

FIRST RECORD OF THE CHINESE MITTEN CRAB (*ERIOCHEIR SINENSIS*) IN THE LAGOON OF MARANO AND GRADO (NORTHERN ADRIATIC SEA)

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ABSTRACT

The Chinese mitten crab (Eriocheir sinensis, H. Milne Edwards, 1853) is native to the Far East and represents one of the most invasive alien species. The aim of the paper is to report the first record of this species in the Lagoon of Marano and Grado, which is also the third record in the northern Adriatic, with a brief overview on the introduction, distribution and the life span of this species in the European waters.

Key words: *Eriocheir sinensis*, alien species, Lagoon of Marano and Grado, northern Adriatic Sea

PRIMA SEGNALAZIONE DEL GRANCHIO CINESE (*ERIOCHEIR SINENSIS*) NELLA LAGUNA DI MARANO E GRADO (ALTO ADRIATICO)

SINTESI

Il granchio cinese (Eriocheir sinensis, H. Milne Edwards, 1853) è originario dell'Estremo Oriente e rappresenta una delle specie aliene più invasive. Lo scopo del presente articolo è di riportare la prima segnalazione di questa specie nella Laguna di Marano e Grado, la quale è anche la terza segnalazione per l'area dell'Alto Adriatico, con un breve resoconto sull'introduzione, distribuzione e ciclo vitale di questa specie nelle acque europee.

Parole chiave: *Eriocheir sinensis*, specie aliene, Laguna di Marano e Grado, Alto Adriatico

INTRODUCTION

The Chinese mitten crab (*Eriocheir sinensis*, H. Milne Edwards, 1853) is native to the Far East, where its range extends from Hong Kong to the border with North Korea (Hymanson *et al.*, 1999). This species has two likely pathways of introduction: through ballast waters release (Peters, 1933; Cohen & Carlton, 1997) and escapes or deliberate releases associated with the transport of this valued aquaculture species (Herborg *et al.*, 2005). The Chinese mitten crab supports a \$1.25 billion per annum aquaculture industry in China, supplying local and international markets with live animals (Hymanson *et al.*, 1999). *E. sinensis* is catadromous, spending most of its life in fresh-waters, and only returning to estuaries to reproduce, whereupon it dies (Herborg *et al.*, 2005). The downstream migrations of sexually mature crabs are well known in the rivers Elbe and Weser (Germany) (Peters, 1933, 1938a) and in the River Thames (United Kingdom) (Robbins *et al.*, 2000). The Chinese mitten crab is listed as one of “100 of the world’s worst invasive alien species” (DAISIE, 2015). The aim of the paper is to report the first record of this species in the Lagoon of Marano and Grado, which is also the third record in the northern Adriatic, with a brief overview on the introduction, distribution and the life span of this species in the European waters.

MATERIAL AND METHODS

The Marano and Grado Lagoon (northern Adriatic Sea, Italy) is an extremely important wetland. It extends approximately 32 km reaching up to 5 km of width for a total area of 160 km², between the Tagliamento and



Fig. 1: Map of the records of *E. sinensis* in the northern Adriatic Sea: (1) Mizzan (2005), (2) Fiorin *et al.* (2013), (3) Marano and Grado Lagoon (present study).

Sl. 1: Dosedanje najdbe vrste *E. sinensis* v severnem Jadranu: (1) Mizzan (2005), (2) Fiorin *et al.* (2013), (3) maranska in gradeška laguna (pričujoča študija)

Isonzo River deltas (Fontolan *et al.*, 2012). The drainage basin (~1880 km²) delivers important loads of both nutrients and pollutants (Covelli *et al.*, 2012; Saccon *et al.*, 2013). Since 1971, the Lagoon is protected by the Ramsar Convention. Following the implementation of the Habitats Directive (Council Directive 92/43/EEC), it was also identified as a Site of Community Importance (SCIs – IT3320037) within Natura 2000 network. The area hosts economic, tourism and industrial services, with fishing, clam harvesting (mainly the Manila clam, *Ruditapes philippinarum* Adams & Reeve, 1850) and fish-farming comprising the most important resources for local inhabitants (Bettoso *et al.*, 2013).

One specimen of *Eriocheir sinensis* was caught on 20 November 2014, using the fyke nets, at a depth of approximately 1 m, on muddy bottom. The specimen was determined and measured to the nearest millimetre and weighed to the nearest gram. It was dry preserved and deposited in the Invertebrate Collection of the Museo Friulano di Storia Naturale (Udine), under accession number ZI-05279.

RESULTS AND DISCUSSION

The capture site of *Eriocheir sinensis* was located off the mouth of Stella river in the Lagoon of Marano and Grado (45° 43' 29" N, 013° 05' 48" E) (Fig. 1). The specimen caught was a male with a carapace width of 75 mm, carapace length 67 mm and the wet weight of 202 g (Fig. 2). This is similar to the previous record in the Venice Lagoon where in June 2013 a male with a carapace width of 61.1 mm was caught in the inner area of the northern lagoon (45° 32' 07" N, 012° 27' 01" E) (Fiorin *et al.*, 2013). The square shaped carapace clearly distinguishes this alien species from other native European brachyuran crabs. It can reach a carapace width of 5 to 7 cm with the maximum of approximately 10 cm (Czerniejewski *et al.*, 2003). One key identification feature is the hair-like covering on the claws, which is especially well developed in male individuals. The colour varies from yellow to brown, rarely purple.

The first record in the Venice Lagoon arises to May 2005, when a specimen was collected in the central part of the basin (Mizzan, 2005), but its first appearance into the Mediterranean Sea arose to 1959 in the Narbonne littoral lagoons (France) (Petit, 1960).

The first report of a Chinese mitten crab in continental Europe was in a tributary of the river Weser in North West Germany in 1912 and in the river Elbe in 1914. No further range expansion along the European coast was reported until 1927. In the following 10 years the species dispersed rapidly in a westerly direction along the North Sea and English Channel coast and into northern France as far as St. Malo (1954) (André, 1954). There was an average rate of spread of 441 km per year during the peak period of 1927–1931. In 1954, *E. sinensis* arrived at the West coast of France and in

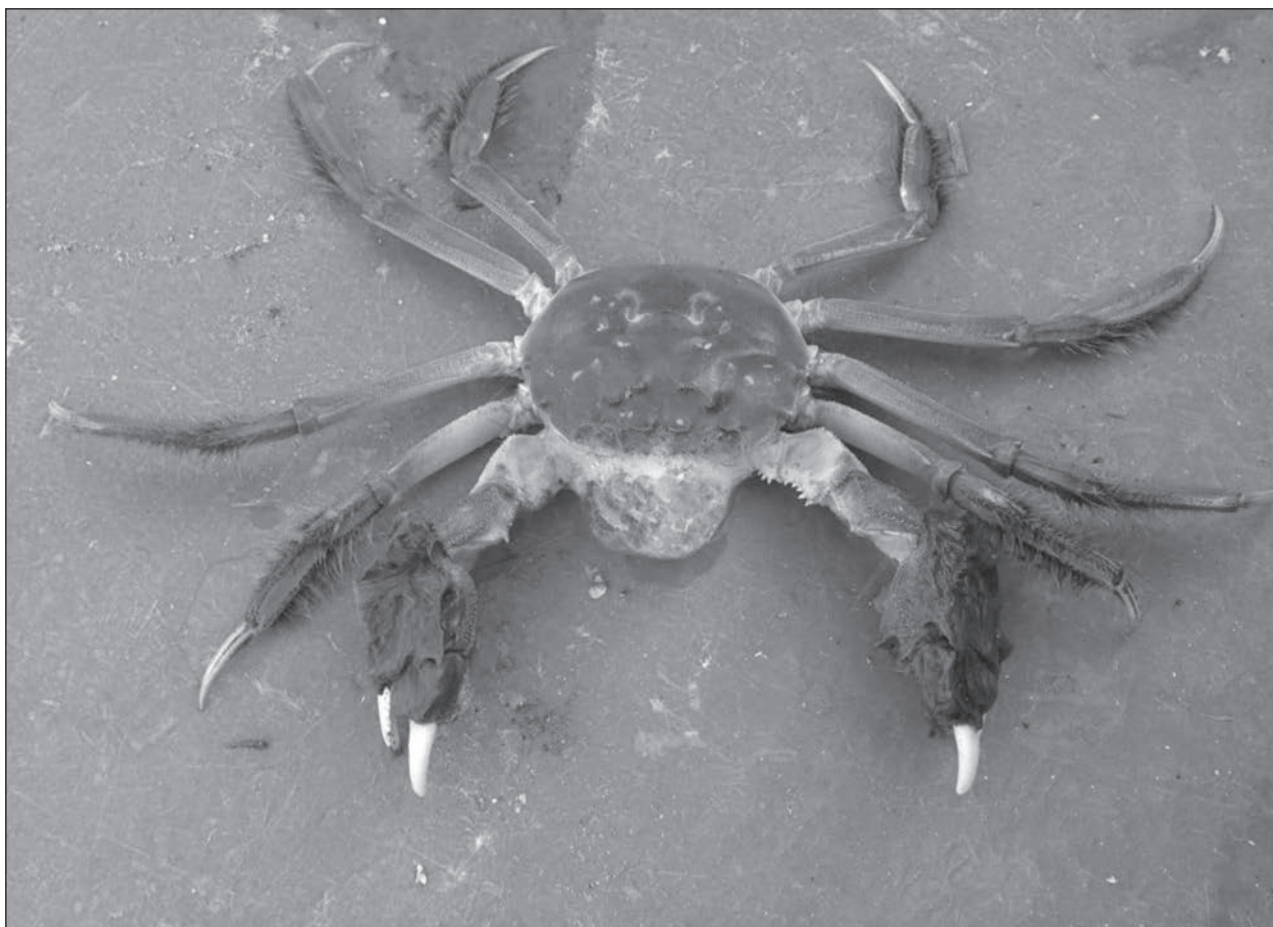


Fig. 2: Specimen of *Eriocheir sinensis* caught in the Marano and Grado Lagoon.
Sl. 2: Primerek vrste *Eriocheir sinensis*, ujete v maranski in gradeški laguni

1958 spread to Hendaye on the French-Spanish border (Hoestlandt, 1959). To the East, the mitten crab entered the Baltic Sea in 1928, spreading as far East as Vyborg in Finland by 1933, and as far North as Gävle in Sweden by 1934 (Peters, 1938b). During the period 1928–1935, *E. sinensis* spread at an average rate of 355 km per year in the Baltic Sea (Herborg *et al.*, 2005).

The Chinese mitten crab was first reported in the United Kingdom in the Thames River in 1935, but became established only in 1973 (Ingle, 1986; Rainbow *et al.*, 2003). In the late 1980s, crabs were found in the Tagus River in Portugal, where the species had become established by 1990 (Cabral & Costa, 1999). Since 1997, the crab has also established itself in the Guadalquivir estuary, near Seville's harbour in Spain (Cuesta *et al.*, 2004, 2015). These last two records represent the southernmost occurrences to date of this species in Europe. Two Chinese mitten crabs were also collected in the Serbian section of the Danube River in June 1995 and November 2001 (Paunović *et al.*, 2004), but after first records the occurrence of this species is still occasional (Škraba *et al.*, 2013).

It is largely accepted that the worldwide spread of the Chinese mitten crab was due to human-mediated activities and was not the result of natural causes (Cohen & Carlton, 1997). The most probable unintentional vector for the introduction and transfer is the transport by ship ballast waters. Presumably, the uptake of pelagic larval stages would be responsible for the spread of the species via this vector (Cohen & Carlton, 1997). In fact, the Chinese mitten crab was one of the first species reported in ballast tanks and was used as a first piece of evidence for the transport of living aquatic alien species in ballast waters (Carlton, 1985). In northern Europe, ship traffic from China headed for Hamburg (Elbe River) and Bremen (Weser River) has been frequent since the end of the 19th century, which may have very likely contributed to a founder specimens introduction via incoming ships from China. The presence of the crab in southern France probably arose through shipping activities (Herborg *et al.*, 2003).

E. sinensis is an euryhaline species characterized by a catadromous life cycle. It spends most of its life in fresh or brackish waters. Mature adults migrate downstream

during the fall to reproduce in brackish or salt waters. Both sexes are thought to die following reproduction (Panning, 1938). 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 megalopa stage (Anger, 1991; Montú *et al.*, 1996). Following the megalopal stage, the larvae metamorphose into juvenile crabs that settle to the bottom, usually in late summer or early fall (Rudnick *et al.*, 2005). The onset of this benthic life for the young crabs corresponds to the beginning of the active upstream migration into rivers to complete the life cycle in fresh waters.

The species can live between one and five years, depending on location. This variability in longevity is apparently related to the time needed to reach the maturity and reproductive activity, since the crab is believed to spawn only once (Panning, 1938). In northern Europe the time to maturity varies between four and five years, while in the warmer waters of the San Francisco Bay, the majority of spawning crabs are at least three years old (Rudnick *et al.*, 2005; Veilleux & de Lafontaine, 2007). This geographic variation in age at maturity suggested that the achievement of maturity can be strongly dependent upon environmental conditions (Rudnick *et al.*, 2005).

Nevertheless, after its appearance in the Narbonne littoral lagoons (Petit, 1960), the population disappeared after a dozen years from the Mediterranean Sea (Petit & Mizoule, 1973). Until the new record in the Venice Lagoon (Mizzan, 2005) there were no other records in the Mediterranean area, although the species was reported in the Ukrainian part of the Black Sea and in the adjacent Azov Sea, where they probably arrived from the

Baltic Sea by active migration via canals and causeways (Murina & Antonovsky, 2001; Gomoiu *et al.*, 2002).

The Chinese mitten crab interferes with recreational and commercial fishing (Ingle, 1986), causes river bank erosion through extensive burrowing (Herborg *et al.*, 2005), and may compete for resources with native freshwater crustaceans (Clark *et al.*, 1998). In this way the presence of *E. sinensis* in the Lagoon of Marano and Grado could represent a potential threat. A number of alien species from different phyla has been reported in the recent past from the North Adriatic lagoons (Frogliola & Speranza, 1993; Mizzan, 1999; Occhipinti Ambrogi, 2000). With regard to exotic crustaceans, the last finding was an established population of the Oriental shrimp (*Palaemon macrodactylus* Rathbun, 1902) in the Lagoon of Venice (May 2012) (Cavraro *et al.*, 2014), Lagoon of Marano and Grado (May 2013) and Sacca di Goro (July 2013) (Cuesta *et al.*, 2014). Also in this case, ballast waters discharge seems to be the most likely vector of introduction (Cavraro *et al.*, 2014; Cuesta *et al.*, 2014).

Even if recorded with a specimen at present, it is recommended that the presence of the Chinese mitten crab and its eventual expansion within the lagoon and adjacent river systems will be monitored in the next few years, through directed monitoring programmes as well as in the artisanal fishery catches.

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PRVI ZAPIS O POJAVLJANJU KITAJSKJE VOLNOKLEŠČE RAKOVICE *ERIOCHEIR SINENSIS* V MARANSKI IN GRADEŠKI LAGUNI (SEVERNI JADRAN)

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POVZETEK

Kitajska volnokleščča rakovica *Eriocheir sinensis* H. Milne Edwards, 1853, ki izvira iz Daljnega vzhoda, je ena izmed najbolj invazivnih tujerodnih vrst. Namen pričujočega prispevka je podati prvi zapis o pojavljanju te vrste v maranski in gradeški laguni. Sicer je to tretji zapis o pojavljanju te tujerodne vrste za severni Jadran.

Ključne besede: *Eriocheir sinensis*, tujerodna vrsta, maranska in gradeška laguna, severni Jadran

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