The Chinese mitten crab *Eriocheir sinensis* (Decapoda: Grapsidae) from Polish waters*

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Abstract

The Chinese mitten crab *Eriocheir sinensis* Milne-Edwards, 1854 is a newcomer to the Baltic Sea. Previous studies have shown that since the 1940s single large specimens of this species have been caught annually in Polish waters. The invasion of the Chinese mitten crab has been reported from many European countries, including Poland, where it is especially abundant in the Odra Estuary. Of 186 specimens captured in Lake Dąbie in August 1998, 45% were females and 55% males. The carapace width of these crabs varied between 53 and 88 mm and the average wet weight was 169 ± 45.3 g.

1. Introduction

New species, sometimes from very remote regions, have appeared in recent decades in the Baltic Sea. The introduction of these organisms to the Baltic is primarily the result of human activity, most often during the dumping of ballast water from ships (Ingle 1986). One of these immigrants to the Baltic is the Chinese mitten crab *Eriocheir sinensis* Milne-Edwards, 1854, so named because of the dense patches of hair on the claws of

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adult specimens. This is the largest crustacean species inhabiting Polish waters. *E. sinensis* is a catadromous species that spends most of its life in freshwaters and only migrates to the sea to reproduce. The first specimens to be found in Europe were reported from German waters near Hamburg in 1912 (Panning 1939). *E. sinensis* appeared in the early 1930s in the inlet area to the Baltic Sea and ever since, large specimens have been reported from almost all parts of the Baltic (Hällfors *et al.* 1981). According to Żmudziński (1961) *E. sinensis* has been found many times in northern Poland, especially in brackish waters and near the larger ports. Stańczykowska (1986) and Grabda (1989) report that the Chinese mitten crab occurs mainly near the mouth of the River Wisła (Vistula); it has also been observed in the Warta and the lower Odra (Oder), and in the Mazurian Lake District. According to the most recent investigations by Jażdżewski & Konopacka (1993), *E. sinensis* occurs in practically all parts of the Polish coastal zone, from the Pomeranian Bay through the central coast and the Gulf of Gdańsk to the Wisła Lagoon. Specimens have been caught not only in inland freshwaters and shallow coastal areas, but in deep-sea waters as well.

The present paper describes the Polish population of *E. sinensis* with regard to size and sex. A further aim of this work was to determine whether and in which parts of the Polish coastal area the Chinese mitten crab occurs, and whether this species is spreading throughout Polish waters.

2. Materials and methods

The specimens were collected with fyke nets in Lake Dąbie in August 1998 (Fig. 1). After collection, the animals were frozen at -30°C and stored for analysis. After defrosting, the length and width of the crabs' carapaces were measured with a slide caliper (± 0.1 mm), their sex determined from their abdominal structure (Schäferna 1935), and their wet weight measured (± 0.01 g). The specimens were then dried at a temperature of 55°C to constant weight. The crabs were divided into 5 mm length classes starting from 51 mm. The linearity of the carapace length-width relationship was determined using regression analysis and the correlation coefficient R. The size-weight relationship was calculated according to the power equation $y = a \times x^b$, where x = size (CW) in mm, y = weight in g, and b = the allometric coefficient (or slope).

3. Results

Of the 186 specimens collected in Lake Dąbie, 45% were females and 55% males. The width of the carapace varied from 53 mm to 88 mm (av. 71.4 ± 6 mm). Frequency was greatest in the 66–70 mm and 71–75 mm

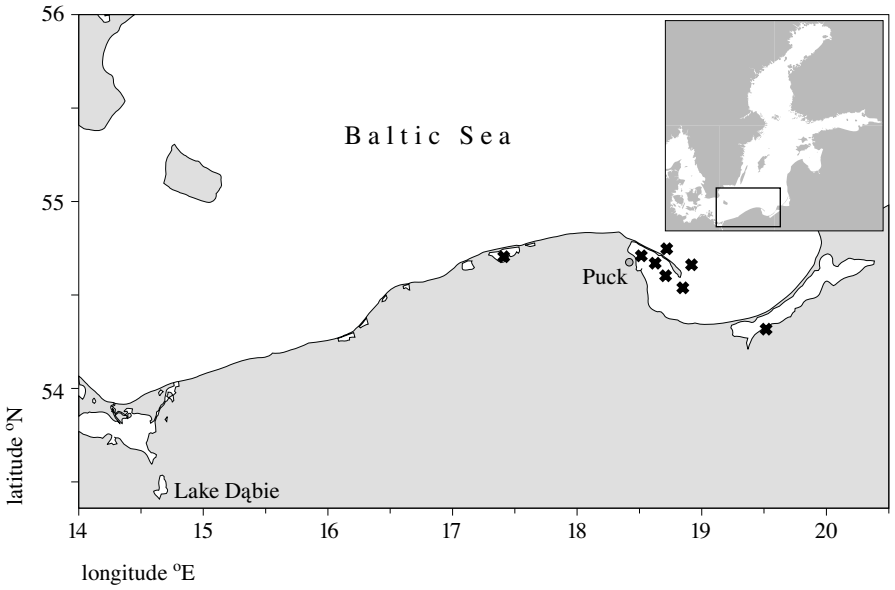

Fig. 1. Location of the sampling site (Lake Dąbie) and other areas where *E. sinensis* has been recorded (crosses)

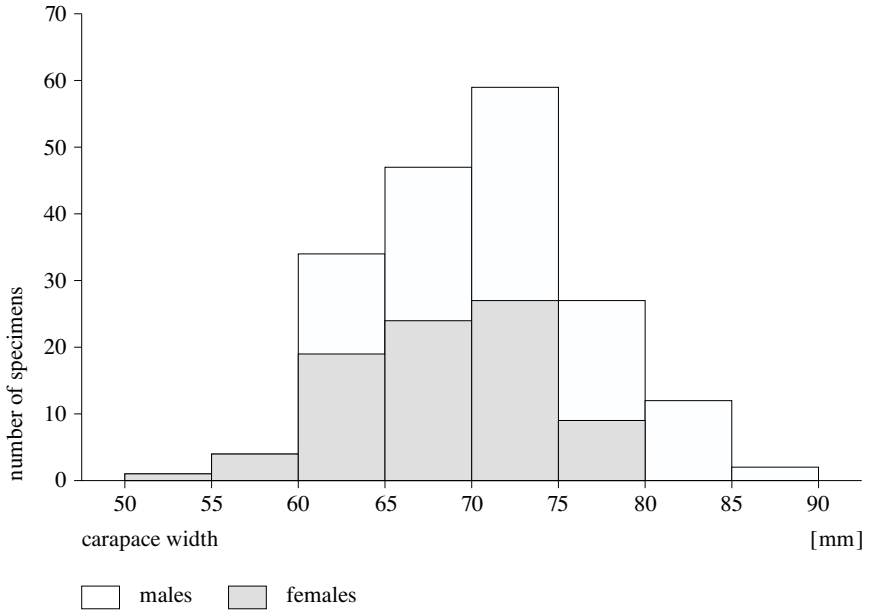

Fig. 2. Abundance of *E. sinensis* in consecutive width classes

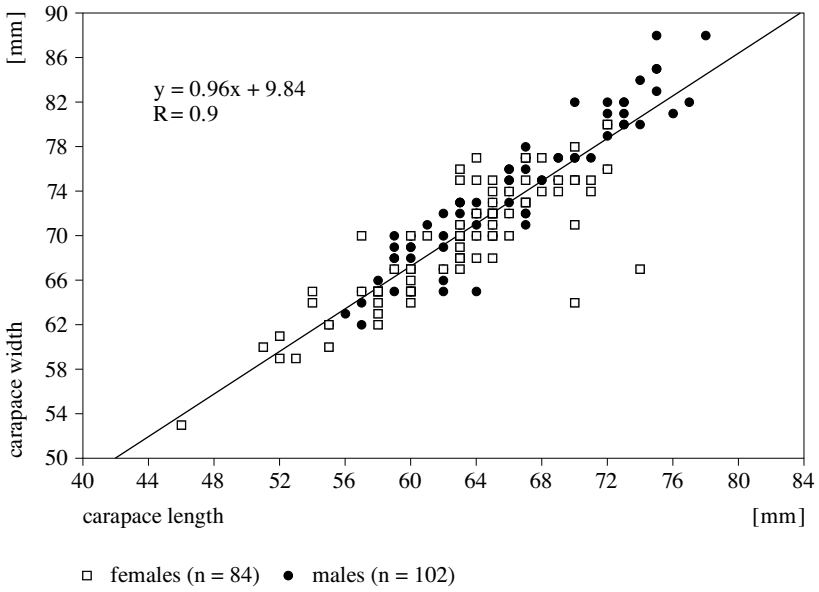

Fig. 3. Relationship between the carapace length and width of *E. sinensis*

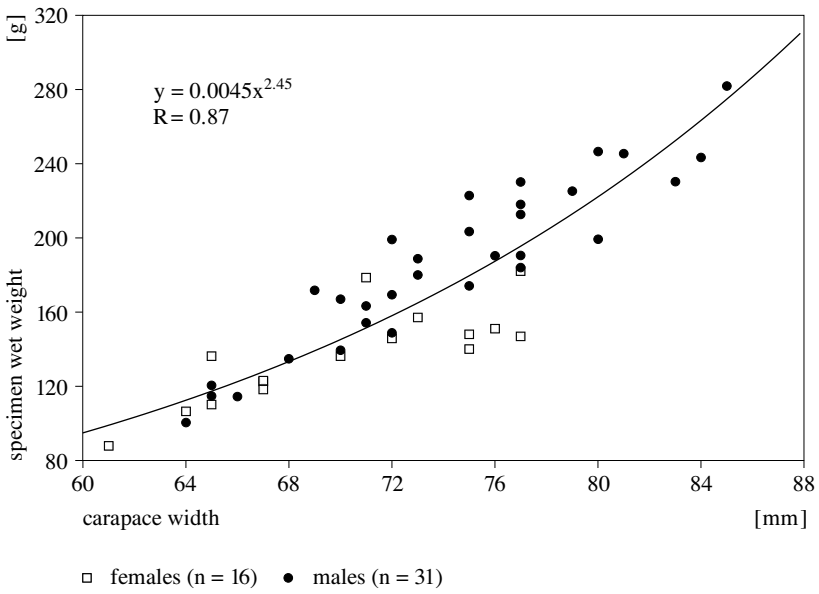

Fig. 4. Relationship between the carapace width and wet weight of *E. sinensis*

width classes – 25 and 32% respectively (Fig. 2). Least numerous were specimens from the 51–55 mm and 86–90 mm width classes – 0.5% and 1% of all specimens respectively. The smallest specimens (< 61 mm) were females, the largest ones (> 81 mm) were males. The carapace of the Chinese mitten crab is broader than it is long; there is a significant correlation ($R = 0.9$, $p < 0.05$) between its length and width (Fig. 3). The wet weight of the specimens varied from 87.9 to 281.9 g (av. 169.4 ± 45.3 g). The carapace width/specimen wet weight ratio for *E. sinensis* is determined by the function $CW = 0.0045 \times W^{2.45}$ (Fig. 4). A significant relationship ($R = 0.87$, $p < 0.05$) exists between the wet weight and the carapace width. The water content in specimens varied from 56.7 to 79.3%, the average being 67.0 ± 5.3% of the specimen's total weight.

4. Discussion

The carapace of the largest *E. sinensis* specimen caught in Lake Dąbie was 88 mm wide. Females from Lake Dąbie were smaller than the males. The same maximum sizes of this species were recorded in Portugal (Cabral & Costa 1999). According to Stańczykowska (1986) and Halat (1997), this species can reach a width of 70–80 mm. The largest specimens of this species, 10 cm wide, were caught in 1949 off the Yorkshire coast of England (Wall & Limbert 1983). The largest *E. sinensis* caught in Holland was 85 mm wide (Adema 1991). The allometric coefficient b in the relationship between carapace width and wet weight is 2.45, which is lower than that of other Baltic crustaceans. In the case of *Mesidotea (Saduria) entomon*, this value hovers around 2.87 for males and 3.18 for females (Kopacz & Wiktor 1986), and in *Rhithropanopeus harrisii tridentatus*, which occurs in Polish waters, the allometric coefficient varies from 2.90 to 3.16 (Rychter 1999). A low value of b indicates a greater increase in *E. sinensis* size than of weight, a feature typical of mesopelagic species rather than benthic ones (Company & Sardá 2000). The slower rate of weight increase in *E. sinenis* in comparison with other crustaceans may also be due to this crab's longer life cycle. A comparative analysis cannot be carried out owing to the lack of data on Chinese mitten crab populations inhabiting other regions of the Baltic Sea and Europe.

The correlation coefficient R in the relationship between wet weight and carapace width differs from the maximum value, because the majority of the specimens analysed were not intact: legs were usually missing.

The percentage of females collected from Lake Dąbie was slightly lower than that of males. Kobayashi & Matsuura (1994, 1995b) confirmed that males of *Eriocheir japonicus*, a species that inhabits Japanese waters, are more active than females. They also observed that the percentage of females

decreases towards river mouths, since the females migrate up-river in greater numbers than males do (Kobayashi & Matsuura 1995a). The time when the crabs were being collected for the investigations indicates that they were migrating for reproduction. None of the females caught contained eggs, which lends further support to this hypothesis.

It can be inferred from these results that there has indeed been a recent increase in the occurrence of Chinese mitten crabs in Polish waters: until a few years ago, *E. sinensis* was rather rare there. According to Grabda (1989) and Jażdżewski & Konopacka (1993), single specimens have been caught annually since the 1940s. Clearly, then, this species has propagated rapidly in Polish waters during the last ten years. The particularly high frequency in the Szczecin Lagoon is of note (Jażdżewski & Konopacka 2000). Specimens have been reported along the Polish coast from spring till late autumn, with numbers peaking in summer (Fig. 5). The crabs are caught mostly in fishing nets, which they damage along with the catch. In the Gulf of Gdańsk, the majority of specimens have been caught near the ports in Hel and Kuźnica, on both the open-sea and Gulf of Gdańsk sides (Fig. 1). Males are prevalent. Large specimens of *E. sinensis* have been reported from near the pier at Puck (B. Arciszewski personal communication). In 1998 a few large specimens were captured in Lake Łebsko by local fishermen. *E. sinensis* has also been caught many times in fyke nets in the Wisła Lagoon

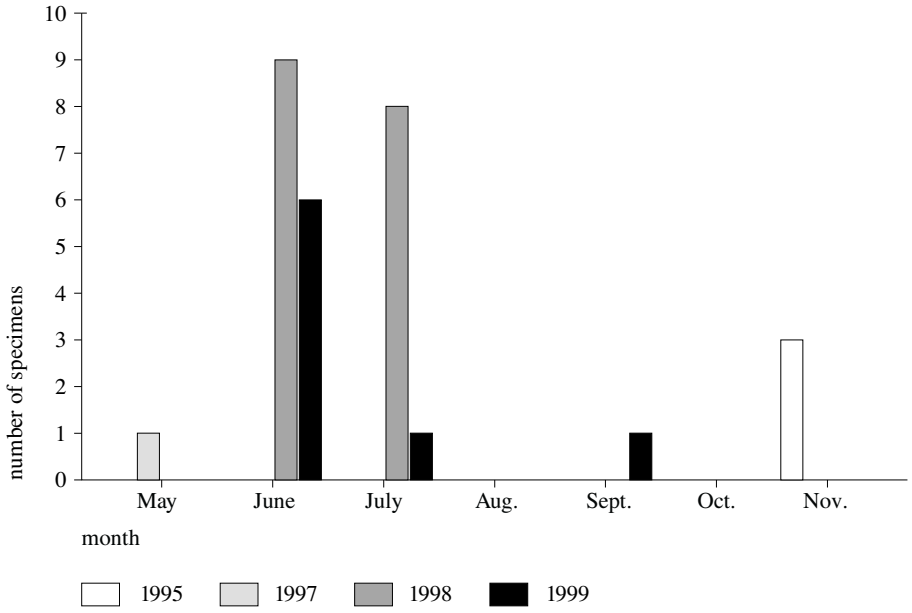

Fig. 5. Numbers of *E. sinensis* specimens caught in fishing nets along the Hel Peninsula in 1995–99

(A. Rychter pers. comm.). The invasion of this species in the 1990s has been reported from many European countries. In Great Britain, the numbers and range of *E. sinensis* have expanded rapidly since 1992 (Clark *et al.* 1998). It would appear that this species also has optimum living conditions in Polish waters. The largest crustacean in the southern Baltic Sea, it has few natural enemies. Only the salinity of the water can restrict its growth in Polish waters, since larval growth cannot go to completion in rivers or brackish estuaries (Anger 1989, 1991). According to Montú *et al.* (1996), the growth of *E. sinensis* larvae for the most part occurs in open-sea waters; the salinity of the Polish waters where this species has been caught is no greater than a few PSU (Nowacki 1984, Cyberska 1994). As Żmudziński (1961) stated much earlier, the lack of larvae or juvenile forms in Polish waters suggests that specimens inhabiting this region must reproduce elsewhere in the Baltic where the salinity is higher. Near Bornholm, the salinity is about 20 PSU, which is the level necessary for the proper growth of this species (Cyberska 1994); this is probably where the crabs migrate to for reproduction. The Chinese mitten crab is capable of migrating long distances and specimens have even been observed in Czech waters, about 800 km from their birthplaces (Schäferna 1935).

According to Haahtela (1963), specimens inhabiting the Baltic may have been transferred from the North Sea as larvae or juvenile specimens. Recent investigations (Gruszka 1999) have revealed that the intensive ship traffic between Szczecin and the inland ports of western Europe has significantly affected the introduction of alien species to the Baltic Sea Basin.

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