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Some malacostracan crustacean assemblages in the southern and western Baltic Sea

Runnning head: Crustacean assemblages in the Baltic Sea

Abstract

The paper presents a survey of four crustacean benthic assemblages in the southern and western Baltic Sea. Relative abundance and a multivariate method (cluster analysis) were used to describe these assemblages in German Baltic waters. This study is based mainly on 17 sampling events carried out during 1998/99. The salinity ranged between 2 and 22 psu and the depth varied between 0.4 and 47.3 m. The habitats were silty sands with *Mytilus*-aggregates, the silt zone below 20 m, shallow stone and boulder grounds and lagoons and fjord-like bays. For assessment of sediment structure, current, patchiness and larger crustaceans (e.g. *Crangon crangon*, *Carcinus maenas*) in the deeper parts an underwater video-camera was used which was mounted on a sledge. In total 43 species were recorded. The most common and important species were *Diastylis rathkei*, *Gammarus salinus*, *G. zaddachi*, *Gastrosaccus spinifer*, *Pontoporeia femorata*, *Calliopius laeviusculus*, *Corophium insidiosum*, *Leptocheirus pilosus*, *Jaera albifrons* s.l. and *Sphaeroma hookeri*. One habitat (Kleines Haff, Oder estuary) is characterised through some non-indigenous species, such as *Pontogammarus robustoides*, *Gammarus tigrinus* and *Corophium curvispinum*, especially.

Kurzfassung

Die Studie präsentiert einen Untersuchung über 4 benthische Krebsgemeinschaften in der südlichen und westlichen Ostsee. Mit relativen Abundanzen und der Cluster-Analyse werden diese Gemeinschaften beschrieben. Die Studie basiert hauptsächlich auf 17 Beprobungen zwischen 1998 und 1999. Die Salinität rangierte zwischen 2 und 22 psu und die Wassertiefe lag zwischen 0,4 und 47,3 m. Die Habitate der Lebensgemeinschaften sind schlickiger Sand mit *Mytilus*-Aggregaten, die Schlickzone unter 20 m, flache Stein- und Findlinggründe sowie Küstengewässer. An den tieferen Stationen wurde zur Beurteilung der Sedimentstruktur, Strömung, Verteilungsmuster und größerer Krebse (z.B. *Crangon crangon*, *Carcinus maenas*) eine schlittengezogene Unterwasser-Video-Kamera eingesetzt. Insgesamt konnten 43 Arten beobachtet werden. Die häufigsten und wichtigsten Arten waren *Diastylis rathkei*, *Gammarus salinus*, *G. zaddachi*, *Gastrosaccus spinifer*, *Pontoporeia femo-*

rata, *Calliopius laeviusculus*, *Corophium insidiosum*, *Leptocheirus pilosus*, *Jaera albifrons* und *Sphaeroma hookeri*. Die Lebensgemeinschaft des Kleinen Haffs (Oderhaff) ist durch einige Neueinwanderer, wie *Pontogammarus robustoides*, *Gammarus tigrinus* und *Corophium curvispinum*, gekennzeichnet.

Introduction

Previous studies concerning the crustaceans of the Baltic Sea mainly focus on population dynamics and production biology of single species (e.g. Köhn and Sammour, 1990a, b; Persson, 1989; Sarvala and Uitto, 1991; Schriever, 1975; Sjöberg, 1969) or on drawings of check lists and identification keys (e.g. Apstein, 1909; Jazdzewski and Konopacka, 1993; Köhn and Gosselck, 1989, 1995). With regard to assemblages crustaceans of the Baltic Sea have been studied only sporadically in the past. Only habitat selection and ecology of some crustacean groups, such as the genus *Gammarus*, were investigated more intensively (e.g. Fenchel and Kolding, 1979; Haahtela, 1969; Jazdzewski, 1973; Jazdzewski and Fronc, 1982; Kinne, 1953/54; Kolding and Fenchel, 1979). More detailed studies on the composition and relative abundance of benthic and epibenthic crustacean fauna of German Baltic waters were carried out in coastal inlets such as the Schlei fjord (Gollasch and Zander, 1995), Bay of Puck (Jazdzewski 1971) and the Breitling (Zettler, 1999). In the inshore waters of Kiel Bay Anger (1975) and Lüthje (1978), for example, analysed the benthic communities which included the crustacean species.

In order to study the variety and composition of crustacean species in different habitats various methods are needed. In the deeper parts of the Baltic endobenthic species have to be collected by use of grabs or corers. However, the major part of the Baltic crustaceans are epibenthic and hyperbenthic. Only the application of dredges (deeper regions) or hand nets (shallow areas) allows a semiquantitative assessment.

The aim of this study is to describe some of the crustacean assemblages inhabiting the southern and western Baltic Sea. Relative abundance, habitat selection and distribution patterns of the observed species are discussed.

Materials and Methods

From 1998 to 1999 the crustacean fauna was investigated at 17 stations in the coastal and offshore waters of the southern and western Baltic (Fig. 1, Table 1). Salinity was in the range between 2 and 22 psu. Water depth was between 0.4 and 47.3 m. In deeper waters the material was collected either by use of a dredge (mesh size 4 mm) or with a van Veen grab (0.1 m², 1 mm mesh size). In more shallow areas (< 1 m) a hand net (1.5 mm mesh size) was used. The animals were preserved with 4 % formaldehyd or 70 % alcohol in the field. For sorting and determining in the laboratory a stereo microscope with 10-40 x magnification was used. In total 12 000 individuals were analysed.

Table 1 Parameters of the stations investigated in 1998/99. Locations marked by asterisks are monitoring stations, regularly sampled since 1991.

station number	coordinate	date	depth (m)	salinity (‰)	method
SK (Stubbenkammer)	54° 35.95 N 13° 44.96 E	17 Aug 1998	25.7	11.1	dredge, video van Veen grab
30 (Darss sill)*	54° 43.24 N 12° 47.00 E	31 Oct 1998	22.6	16.2	dredge, video van Veen grab
152 (Arkona Sea)*	55° 35.00 N 14° 17.00 E	03 Nov 1998	31.2	10.3	dredge, video van Veen grab
10 (Femarnbelt)*	54° 34.20 N 11° 20.00 E	29 Oct 1998	27	22	dredge, video van Veen grab
12 (Luebeck Bay)*	54° 18.54 N 11° 33.00 E	28 Oct 1998	24	17.2	dredge, video van Veen grab
MB 1 (Mecklenburg Bight)	54° 18.16 N 12° 06.11 E	14 Aug 1998	19.4	16	video van Veen grab
109 (Arkona Sea)*	55° 00.00 N 12° 47.00 E	01 Nov 1998	47.3	17	dredge, video van Veen grab
T1 (Pomeranian Bay)	54° 02.91 N 14° 10.55 E	15 Aug 1998	15	6.5	dredge, video van Veen grab
160 (Pomeranian Bay)	54° 14.46 N 14° 04.04 E	15 Aug 1998	14.5	7.1	dredge, video van Veen grab
NH (Nienhagen, Stolteraa)	54° 10.40 N 11° 58.90 E	30 Dec 1998	0.4	13	hand net
KK (Klein Kluetzhoeved)	54° 00.90 N 11° 06.05 E	10 Jan 1999	0.4	15.9	hand net
B1 (Pagenwerder, Breitling)	54° 10.20 N 12° 06.70 E	07 Aug 1998	2.5	9.3	dredge
B2 (Anleger, Breitling)	54° 09.60 N 12° 08.20 E	15 May 1998	0.5	9	hand net
PD (Poeldamm, Faehrdorf)	53° 58.25 N 11° 28.45 E	02 Jan 1999	0.4	11	hand net
SH (Salzhaff, Boiensdorf)	54° 01.60 N 11° 32.40 E	02 Jan 1999	0.4	10	hand net
PW (Poetenitzer Wiek)	53° 56.95 N 10° 54.60 E	10 Jan 1999	0.4	8.7	hand net
KH (Kleines Haff, Kamminke)	53° 52.30 N 14° 10.00 E	02 May 1998	0.5	2	hand net

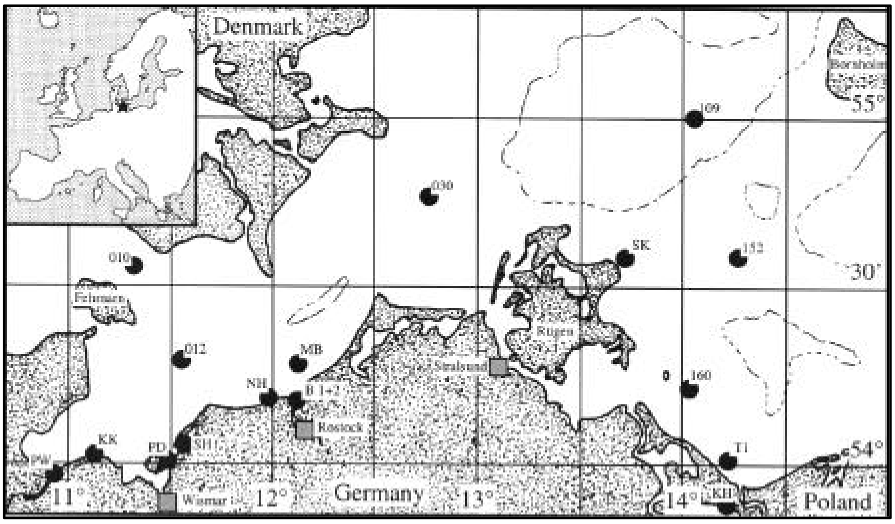

Fig. 1 Investigation area with stations in the southern and western Baltic Sea

In order to analyse the community structure cluster analysis was performed using the Primer programme of the Plymouth Marine Laboratory. Furthermore, relative abundance of the malacostracan crustaceans was calculated for each station.

For the characterization of the habitats in the deeper parts, i.e.for the assessment of sediment structure, current, and patchiness, and for larger crustaceans (e.g. *Crangon crangon*, *Carcinus maenas*) an underwater video-system was used which was mounted on a sledge. The sledge was towed over the bottom by a drifting vessel at lowest possible speed (< 1 knot). The camera was installed on a pan and tilt head. Scaling was accomplished by two parallel laser beams projected into the picture.

Results

In total 43 crustacean species were observed. These species are members of the orders Mysidacea (6), Cumacea (1), Tanaidacea (1), Isopoda (8), Amphipoda (23) and Decapoda (4).

Cluster analysis (similarities between samples)

Using cluster analysis five groups (assemblages) were established with respect to species composition (Fig. 2). After evaluation of the video material and according to Boedeker *et al.* (1998) these groups are representative of specific habitats within the Baltic. These groups reflect sediment structure, salinity and oxygen conditions which caused the specific crustacean settlement.

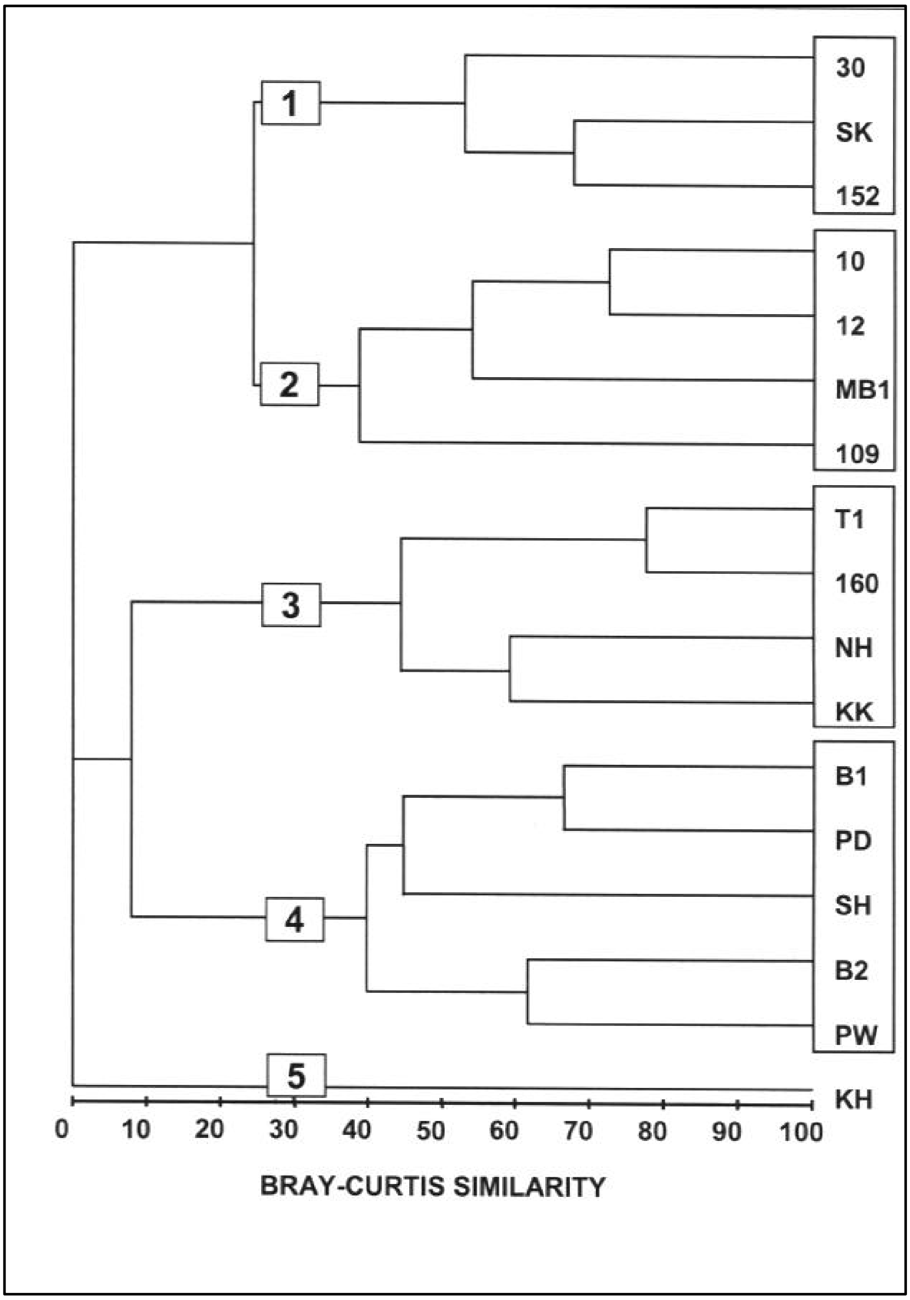

Fig. 2 Cluster analysis of the stations on the basis of the total number of species found (4^{th} root transformation). The five observed groups (communities) are indicated.

1. Silty sands and silt between 20 and 30 m depth (10-16 psu) with *Mytilus*- aggregates
   (Stns 30, SK, 152)[1]

The community is dominated by *Diastylis rathkei* (more silty substrates) and *Gammarus*-species (within the *Mytilus*-aggregates) (Fig. 3). The mysids *Mysis mixta*

[1] for the numbers of collected individuals and for species authors, see Tab. 2

and *Gastrosaccus spinifer* and the decapod *Crangon crangon* were only observed in low numbers. *Saduria entomon* occurs occasionally at all stations. Furthermore *Hyperia galba* was found at Stn 152 and *Bathyporeia pilosa* and *Corophium crassicorne* at Stn 30.

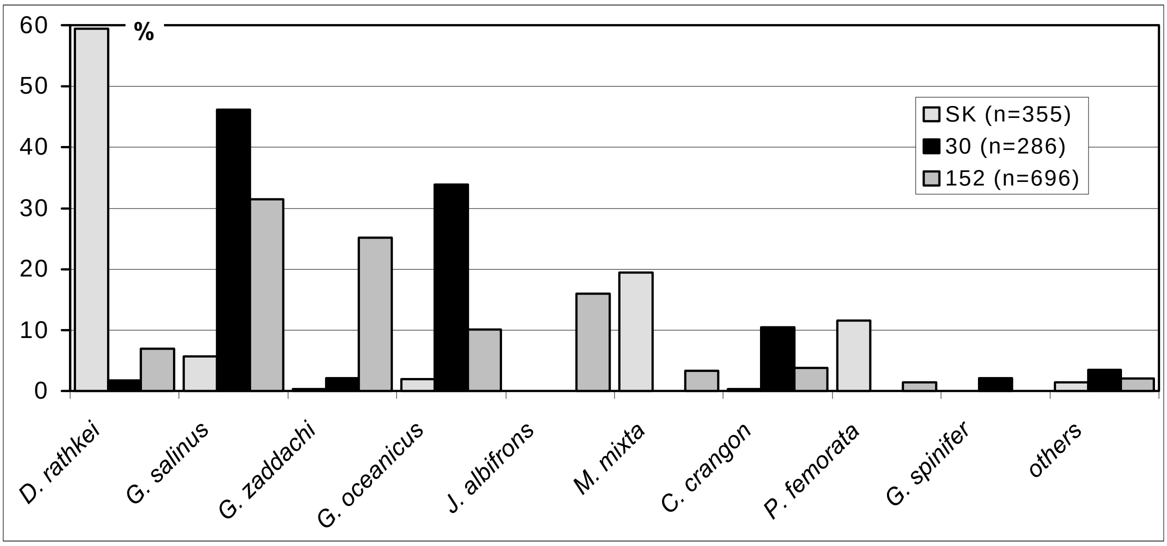

Fig. 3 Relative abundance of crustacean species on silty sands and silt between 20 and 30 m water depth (10-16 ‰) with *Mytilus*-aggregates.

2. Silty sands below 20 m depth without *Mytilus*-aggregates (16-22 psu) (Stns 10, 12, 109, MB1)[1]

This community is very similar to the previous, but the lack of *Mytilus*-aggregates supports endobenthic species such as *Diastylis rathkei*, *Pontoporeia femorata* and *Gastrosaccus spinifer* (Fig. 4), whereas for the epibenthic crustaceans, e.g. *Gammarus* spp., the sediment surface structure is unfavourable. However, at Stn MB1 the situation was somewhat different. The sediment consisted of a mix of silty sands and gravel with patches of stones. The stones and their epizoic structuring species (Bryozoa, Hydrozoa) offered the habitat for some crustacean species, e.g. *Metopa pusilla*, *Corophium insidiosum*, *Dyopedos monacanthus*, *Gammarus salinus* and *Idotea balthica* which occurred in low numbers. Besides some specimen of *Ampithoe rubricata* were observed in the last two years at Stn 10.

Table 2 Total numbers of collected individuals of crustacean species of silty sands and silt with *Mytilus*-aggregates (group 1) and silty sands without *Mytilus*-aggregates (group 2). For the selection of stations in groups see Figure 2.

	group 1			group 2			
	30	**SK**	**152**	**10**	**12**	**109**	**MB1**
Ampithoe rubricata (Montagu)				2			
Bathyporeia pilosa Lindström	2						
Corophium crassiscorne Bruzelius	4						
Corophium insidiosum Crawford							3
Crangon crangon (L.)	30	1	26				
Diastylis rathkei (Krøyer)	5	211	48	322	148	27	69
Dyopedos monacanthus (Metzger)							1
Gammarus oceanicus Segerstråle	97	7	70				
Gammarus salinus Spooner	132	20	219				1
Gammarus zaddachi Sexton		1	175				
Gastrosaccus spinifer (Goës)	6			30	1		1
Hyperia galba (Montagu)			7				
Idotea balthica (Pallas)							1
Jaera albifrons Leach s.l.			111				
Metopa pusilla Sars							3
Mysis mixta Lilljeborg		69	23				
Neomysis integer (Leach)		4	2				
Pontoporeia femorata Krøyer		41	10	2	1	26	1
Saduria entomon (L.)	4	1	5				
	286	**355**	**696**	**356**	**150**	**53**	**80**

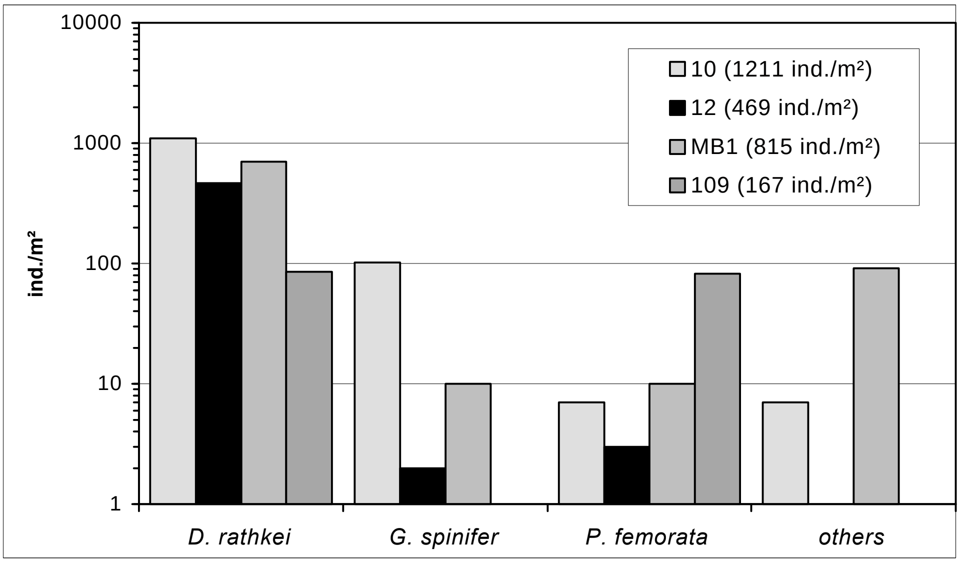

Fig. 4 Abundance (ind./m²) of crustacean species on silty sands below 20 m depth without *Mytilus*-aggregates (S = 16-22 ‰).

3. Shallow stone (or *Mytilus*-aggregates) and boulder grounds (0-15 m depth) (7-16 psu) (Stns T1, 160, NH, KK)[2]

The Stns T1 and 160 were characterised by sandy substrates covered with many *Mytilus*-aggregates in depths between 10 and 15 m. This is the typical sediment structure for most parts of the Pomeranian Bay. The two other stations of this group (Stns NH, KK) were situated in shallow areas (0-1 m depth) near the coast. Stones and boulders were typical for these stations. *Gammarus zaddachi* was a characteristic species of this assemblage (Fig. 5). For the shallow boulder grounds *Calliopius laeviusculus* was typical, as was *Gammarus salinus* for the *Mytilus*-aggregates.

Neomysis integer, *Corophium volutator* and *Gammarus oceanicus* occurred occasionally at all stations. Furthermore *Crangon crangon* (Stns T1, 160), *Jaera albifrons* s.l. (Stns T1, 160, KK), *Chaetogammarus stoerensis* (Stn KK) and the mysids *Praunus flexuosus* (Stns 160, NH) and *Schistomysis spiritus* (Stn NH) were observed in low numbers.

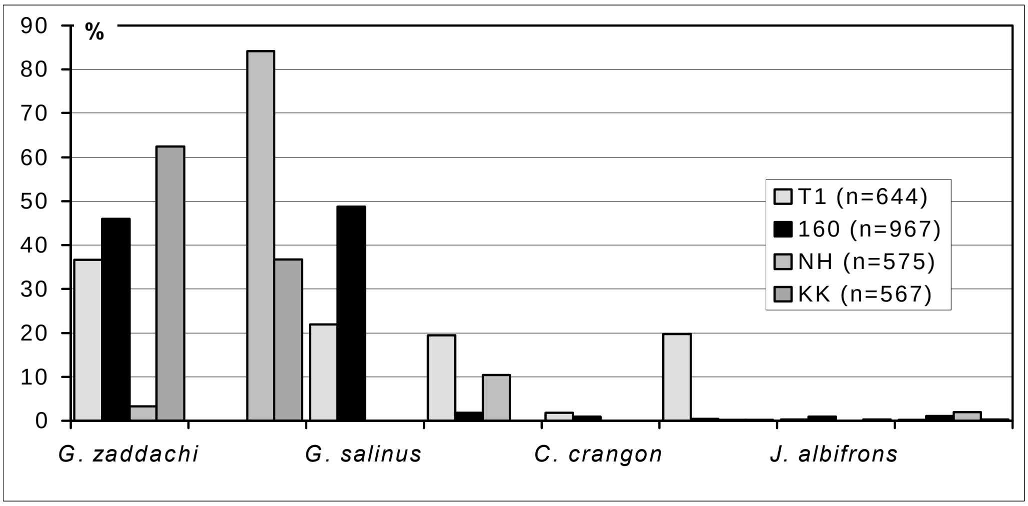

Fig. 5 Relative abundance of crustacean species on shallow stone (or *Mytilus*-aggregates) and boulder grounds (0-15 m depth).

4. Lagoons and fjord like bays (Bodden, Haffe, estuaries) (Stns B1, B2, PD, SH, PW) (8-11 psu) and 5. Kleines Haff (Stn KH) (2 psu)[2]

The stations in these typical coastal waters of the Baltic Sea were characterised by low salinity regimes (2-11 psu) and low depths (0.4-2.5 m). Species number was highest in these lagoons. In total (together with the 5th group) 30 crustacean species were present in these habitats (Table 3). The mean species number of group 4 was 15. Characteristic species were *C. insidiosum*, *J. albifrons* s.l., *L. pilosus*, *S. hookeri*, *C. volutator* and *N. integer* (Fig. 6). In these estuaries six *Gamma-*

[2] for the numbers of collected individuals and for species authors, see Tab. 3

rus species occur (viz. *G. salinus*, *G. zaddachi*, *G. oceanicus*, *G. tigrinus*, *G. duebeni* and *G. locusta*), but *G. salinus* and *G. zaddachi* were the most frequent. In more fresh water influenced areas (e.g. small brooks inlets) *G. duebeni* and *G. tigrinus* became more abundant.

The station Kleines Haff, which is situated in the Oder estuary, was separated by cluster analysis mainly due to some non-indigenous species (*Pontogammarus robustoides*, *Corophium curvispinum* and *Gammarus tigrinus*) which dominated this assemblage (Fig. 2). These three species usually appear in fresh water and in brackish environments. In fjord-like bays of the western Baltic (e.g. Schlei estuary, Poetenitzer Wiek, Bodden of Darss-Zingst) only *G. tigrinus* occurred, but not *C. curvispinum* and *P. robustoides* although these two species are widely distributed within German rivers and lakes (Zettler, 1995, 1998).

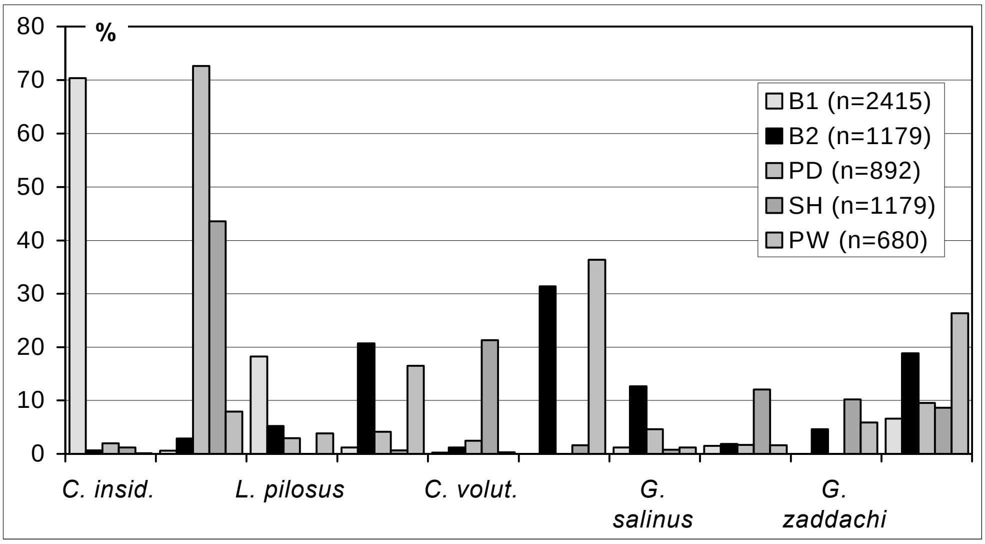

Fig. 6 Relative abundance of crustacean species in lagoons and fjord-like bays (Bodden, Haffe, estuaries).

Table 3 Total numbers of collected individuals of crustacean species of the shallow stone and boulder grounds (group 3) and of the lagoons and fjord like bays (group 4 & 5). For the selection of stations in groups see Figure 2.

	group 3				**group 4**					**5**
	T1	**160**	**NH**	**KK**	**B1**	**B2**	**PD**	**SH**	**PW**	**KH**
Asellus aquaticus (L.)									11	5
Calliopius laeviusculus (Krøyer)			484	208				34		
Carcinus maenas (L.)					1					
Chaetogammarus stoerensis Reid				1						
Corophium curvispinum Sars										15
Corophium insidiosum Crawford					1700	8	18	14	1	
Corophium lacustre Vanhöffen					28	1				
Corophium volutator (Pallas)	127	4	1	1	6	14	22	251	2	
Crangon crangon (L.)	12	9			2	6				
Cyathura carinata (Krøyer)						49	18			
Gammarus duebeni Lilljeborg						55			34	1
Gammarus locusta (L.)								5		
Gammarus oceanicus Segerstråle	1	9	1	1	37	77	6			
Gammarus salinus Spooner	141	471			30	149	41	9	8	
Gammarus tigrinus Sexton						6			132	113
Gammarus zaddachi Sexton	236	445	19	354		54		120	40	
Heterotanais oerstedi (Krøyer)								4		
Idotea balthica (Pallas)					11	2	2			
Idotea chelipes (Pallas)					36	22	15	142	11	
Jaera albifrons Leach s.l.	2	9		2	14	34	648	514	54	
Leptocheirus pilosus Zaddach					440	62	26		26	
Melita palmata (Montagu)					20		25	10	2	
Microdeutopus gryllotalpa Da Costa					58		14	48		
Neomysis integer (Leach)	125	18	60			370		19	247	10
Palaemon squilla (Rathke)						1				
Palaemonetes varians (Leach)						2	10			
Pontogammarus robustoides (Sars)										44
Praunus flexuosus (Müller)		2	9			1	10	1		
Praunus inermis (Rathke)						1				
Schistomysis spiritus (Norman)			1							
Sphaeroma hookeri Leach					30	244	37	8	112	
Sphaeroma rugicauda Leach						4				
	644	**967**	**575**	**567**	**2415**	**1179**	**892**	**1179**	**680**	**188**

Cluster analysis (similarities between species)

The analysis of crustacean assemblages by cluster analysis shows six groups (Fig. 7). Only species which occur at more than one station are included. Furthermore the "non-indigenous species-station" KH (Kleines Haff) was not taken into account. A 4th root transformation of the absolute number of specimen caught (300 at least at each station) was used. Group 1 included fresh water influenced species such as *A. aquaticus*, *G. duebeni* and *G. tigrinus*. Group 2 corresponded with the community of shallow stone and boulder grounds or *Mytilus*-aggregates. Group 3 comprise the three dominant species of the silt zone below 20 m. The crustacean community of the lagoons and fjord like bays represent group 6. The separation of group 2 and 6 from all other groups is highly significant (One-Way-Anosim).

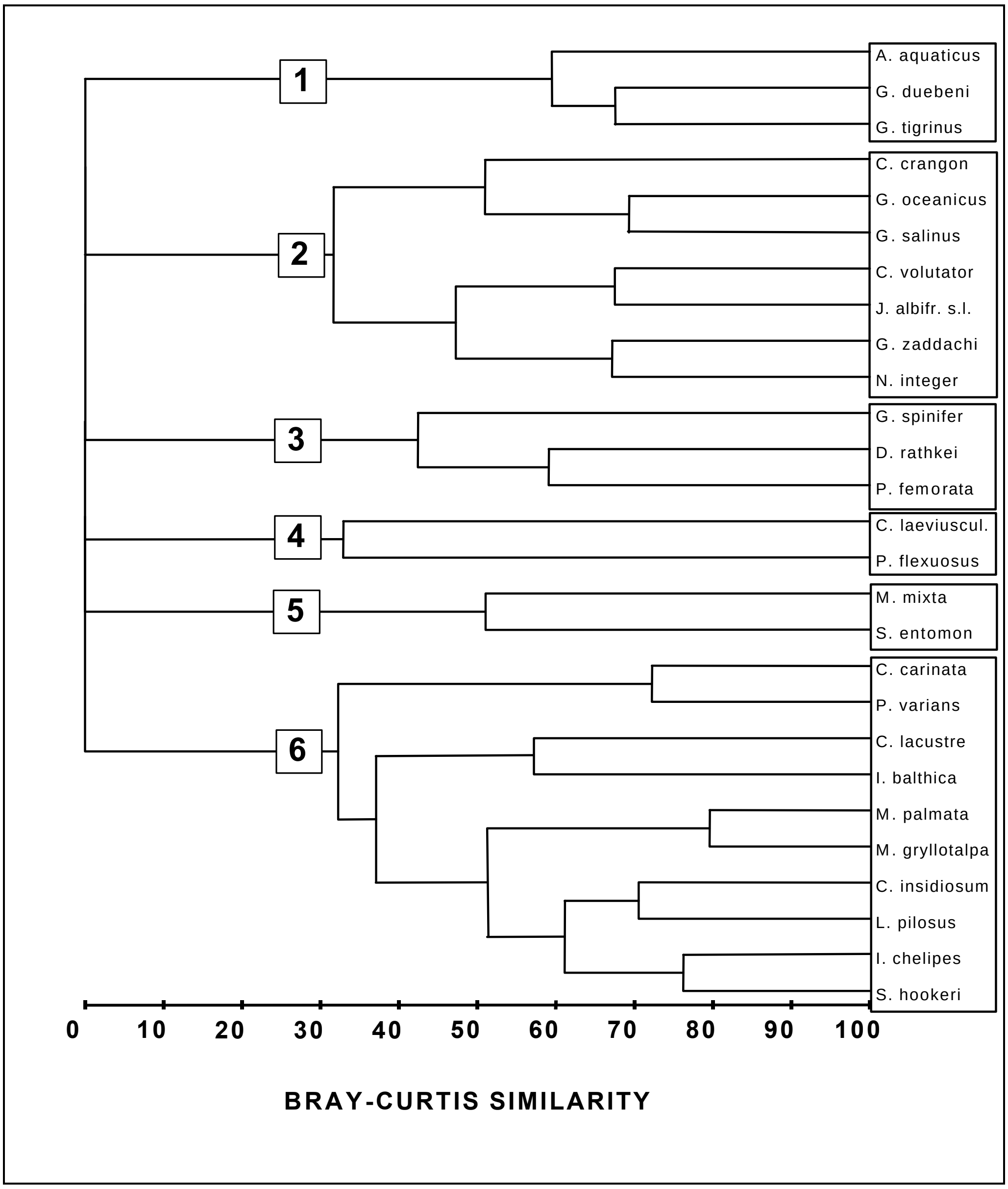

Fig. 7 Cluster analysis of crustacean species on the basis of the total number (4th root transformation). Only species which occur at more than 1 station are included. Furthermore the ”neozoans-station” KH (Kleines Haff) is excluded.

Discussion

Typical indicator species for the silt zone below 20 m are *Diastylis rathkei*, *Gastrosaccus spinifer* and *Pontoporeia femorata*. *D. rathkei* is common for muddy bottom areas in the southern and western Baltic Sea (Krüger, 1940; Persson, 1989; Rachor *et al.,* 1982). Rumohr *et al.* (1996) describe this species as a characteristic taxon for the offshore, sub-halocline (19-29 m) regions of the western parts. Persson (1989) and Krüger (1940) found it in nearshore areas between 5 and 20 m. Möbius (1873) indicated a depth distribution of 9 to 90 m. In this study *D. rathkei* was distributed between 16 and 47 m in abundances between 200 and 3000 ind./m². Arntz and Rumohr (1986) emphasize the most obvious seasonality of *D. rathkei* of all benthic species in the Kiel Bay, with lowest densities by the end of winter and in spring and the highest values during summer and autumn.

After a longer period of absence (10-15 years) the oxygen sensitive amphipod (Johansson, 1997) *P. femorata* occurred in low numbers (3-160 ind./m²) at several station between 19 and 47 m depth. Gosselck and Georgi (1984) found this species in Mecklenburg Bight for the last time at the beginning of the 1980s. In the Pomeranian Bay it disappeared during the last 10 years, too (Kube *et al.,* 1997). Since the beginning of the 1980s its frequency tended to decrease in the western and southern Baltic. *P. femorata* occurred only in low numbers in restricted areas or was lacking (Köhn, 1989). The reappearance of *P. femorata* in the present investigation indicates better oxygen conditions. The distribution of a further glacial relict species, *Saduria entomon*, in the Arkona Basin (Stns SK, 152) and at the Darss sill (Stn 30) confirmed the investigations of Köhn (1989).

In the lagoons and fjord like bays the isopod *J. albifrons* s.l. and amphipod *C. insidiosum* occurred very frequently and in high abundance due to structures such as phytal (algae) and stones or other hard substrates which offer favourable living conditions. *C. insidiosum* is typically recorded from areas of low salinity and builds tubes of mud on algae and in the gaps within mussel aggregates (e.g. Anger, 1975; Sheader, 1978). Anger (1975) indicated several macrozoobenthic species together with *C. insidiosum*, *Microdeutopus gryllotalpa*, *Idotea balthica* and *Gammarus salinus* as a typical recurrent ”indicator association” for organic pollution. In this study quite similar results were obtained, but *I. balthica* was replaced by *I. chelipes*. Furthermore, *Leptocheirus pilosus* supplemented this association. *L. pilosus*, a genuine and tube building brackish water species, reached highest abundance in estuaries like the Breitling (about 10 000 ind./m²) and the Greifswalder Bodden (Messner, 1986; Zettler, 1999). Species (or subspecies) of the *J. albifrons* group (sensu Sjöberg, 1969) settled in both exposed localities and sheltered waters on stones and algae. This isopod is commonly distributed in shallow waters of the whole Baltic Sea (Köhn and Gosselck 1989). In the present study we observed it down to 31.2 m in *Mytilus*-aggregates (Stn 152). This stresses the great importance of suitable settling substrates (see also Ragnarsson and Raffaelli, 1999). With regard to phytal, the more exposed and shallower, the greater the percentage of mobile clinging animals (e.g. *Gammarus* spp., *Calliopius laeviusculus*) and the more sheltered the phytal, the greater the number of ”sediment preferring” species (e.g. tube building amphipods like *C. insidiosum*, *L. pilosus*, *M. gryllotalpa*) (see Lüthje, 1978).

With increasing water depth we observed a gradual decrease of the total and mean species number (Fig. 8). In the shallower parts of the western and southern Baltic Sea, especially in the lagoons and fjord like bays (group 4), species number were highest. Some examples for this region were given by Jaschhoff *et al.* (1992), who described 24 crustaceans for the Salzhaff, by Zettler (1999), who found 25 species in the Breitling (Warnow estuary) and by Gollasch and Zander (1995), who observed 17 crustacean species in the Schlei fjord. Messner (1986) lists in his own observations 24 crustacean species in the Greifswalder Bodden. The most common crustacean species for the lentic and oligo/mesohaline parts in estuaries and lagoons in the southern and western Baltic Sea are *Jaera albifrons* s.l., *Corophium insidiosum*, *Leptocheirus pilosus*, *Microdeutopus gryllotalpa*, *Gammarus zaddachi* and *Idotea chelipes*. The exposed lotic zones of the outer coast (shallow stone and boulder grounds) were mainly inhabited by *Calliopius laeviusculus*, *Gammarus salinus* and *G. zaddachi* as well.

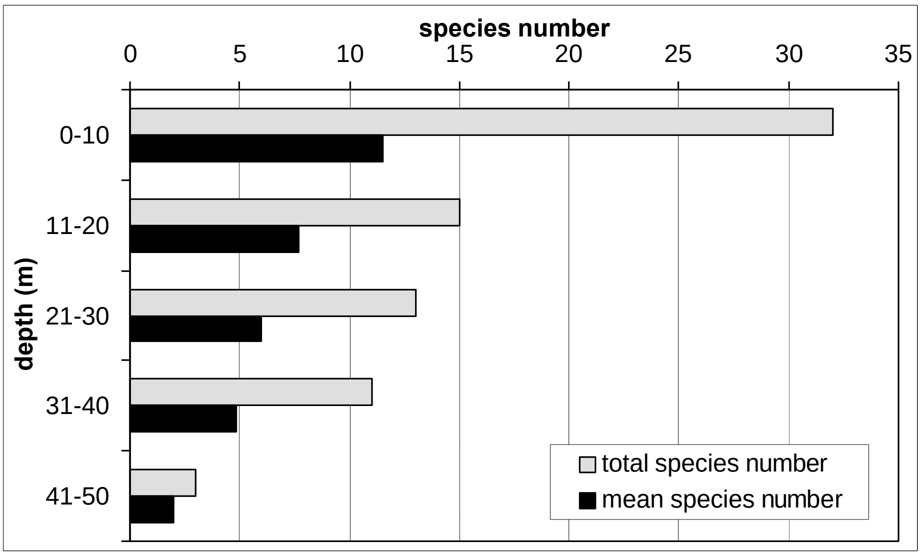

Fig. 8 Total and mean species number versus water depth.

For the genus *Gammarus* Fenchel and Kolding (1979) mentioned that stable zonation pattern which correlate with salinity are absent and the higher degree of coexistence, exposure, substrate and depth is indicated. *G. zaddachi*, for example, prefer exposed localities in the Baltic and is confined to sheltered localities in the Limfjord (Denmark), where more stagnant water is related to a low salinity regime. Jazdzewski (1973) observed that *G. zaddachi* is most frequent and abundant in shallower areas, whereas *G. salinus* is the dominant species of the mussel beds in deeper parts. In the Bodden of Darss-Zingst *G. zaddachi* was more frequent than *G. salinus* and *G. oceanicus* (Schulze, 1971). Haahtela (1969) stressed the occurrence of three *Gammarus*-species in open and deep waters of the northern Baltic. *G. oceanicus* and *G. zaddachi* usually occurred together down to 109 m, the latter one even down to 139 m. *G. salinus* was caught only occasionally. In the Breitling (Warnow estuary) *G. zaddachi* and *G. duebeni* were found only in low numbers whereas *G. oceanicus* and *G. salinus* were the most frequent species of this genus (Zettler, 1999). In the present study both *G. zaddachi* and *G. salinus* dominated at all depths alternately (Fig. 9). In the shallower parts *G. tigrinus* and in the depth between 21 and 30 m *G. oceanicus* settled subdominant. In fact, the dependencies of *Gammarus* species on abiotic factors in the Baltic Sea are very complex.

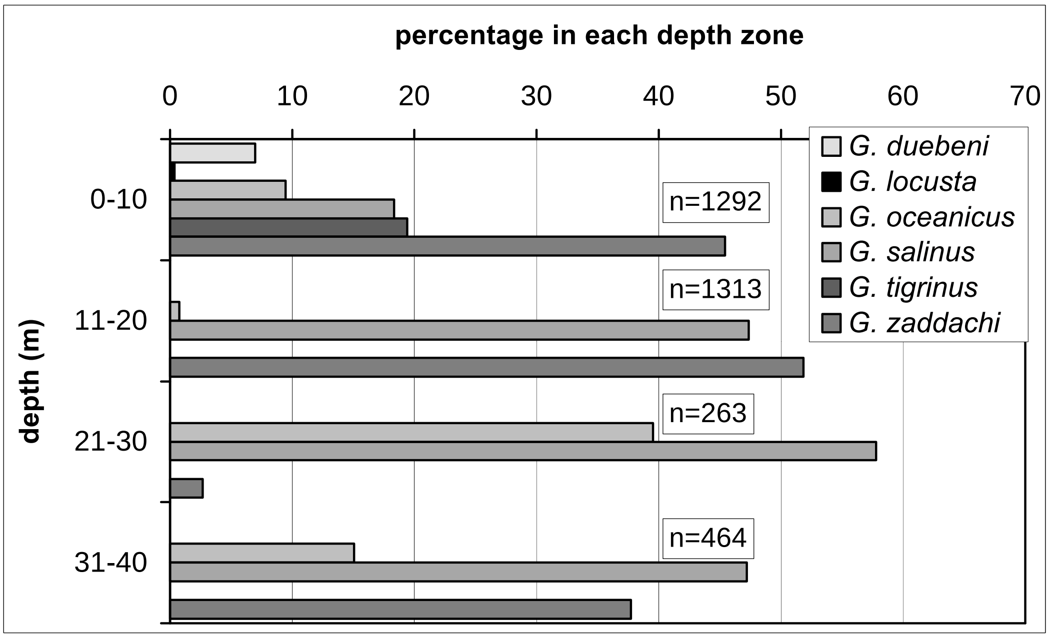

Fig. 9 Percentage of species within the genus *Gammarus* versus water depth. Calculations are based on the total number of specimen per depth interval (number n).

One of the observed species, *Bathyporeia pilosa*, is a dominant member of a fine sand community. In the western Baltic Sea for instance this species reached an abundance between 800 and 8000 ind./m² (Köhn and Sammour, 1990a). In the southern Baltic, *B. pilosa* dominates the sandy substrates on the Oder Bank (Pomeranian Bay) in abundance of about 2500 ind./m² (Kube *et al.,* 1997). Fine sand communities are not described in this paper, but *B. pilosa* occurs in low abundance at several stations with sand, too.

Another observed species in this study was *Ampithoe rubricata* at Stn 10. *A. rubricata* is a dominant member of the red algae zone (not topic of this study) in water depths between 10 and 20 m and salinities between 10 and 15 psu. At several places in the Lübeck Bay we found during other investigations these typical community, which was dominated by *Corophium insidiosum*, *Microdeutopus gryllotalpa*, *Idotea balthica*, *Apherusa bispinosa* and *Ampithoe rubricata*. *Corophium crassicorne*, *Gammarellus homari* and *Phoxocephalus holbolli* were subdominant too. Similar observations were made by Lüthje (1978) in the Kiel Bay.

Marine benthic communities may differ greatly in the width of oscillations both of individual species and of the community as a whole (Arntz and Rumohr, 1986). Distribution patterns and species composition of the observed benthic communities were caused by several abiotic factors such as depth, oxygen, salinity and sediment structure (e.g. Boedeker *et al.,* 1998). The habitat selection due to interspecific competition and predation represents another regulator. Both the species number and the species composition depend on these two important complexes. In summary one can state that the crustacean biodiversity in the southern and western Baltic Sea very much depends on sufficient structure of the substrates due to phytal, stones, epizoic species or mussel beds. They constitute the preferred habitat for the major part of the crustacean fauna. Only few species live either in the pelagic (partly *Hyperia galba*, Mysidacea) or settle in homogenous sediments such as sand (*Bathyporeia pilosa*) and mud flats (e.g. *Corophium volutator*, *Cyathura carinata*) in high densities. Despite great variability of species composition within communities (sensu Arntz and Rumohr, 1986) several of the species presented are suitable as indicators particularly in regard to sediment structure. They form distinguishable crustacean assemblages.

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