions (2011) in press
Summary: Available from: http://www.aquaticinvasions.net/2011/ACCEPTED/AI_accepted_Blumenshine_etal_correctedproof.pdf [Accessed 16 August 2011]
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].
Clark, P.F., Mortimer, D.N., Law, R.J., Averns, J.M., Cohen, B.A., Wood, D., Rose, M.D., Fernandes, A.R. & Rainbow, P.S. 2009. Dioxin and PCB Contamination in Chinese Mitten Crabs: Human Consumption as a Control Mechanism for an Invasive Species. *Environmental Science and Technology 43*: 1624-1629.
Department of Primary Industries and Water (DPIW Tasmania) 2009. Identification Guide. Marine Biosecurity Alert. Chinese Mitten Crab *Eriocheir* spp.
Summary: Available from: http://www.dpiw.tas.gov.au/inter.nsf/Attachments/LBUN-7T67FU/$FILE/ChineseMittenCrab1.pdf [Accessed 10 August 2009]
Dittel, Ana I. & Charles E. Epifanio., 2009. Invasion biology of the Chinese mitten crab *Eriocheir sinensis*: A brief review. Journal of Experimental Marine Biology and Ecology 374 (2009) 79–92
Summary: Available from: http://www.delawareestuary.org/pdf/ScienceReportsbyOthers/mitten_crabs.pdf [Accessed 10 August 2009]
Dutton C and Conroy C (1998) Effects of burrowing Chinese mitten crabs (*Eriocheir sinensis*) on the Thames Tideway. Environment Agency, London
Summary: Impact information.
Gollasch (2005, in preparation). Dr. Stephan Gollasch (GoConsult), www.gollaschconsulting.de, www.ballastwaterproject.com
Summary: Financial impacts of *Eriocheir sinensis* in Germany and management information.
Gollasch, S. 1997. *Eriocheir sinensis*. In: Baltic Research Network on Ecology of Marine Invasions and Introductions. S. Olenin and D. Daunys (eds.).
Summary: Species invasion and spread details in Europe.
Available from: http://www.corpi.ku.lt/nemo/alien_species_directory.html [Accessed on July 9 2007].
Gollasch, S. 1999 Current Status on the increasing abundance of the Chinese mitten crab *Eriocheir sinensis* H. Milne Edwards, 1854 in German rivers. Proceedings of the First Annual Meeting on the Chinese mitten crab in California. 23 March. Sacramento, CA
Summary: Distribution of the mitten crab in Europe.
Gollasch, S. 1999. *Eriocheir sinensis* (Milne-Edwards, 1854), the Chinese Mitten Crab. In: Gollasch, S., Minchin, D., Rosenthal, H. and Voigt, M. (eds.): Exotics Across the Ocean. Case histories on introduced species: their general biology, distribution, range expansion and impact: 55-60.

Great Britian Non-Native Species Secretariat (NNSS)., undated. Chinese Mitten Crab
Summary: Available from: http://www.nonnativespecies.org/documents/Eriocheir_sinensis_(Chinese_Mitten_Crab).pdf [Accessed 10 August 2009]
Hanson, E. and Sytsma, M. 2005. The potential for Mitten crab colonization of Estuaries on the West coast of North America. Center for lakes and reservoirs, Portland State University.
Hayes, K., Sliwa, C., Migus, S., McEnnulty, F., Dunstan, P. 2005. National priority pests: Part II Ranking of Australian marine pests. An independent report undertaken for the Department of Environment and Heritage by CSIRO Marine Research.
Summary: This report is the final report of a two year study designed to identify and rank introduced marine species found within Australian waters (potential domestic target species) and those that are not found within Australian waters (potential international target species).
Available from: http://www.marine.csiro.au/crimp/reports/PrioritypestsFinalreport.pdf [Accessed 25 May 2005]
Herborg, Leif-Matthias, Rudnick, Deborah A., Siliang, Yang, Lodge, David M., MacIsaac, Hugh J. 2007. Predicting the range of Chinese mitten crabs in Europe. Conservation Biology. 21(5). OCT 2007. 1316-1323.
Herborg, L.-M., C. L. Jerde, D. M. Lodge, G. M. Ruiz,and H. J. MacIsaac., (in Press). Predicting the North American distribution of Chinese mitten crabs (*Eriocheir sinensis*) using measures of propagule pressure and environmental niche models. Ecological Applications
Hoestlandt H (1948) Recherches sur la biologie de l'*Eriocheir sinensis* H. Milne-Edwards (Crustac' Brachyoure). Annales de l'Institut Oc'anographique 24:1-116
Interagency Ecological Program (IEP), undated. The Chinese Mitten Crab
Summary: Available from: http://www.recfin.org/lib/2003/mitten_crab_brochure.pdf [Accessed 10 August 2009]
Kelly, J., and Maguire, C.M. 2009. Chinese Mitten Crab (*Eriocheir sinensis*)Invasive Species Action Plan. Prepared for NIEA and NPWS as part of Invasive Species Ireland.
Summary: Available from: http://www.invasivespeciesireland.com/files/public/Management%20contingency/Eriocheir%20sinensis%20Invasive%20Species%20Action%20Plan.pdf [Accessed 10 August 2009]
McEnnulty, F.R., Jones, T.E. and Bax, N.J. (2001), The Wed-Based Rapid Response Toolbox
Summary: Web publication: Date of release: June 2001, Date of access: 26/03/2004.
Ministry of Fisheries Biosecurity New Zealand, 2001. Action plan for unwanted species, Chinese Mitten Crab (*Eriocheir sinensis*)
Summary: Available from: http://www.biodiversity.govt.nz/pdfs/seas/chinese_mitten_crab_action_plan.pdf [Accessed 10 August 2009]
Normant, M., Wiszniewska, A. & Szaniawska, A. 2000. The Chinese mitten crab *Eriocheir sinensis* (Decapoda: Grapsidae) from Polish waters. *Oceanologia 42*(3): 375 '383.
Summary: Species invasion in Poland.
Available from: http://www.iopan.gda.pl/oceanologia/423Norma.pdf. [Accessed on 1:16 PM 3/29/2004]
Panning, A. 1938. The Chinese Mitten Crab. Smithsonian Rep.: 361-375.
Rainbow, Phil; Roni Robbins and Paul Clark, 2005. Alien invaders: Chinese mitten crabs in the Thames and spreading. Biologist (2003) 50 (5)
Summary: Available from: http://www.wew.nu/exoten/doc/mittencrabs_50_5.pdf [Accessed 10 August 2009]
Rudnick A. Deborah Kathryn Hieb, Karen F. Grimmer, Vincent H. Resh., 2003. Patterns and processes of biological invasion: The Chinese mitten crab in San Francisco Bay. Basic Appl. Ecol. 4, 249'262 (2003).
Summary: Species distribution and impacts in the San Francisco Bay area.
Rudnick D.A and Resh V.H 2002. A survey to examine the effects of the Chinese mitten crab on commercial fisheries in northern California. Interagency Ecological Program Newsletter 15(1): 19-21
Summary: Impact information.
Rudnick D.A, Hieb K, Grimmer K.F and Resh V.H 2003. Patterns and processes of biological invasion: The Chinese mitten crab in San Francisco Bay. Journal of Basic and Applied Ecology 4: 249-262
Rudnick, Deborah and Vincent Resh, 2005. Stable isotopes, mesocosms and gut content analysis demonstrate trophic differences in two invasive decapod crustacea. Freshwater Biology (2005) 50, 1323'1336
Rudnick, Deborah, Valerie Chan and Vincent Resh, 2005. Morphology and Impacts of the burrows of the Chinese mitten crab, *Eriocheir sinensis* H. Milne Edwards (Decapoda Grapsoidea), in South San Francisco bay, California , U.S.A. Crustaceana 78 (7): 787-807
Sea Grant Washington, 2009. Chinese mitten crab
Summary: Available from: http://www.wsg.washington.edu/mas/ecohealth/invasive_crabs/mitten_crab.html[Accessed 10 August 2009]
Siegfried, S. 1999. Notes on the invasion of the Chinese mitten crab (*Eriocheir sinensis*) and their entrainment at the Tracy Fish Collection Facility. *Interagency Ecological Project Newsletter 12*(2): 24-25.
The National System for the Prevention and Management of Marine Pest Incursions., 2008. Marine Pest Chinese Mitten Crab *Eriocheir sinensis*. An Australian Government Initiative
Summary: Available from: http://www.marinepests.gov.au/__data/assets/pdf_file/0020/852113/Eriocheir-sinensis.pdf [Accessed 10 August 2009]
US Fish and Wildlife Service and USGS, 2007. Burrowing activities of Chinese mitten crabs in San Francisquito Creek: an assessment of stream bank substrate, burrowing effects, and sediment erosion. USGS Geological Research Activities with U.S. Fish and Wildlife Service
Summary: Available from: http://geology.usgs.gov/connections/fws/landscapes/chinese_mitten_crabs.htm [Accessed 10 August 2009]
Veilleux, E., and de Lafontaine, Y. 2007. Biological synopsis of the Chinese mitten crab (*Eriocheir sinensis*). Can. Manusc. Rep. Fish. Aquat. Sci. 2812: vi + 45 p.
Summary: Available from: http://www.dfo-mpo.gc.ca/Library/330849.pdf Accessed 10 August 2009]
Washington Sea Grant Program, 2000. Non-Indigenous Species Facts. Chinese Mitten Crab
Summary: Identification and Impacts.
Available from: http://www.wsg.washington.edu/outreach/mas/nis/mittencrab.html [Accessed on 10:42 AM 3/30/2004].
Weber, A. 2008. Predation of Invasive Species Chinese Mitten Crab (*Eriocheir sinensis*) By Eurasian Otter (*Lutra lutra*) in the Dr'mling Nature Reserve, Saxony-Anhalt, Germany. IUCN Otter Spec. Group Bull. 25 (1): 104 - 104
Summary: Available from: http://www.otterspecialistgroup.org/Bulletin/Volume25/Weber_2008.html [Accessed 10 August 2009]

Zhang T, Li Z and Cui Y., 2001. Survival, growth, sex ratio, and maturity of the Chinese mitten crab (*Eriocheir sinensis*) reared in a Chinese pond. Journal of Freshwater Ecology 16: 633-640

General information

Benson, A. J. and P. L. Fuller. 2009. *Eriocheir sinensis*. USGS Nonindigenous Aquatic Species Database, Gainesville, FL.
Summary: Available from: http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=182 [Accessed 10 August 2009]
California Department of Fish and Game, 1998. Chinese Mitten Crab.
Summary: Available from: http://www.dfg.ca.gov/delta/mittencrab/index.asp [Accessed 6 October 2009]
Chan, T.Y., Hung, M.S., & Yu, H.P. 1995. Identity of *Eriocheir recta* (Stimpson 1858) (Decapoda: Brachyura) with description of a new mitten crab from Taiwan. *Journal of Crustacean Biology 15*: 301-308. .
Chu, K. H., H. Y. Ho, C. P. Li & T.Y. Chan. Molecular Phylogenetics of the Mitten Crab Species in Eriocheir, sensu lato (Brachyura: Grapsidae), *Journal of Crustacean Biology 23*(3): 738-746.
Summary: Discussion of the phylogeny of the *Eriocheir* genus.
Clark, P. F., Rainbow, P. S., Robbins, R. S., Smith, B., Yeomans, W. E., Thomas, M. and Dobson, G. 1998. The alien Chinese mitten crab, *Eriocheir sinensis* (Crustacea: Decapoda: Brachyura), in the Thames catchment. J. Mar. Biol. Ass. U.K. 78: 1215-1221.
CONABIO. 2008. Sistema de informaci&#65533;n sobre especies invasoras en M&#65533;xico. Especies invasoras - Crust&#65533;ceos. Comisi&#65533;n 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 informaci&#65533;n sobre especies invasoras de m&#65533;xico cuenta actualmente con informaci&#65533;n aceca de nombre cient&#65533;fico, familia, grupo y nombre com&#65533;n, as&#65533; como h&#65533;bitat, estado de la invasi&#65533;n en M&#65533;xico, rutas de introducci&#65533;n y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la p&#65533;gina de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualizaci&#65533;n, por favor consulte la portada (http://www.conabio.gob.mx/invasoras/index.php/Portada), en la secci&#65533;n novedades, para conocer los cambios.
Especies invasoras - Crust&#65533;ceos is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Crust%C3%A1ceos [Accessed 30 July 2008]
de Lafontaine, Y. 2005. First Record of the Chinese Mitten Crab (*Eriocheir sinensis*) in the St. Lawrence River, Canada . *Journal of Great Lakes Research 31*(3): 367-370.
de Lafontaine, Y., Sevigny, J.M., Calve, R., Verreault, G., Despatie, S.P. & Veilleux , E. 2008. Chinese mitten crabs (*Eriocheir sinensis*) in the St. Lawrence River and Estuary, Canada: new records and risk of invasion. *Aquatic Invasions 3*(2): 153-163.
Delivering Alien Invasive Species Inventories for Europe (DAISIE), 2006. Factsheet *Eriocheir sinensis*
Summary: Available from: http://www.europe-aliens.org/pdf/Eriocheir_sinensis.pdf [Accessed 10 August 2009]
Delivering Alien Invasive Species Inventories for Europe (DAISIE), 2006. *Eriocheir sinensis*
Summary: Available from: http://www.europe-aliens.org/speciesFactsheet.do?speciesId=50176 [Accessed 10 August 2009]
Gilbey, V., Attrill, M.J. & Coleman, R.A. 2008. Juvenile Chinese mitten crabs (*Eriocheir sinensis*) in the Thames estuary: distribution, movement and possible interactions with the native crab *Carcinus maenas*. *Biological Invasions 10*(1)>: 67-77.
Gollasch, S. 2006. NOBANIS &#65533; Invasive Alien Species Fact Sheet &#65533; *Eriocheir sinensis*
Summary: Available from: http://www.nobanis.org/files/factsheets/Eriocheir_sinensis.pdf [Accessed 10 August 2009]
Gollasch, S. & Rosenthal, H. 2006: The Kiel Canal. In S. Gollasch, B.S. Galil, & A. Cohen (Eds.), *Bridging Divides &#65533; Maritime Canals as Invasion Corridors* (pp. 5-90). The Netherlands: Springer, Dordrecht.
Gonzales, V.A., G.G. Casta&#65533;eda and B. Tsukimura. 2009. The key to the identification of brachyuran megalopa of the San Francisco Bay Estuary. Proc. CA Acad. Sci. 60:615-625.
Gulf States Marine Fisheries Commission (GSFMC), 2003. *Eriocheir sinensis* (Milne Edwards, 1853)
Summary: Available from: http://nis.gsmfc.org/nis_factsheet.php?toc_id=132 [Accessed 10 August 2009]
Hanson, Erik and Sytsma, Mark. 2008. The potential for mitten crab *Eriocheir sinensis* H. Milne Edwards, 1853 (Crustacea : Brachyura) invasion of Pacific Northwest and Alaskan estuaries. Biological Invasions. 10(5). JUN 2008. 603-614.
Herborg, L-M., Bentely, M.G., and Clare, A.S., 2002. First confirmed record of the Chinese mitten crab (*Eriocheir sinensis*) from the River Tyne, United Kingdom. Journal of the Marine Biological Association of the United Kingdom, 82, 4078/1-2
Herborg, L-M., D. Weetman, C. Van Oosterhout, B. Hanfling., 2007. Genetic population structure and contemporary dispersal patterns of a recent European invader, the Chinese mitten crab, *Eriocheir sinensis*. Molecular Ecology 16: 231-242
Herborg, L.-M., M.G. Bentley & A. S. Clare. 2006. Mating behaviour and chemical communication in *Eriocheir sinensis*. Journal of Experimental Marine Biology and Ecology 329:1-10.
Herborg, L-M., Rushton, S.P., Clare, A.S., and Bentely, M.G., 2003. Spread of the Chinese mitten crab (*Eriocheir sinensis*H. Milne Edwards) in Continental Europe: analysis of a historical dataset.Hydrobiologia 503: 21-28
Summary: This paper uses a historical dataset to map the lifecycle and spread of the chinese mitten crab over Continental Europe.
Herborg, L-M., Rushton, S.P., Clare, A.S., and Bentely, M.G., 2005. The invasion of the Chinese mitten crab (*Eriocheir sinensis*) in the United Kingdom and its comparision to Continental Europe. Biological Invasions 2005 In press.
Herborg, L. M., Rushton, S. P., Clare, A. S., Bentley, M. G. 2005. The invasion of the Chinese mitten crab (*Eriocheir sinensis*) in the United Kingdom and its comparison to continental Europe. Biological Invasions. 7(6). NOV 2005. 959-968.

ITIS (Integrated Taxonomic Information System), 2005. Online Database *Eriocheir sinensis*
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.cbif.gc.ca/pls/itisca/taxastep?king=every&p_action=containing&taxa=Eriocheir+sinensis&p_format=&p_ifx=plglt&p_lang= [Accessed March 2005]
Leppäkoski, E. 1991. Introduced species - Resource or threat in brackish-water seas? Examples from the Baltic and the Black Sea. Mar. Poll. Bull. (23): 219-223.
Minchin, D. 2006. First Irish record of the Chinese-mitten crab *Eriocheir sinensis* (Milne-Edwards, 1854)(Decapoda: Crustacea). *Irish Naturalist*s *Journal*.
Moyle, P.B., 1991. Ballast water introductions. Fisheries, 16(1):4-6.
Natural History Museum: Chinese mitten crab webpage.
Summary: Describes the species and documents its invasion of Britain and elsewhere.
Nature, 1934. The Chinese Mitten Crab. 17-17 (07 July 1934) | doi:10.1038/134017a0
Summary: Available from: http://www.wsg.washington.edu/mas/ecohealth/invasive_crabs/mitten_crab.html[Accessed 10 August 2009]
Nature, 1934. Will the Chinese Mitten Crab Invade British Waters? 17-17 (07 July 1934) | doi:10.1038/134017a0
Summary: Available from: http://www.wsg.washington.edu/mas/ecohealth/invasive_crabs/mitten_crab.html[Accessed 10 August 2009]
Neal, K.J. 2008. *Eriocheir sinensis*. Chinese mitten crab. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom.
Summary: Available from: http://www.marlin.ac.uk/speciesinformation.php?speciesID=3283 [Accessed 10 August 2009]
Normant, M. & Skora, K. 2002. The Chinese mitten crab *Eriocheir sinensis* - an immigrant from Asia in the Gulf of Gdansk. *Oceanologia 44*(1):123–125.
Ojaveer, H., Gollasch, S., Jaanus, A., Kotta, J., Laine, A.O., Minde, A., Normant, M. & Panov, V.E. 2007. Chinese mitten crab *Eriocheir sinensis* in the Baltic Sea - a supply-side invader? *Biological Invasions 9*(4): 409-418.
Owen, J. 2003. *Eat the Invading Alien Crabs, Urge U.K. Scientists.* National Geographic News.
Summary: Available from: http://news.nationalgeographic.com/news/2003/11/1113_031113_mittencrabs.html [Accessed 29 March 2006]
Panov, V.E. 2006. First record of the Chinese mitten crab, *Eriocheir sinensis* H. Milne Edwards, 1853 (Crustacea: Brachyura: Varunidae) from Lake Ladoga, Russia, *Aquatic Invasions 1*(1): pp 28-31.
Summary: Available from: http://www.aquaticinvasions.ru/2006/AI_2006_1_1_Panov.pdf [Accessed 10 December 2009]
Paunovic, M., Cakic, P., Aleksandar, H., Kolarevic, J., Lenhardt, M. 2004. A report of *Eriocheir sinensis* (H. Milne Edwards, 1854) [Crustacea: Brachyura: Grapsidae] from the Serbian part of the Danube River. Hydrobiologia 529: 275–277, 2004.
Puky, M., Reynolds, J. D., Schad, P. 2005. Native and alien Decapoda species in Hungary: Distribution, status, conservation importance. Bulletin Francais de la Peche et de la Pisciculture.(376-77). 2005. 553-568.
Rice, A. and B.Tsukimura. 2007. An illustrated key to the brachyuran zoea of the San Francisco Bay Estuary. J. Crustacean Biology. 27:74-79.
Robbins, R.S., Sakari, M., Baluchi, S.N. and Clark, P.F. The occurrence of *Eriocheir sinensis* H. Milne Edwards, 1853 (Crustacea: Brachyura: Varunidae) from the Caspian Sea region, Iran, *Aquatic Invasions 1*(1): pp 32-34.
Summary: Available from: http://www.aquaticinvasions.ru/2006/AI_2006_1_1_Robbins_etal.pdf [Accessed 10 December 2009]
Rudnick, D., Chan, V., Resh, V. 2005a. Morphology and Impacts of the Burrows of the Chinese Mitten Crab, *Eriocheir sinensis* H. Milne Edwars (Decapoda, Grapsoidea), in South San Francisco Bay, California U.S.A Department of Environmental Science, Policy, and Management, University of California.
Rudnick, Deborah and Resh, Vincent. 2005. Stable isotopes, mesocosms and gut content analysis demonstrate trophic differences in two invasive decapod crustacea. Freshwater Biology (2005) 50, 1323–1336
Rudnick, Deborah, Veldhuizen, Tanya, Tullis, Richard, Culver, Carolyn, Hieb, Kathryn, Tsukimura, Brian. 2005b. A life history model for the San Francisco Estuary population of the Chinese mitten crab, *Eriocheir sinensis* (Decapoda : Grapsoidea). Biological Invasions. 7(2). MAR 05. 333-350.
Rudnick, D., Halat, K., Resh, V. 2000. Distribution, Ecology and Potential impacts of the Chinese Mitten Crab (*Eriocheir sinensis*) in San Francisco Bay. Department of Environmental Science, Policy and Management University of California, Berkeley.
Rudnick, D., Hieb, K., Grimmer, K., Resh, V. 2003. Patterns and processes of biological invasion: The Chinese mitten crab in San Francisco Bay. Basic Appl. Ecol. 4, 249–262 (2003).
Shakirova, F.M., Panov, V., Clark, P. 2007. New records of the Chinese mitten crab, *Eriocheir sinensis* H. Milne Edwards, 1853, from the Volga River, Russia. Aquatic Invasions (2007) Volume 2, Issue 3: 169-173.
Smithsonian Environmental Research Center. 2009. Chinese Mitten Crab Update. [Accessed January 14, 2009]
Summary: Available from: http://serc.si.edu/labs/marine_invasions/news/CHINESE_MITTEN_CRAB_UPDATE_APR21_09.pdf
Smithsonian Environmental Research Center (SERC) August 2006. Marine Invasions Research Lab. Chinese Mitten Crab caught in Chesapeake Waters
Summary: Available from: http://serc.si.edu/labs/marine_invasions/news/news.aspx [Accessed December 10 2009]
Takeda, Masatsune and Koizumi, Masayuki. 2005. Occurrence of the Chinese mitten crab, *Eriocheir sinensis* H. Milne Edwards, in Tokyo Bay, Japan. Bulletin of the National Science Museum Series A (Zoology). 31(1). MAR 2005. 21-24.
Tepolt, Carolyn K., Blum, Michael J., Lee, Victoria A., Hanson, Erik D. 2007. Genetic analysis of the Chinese mitten crab (*Eriocheir sinensis*) introduced to the North American Great Lakes and St. Lawrence seaway. Journal of Great Lakes Research. 33(3). SEP 2007. 658-667.
The Natural History Museum. 2005. *Chinese Mitten Crabs.* The Natural History Museum: London.
Summary: Available from: http://www.nhm.ac.uk/nature-online/life/other-invertebrates/chinese-mitten-crabs/ [Accessed September 30 2009]
The North European and Baltic Network on Invasive Alien Species (NOBANIS), 2009. *Eriocheir sinensis*
Summary: Available from: http://www.nobanis.org/speciesInfo.asp?taxaID=260 [Accessed 10 August 2009]

Valovirta, Ilmari and Eronen, Reijo. 2000. First record of *Eriocheir sinensis* from Finnish inland. Memoranda Societatis pro Fauna et Flora Fennica. 76(1-2). 2000. 23-25.
Summary: An adult *Eriocheir sinensis* was found in October 1999 in a fishing net examined by Reijo Eronen, in Haukivesi (Poronsalmi) in Rantasalmi, in the lake area of the Finnish inland. This was the first time when this crayfish species has been recorded on the Finnish mainland. The species is distributed almost yearly to our seacoast area by ships coming from the North Sea or from the Southern Baltic Sea. The first record of this species in Finland is from year 1933. This time the specimen had travelled by ship through the Saimaa Canal and been ejected with the balance water into the lake of Haukivesi. The ecology and life span of the species is discussed. Eriocheir chinensis cannot breed in our brackish sea water, as the salinity is too low for the hatching of the eggs.
Zhao, J., Murphy, R. and Li, S. 2002. Relationships of mitten crabs (*Eriocheir*) from inland rivers of China inferred from cytochrome oxidase subunit 1 sequences. Biochemical Systematics and Ecology 30, 931-941.