

Aquatic Invasions Records

Establishment of the angular crab *Goneplax rhomboides* (Linnaeus, 1758) (Crustacea, Decapoda, Brachyura) in the southern North Sea

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Abstract

So far the angular crab *Goneplax rhomboides* (Linnaeus, 1758) was mostly a northeastern Atlantic and Mediterranean species and was quite rare in the North Sea where no evidence for sustainable populations existed. In 2008 and 2009 a total of 82 individuals of *Goneplax rhomboides* (Linnaeus, 1758) were found at 22 widespread locations in the southern North Sea indicating that this species is now well established in the area.

Key words: *Goneplax rhomboides*, North Sea, alien species, range extension, climate change, larvae drift, currents

Introduction

The angular crab *Goneplax rhomboides* is a brachyuran crab with a distinctive rectangular carapax whose color varies from yellow to red. Carapax of typical male is 20 mm in length and 34 mm in breadth, those of female 11 mm and 18 mm, respectively (Moyse and Smaldon 1990). A clear sexual dimorphism is obvious in chelipeds length with chelipeds of males four or five times length of carapax (100 mm) and conspicuous shorter in female (Figure 2 and 3).

Goneplax rhomboides is native to the north-eastern Atlantic (Türkay 1976; Farina et al. 1997; Trenkel et al. 2007) where it is fairly common on all British coasts (Skewes 2008) as well as in the Mediterranean where it is frequent and common from 3 to 750 m on muddy to sandy bottom (Cartes and Sarda 1992; Abello et al. 2002; Sartor et al. 2006; Fanelli et al. 2007; Balkis and Kurun 2008). The southern distribution limit of *G. rhomboides* in the eastern Atlantic is uncertain since West and South African populations of *G. rhomboides* (e.g. Manning and Holthuis 1981) were now regarded to be populations of the new species *Goneplax clevei* (Guinot and Castro 2007).

However, *G. rhomboides* has been very rarely recorded in the North Sea and no evidence for sustainable populations existed. Single records were reported from Northumberland coast in

1963 (73 m), from the Doggerbank in 1998 (NW Rough, 54 m, sand and gravel) and from Smiths Knoll in 2000 (Yarmouth area, 30 m) (Moore 1987; d'Udekem d'Acoz 2001). More recently, *G. rhomboides* was found in Dutch waters (Ruijter 2004; Oosterbaan 2005) where it was caught regularly since 2004 during scientific surveys in the Oyster Ground with an 8 m beam trawl (I. de Boois, pers. comm.). Additionally, a single juvenile of *G. rhomboides* was found in the outside part of the Oslofjord (Norway) at 50 m depth in 2009 (NIVA 2009).

Materials and methods

Samples were taken during scientific surveys in August 2008 and 2009 as well as in December 2009 in the southern North Sea (Figure 1). Samples in August 2008 and 2009 were analysed from 2 m beam trawl catches during the ICES-coordinated International Bottom Trawl Survey (IBTS), which covers an area from 53°30' to 56°N and 3° to 8°E. Epifauna sampling during this survey took place every year in the summer months since 1998 and *G. rhomboides* was found for the first time in 2008. Additionally, *G. rhomboides* was caught in December 2009 with a 7 m beam trawl during an epibenthic and demersal fish survey in the German Exclusive Economic Zone (EEZ). This survey started in

Figure 1. Sampling sites in the southern North Sea. Black triangles, crosses and circles show sampling sites where *Goneplax rhomboides* was found in August 2008, August 2009 and December 2009, respectively. White triangles, crosses and circles indicate sampling sites where *G. rhomboides* was not found during these surveys.

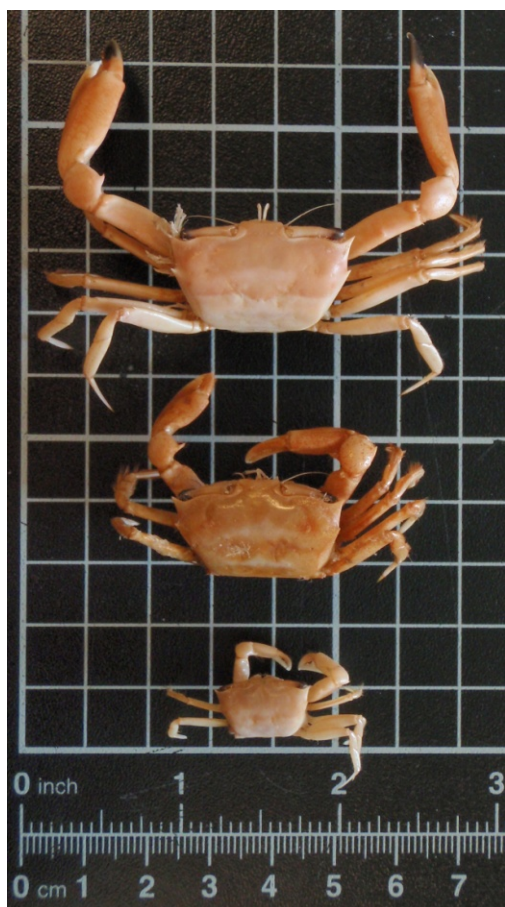
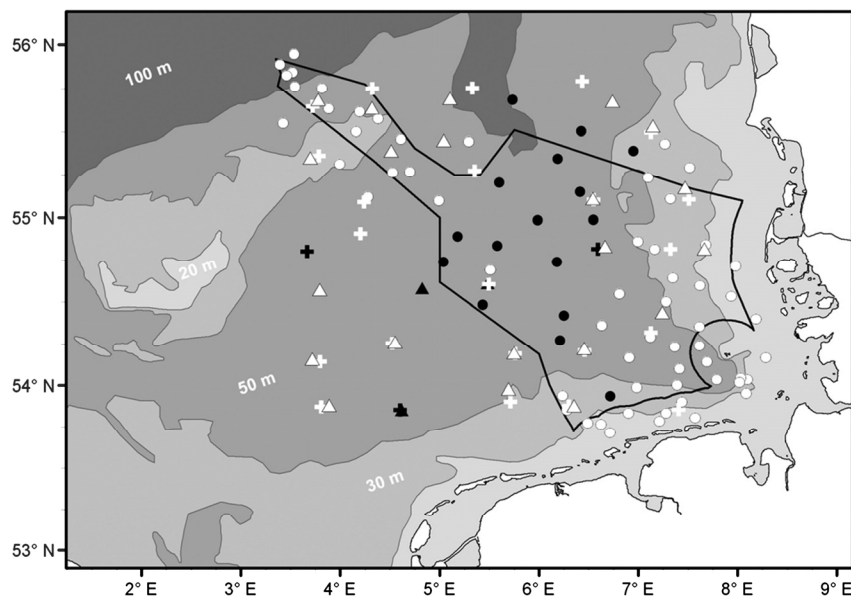


Figure 2. *Goneplax rhomboides* (Linnaeus, 1758): dorsal view of male (top), female (middle) and juvenile (bottom). Photograph by H. Neumann.



Figure 3. *Goneplax rhomboides* (Linnaeus, 1758): ventral view of male (left) and female (right) clearly showing the sexual dimorphism in chelipeds length. Photograph by H. Neumann.

2004 and samples were taken every December at 83 stations in the German EEZ. *G. rhomboides* was recorded for the first time at this survey in 2009. All samples were taken during daylight.

Results and discussion

A total number of 82 individuals of the angular crab *Goneplax rhomboides* (Linnaeus, 1758) (Crustacea, Decapoda, Brachyura) were found in depths ranging from 25 m to 50 m on

predominant muddy bottom (Annex 1; Figure 1). Most locations where *G. rhomboides* was found as well as highest abundances of *G. rhomboides* were recorded in the German EEZ, where a 7 m beam trawl was used. However, locations and abundances may be underestimated during our surveys easterly of the EEZ (Oyster Ground) where we used a 2 m beam trawl, since *G. rhomboides* lives in burrows up to 15 cm beneath the surface (Rice and Chapman 1971) and catch efficiency of small beam trawls is low for burrowing species (Reiss et al. 2006). It is most likely that our 2 m beam trawl data were not representative for the Oyster Ground, since *G. rhomboides* was regularly caught in high abundances during scientific surveys in that area with an 8 m beam trawl (I. de Boois, pers. comm.). Additionally, there is evidence that *G. rhomboides* is more active early at night (Atkinson and Naylor 1973). Since samples were taken by day during our surveys, this may result in an underestimation of records of *G. rhomboides* in the southern North Sea.

However, sex and carapax length/breadth of *G. rhomboides* were determined at our surveys in August 2008 and 2009. In total, we found 10 males and 8 females with a maximum carapax length in male of 13 – 22 mm (breadth 21 – 37 mm) and in female of 5 – 16 mm (breadth 9 – 25 mm). At least five individuals were juveniles, one female was ovigerous and on the carapax of five males the epibiontic bryozoan *Triticella flava* Dalyell, 1848 (Bryozoa, Ctenostomatida) was found, which is a common epibiont of *G. rhomboides* in the Mediterranean (Abello and Corbera 1996), but also of other crabs such as the Norway lobster *Nephrops norvegicus* (Linnaeus, 1758) in the North Sea (Ryland 1990). We hypothesise, that *G. rhomboides* extends its distribution range from the eastern Atlantic to the southern North Sea and is now well established in that area, which is indicated by the regular findings of juveniles, ovigerous females and individuals of various size. It is reasonable, that larvae of *G. rhomboides* were introduced into the southern North Sea via channel currents and that an increase in water temperature especially during the winter months (Neumann et al. 2009) enhances the survival of the larvae in that area. However, shipping as potential vector of arrival cannot be excluded.

So far the consequences of the establishment of *G. rhomboides* on the benthic communities in the southern North Sea remain unclear. One might assume a competition especially for space

between *G. rhomboides* and other burrowing species in the southern North Sea such as the Norway lobster *Nephrops norvegicus* or the masked crab *Corystes cassivelaunus* (Pennant, 1777), which were common species in the German EEZ. On the other hand Trenkel et al. (2007) found that a temporal separation due to different diurnal activity patterns reduce direct competition of *G. rhomboides* and *N. norvegicus* in the Bay of Biscay.

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Annex 1. Records of *Goneplax rhomboides* in the southern North Sea.

Record No. (map ref.)	Year	Record coordinates		Abundance	Depth	Gear	Fishing duration [min]	Codend mesh size [mm]
		Latitude, °N	Longitude, °E					
1	2009	54°59,10'	6°32,93'	10	45	7 m beam trawl	15	20
2	2009	55°08,97'	6°24,89'	6	48	7 m beam trawl	15	20
3	2009	55°20,55'	6°11,37'	5	48	7 m beam trawl	15	20
4	2009	55°12,14'	5°36,21'	1	43	7 m beam trawl	15	20
5	2009	55°40,95'	5°44,09'	1	50	7 m beam trawl	15	20
6	2009	55°30,09'	6°25,57'	3	42	7 m beam trawl	15	20
7	2009	55°23,22'	6°57,04'	8	30	7 m beam trawl	15	20
8	2009	54°25,08'	6°15,19'	4	39	7 m beam trawl	15	20
9	2009	54°16,05'	6°12,81'	3	37	7 m beam trawl	15	20
10	2009	54°28,98'	5°26,15'	1	41	7 m beam trawl	15	20
11	2009	54°50,01'	5°35,03'	1	42	7 m beam trawl	15	20
12	2009	54°58,97'	5°59,43'	14	37	7 m beam trawl	15	20
13	2009	54°44,28'	6°10,97'	3	41	7 m beam trawl	15	20
14	2009	53°56,14'	6°43,27'	1	25	7 m beam trawl	15	20
15	2009	54°44,34'	5°02,34'	2	45	7 m beam trawl	15	20
16	2009	54°53,24'	5°11,02'	1	40	7 m beam trawl	15	20
17	2008	54°36,74'	5°29,21'	2	43	2 m beam trawl	5	4
18	2008	54°34,95'	4°49,70'	7	46	2 m beam trawl	5	4
19	2008	53°51,19'	4°37,22'	2	41	2 m beam trawl	5	4
20	2009	53°51,14'	4°36,05'	4	42	2 m beam trawl	5	4
21	2009	54°48,89'	6°35,53'	2	41	2 m beam trawl	5	4
22	2009	54°48,11'	3°39,95'	1	45	2 m beam trawl	5	4