POLISH POLAR RESEARCH	21	3–4	171–180	2000

Magdalena BŁAŻEWICZ-PASZKOWYCZ and Krzysztof JAŻDŻEWSKI

Zakład Biologii Polarnej i Oceanobiologii
Katedra Zoologii Bezkręgowców i Hydrobiologii
Uniwersytet Łódzki
Banacha 12/16
90-237 Łódź, POLSKA
e-mail: magdab@biol.uni.lodz.pl

Quantitative data on Tanaidacea of Admiralty Bay (King George Island, South Shetland Islands, Antarctica)

ABSTRACT: This paper presents some preliminary data on the quantitative distribution of Tanaidacea in Admiralty Bay, mainly in its Ezcurra Inlet. On the soft bottom of this inlet, and especially its small glacial lagoon, Herve Cove, the highest abundance but the lowest species richness of Tanaidacea was found. In the central basin of Admiralty Bay, much higher species richness was observed along with much lower tanaid abundance.

Key words: Antarctica, King George Island, Admiralty Bay, zoobenthos, Tanaidacea.

Introduction

Knowledge concerning the role of Tanaidacea in the Antarctic ecosystem is still insufficient, even though they may constitute an abundant element of Antarctic zoobenthos (Lowry 1975, Dayton and Oliver 1977, Gallardo *et al.* 1977, Richardson and Hedgpeth 1977, Jażdżewski *et al.* 1986).

Intensive studies of zoobenthos in Admiralty Bay revealed that Tanaidacea are locally an important group among the soft bottom communities (Jażdżewski *et al.* 1986). Similar observations were also noted by Siciński *et al.* (1996), who found tanaids as a subdominant element of zoobenthos (in terms of abundance) in some places in Herve Cove, a small glacial lagoon of Admiralty Bay. On the other hand, because of the tanaid small body size, their share in zoobenthos biomass usually constitutes only a fraction of percent (Jażdżewski *et al.* 1986, Siciński *et al.* 1996).

The distribution of bottom dwelling fauna is often explained by the structure of sediments (Thorson 1957, Gray 1974). Undoubtedly the quality of the bottom is

also an important factor for tube – making tanaids (Tanaidomorpha). For example *Nototanais antarcticus*, the dominant tanaid species in West Antarctic, occupies the corridors inside soft sediment hardened by the secretion of its tegumental glands and was noted as an important element of soft bottom assemblages (Lowry 1975, Richardson and Hedgpeth 1977). Trucker (1988) also listed it as a species frequently found in sandy bottom. On the other hand Gambi *et al.* (1994) and Gambi and Bussotti (1999) observed another common and abundant Antarctic species – *N. dimorphus* – as a major element of hard bottom assemblage and of the *Phyllophora* thalli habitat, although Trucker (1988) mentioned the same species as a dominant element of infauna in muddy bottom.

The distribution of benthic fauna is a complex problem and cannot be explained only in the terms of substrate quality (Siciński 1998). This confirms Trucker's (1988) observation which noted relatively similar tanaid assemblages at a muddy, sandy, and rocky substrate in Davis Sea. Delille *et al.* (1985) suggested that the concentration of food could be an important factor determining the distribution of Tanaidacea. These authors also indicated a positive correlation between the high density of *Allotanais hirsutus* (56 000 to 146 000 ind.m^{-2}) and the amount of bacteria in Morbihan Bay (Kerguelen Island).

Siciński (1998), in his study on the Polychaeta of Admiralty Bay, indicated that in addition to the grain size of sediments the distribution of soft bottom assemblages depends also on such features as, *e.g.*, porosity and hydratation, the slope of the bottom, and the influence of fresh water. The present study gives some details on the quantitative distribution, diversity and dominance of particular species of Tanaidacea in Admiralty Bay and especially in its inner branch – the Ezcurra Inlet.

Study area, material, and methods

Admiralty Bay is the largest fjord-like bay area of South Shetland Islands (Fig. 1). The morphology of the basin is presented in the papers by Pruszak (1980), Rakusa-Suszczewski (1980), Marsz (1983) and Rakusa-Suszczewski *et al.* (1993). Hydrobiological conditions in Admiralty Bay are discussed in the papers by Pęcherzewski (1980), Rakusa-Suszczewski (1980), Samp (1980), Szafrański and Lipski (1982), Lipski (1987) and Sarukharynian and Tokarczyk (1988).

Bottom sediments in the Ezcurra Inlet and in the vicinity of the *H. Arctowski* Station have been studied by Siciński (1998, Figs. 5 and 6). They were poorly sorted sands, muds, and loams whose grain size, described by the coefficient ϕ, ranged from 2 to 8, but for the majority of stations varied from 3 to 6. These sediments were patchily mixed with coarse elements like drop-stones. Coarse sediments were deposited mainly in the shore zone of the central basin of Admiralty Bay, where the sedimentation rate is lower (*e.g.* near Shag Rocks).

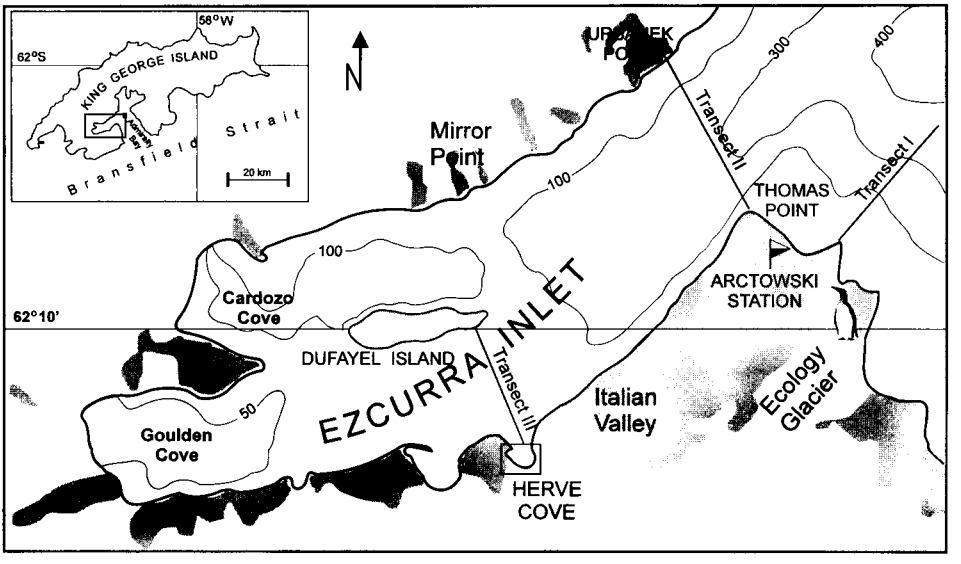

Fig. 1. Study area. Dotted land area – free of ice.

Material for the present study was collected by Van Veen grab (0.1m^2) and during SCUBA diving using the Tvärminne sampler (0.565 m^2). The samples were taken in three seasons: (1) in the season 1979/80, at 18 stations of three transects representing three various areas of the bay (Jażdżewski *et al.* 1986); (2) in the season 1984/85 in the previously established transect I and inside the whole Ezcurra Inlet; and (3) in 1993/94 in the Herve Cove (Siciński *et al.* 1996). Samples taken in 1979/80 consisted generally of 3 subsamples at each station (Jażdżewski *et al.* 1986), while the remaining samples taken in 1984/85 and 1993/94 were not replicated (each grab makes one sample). Because materials at transect I were taken twice (in 1979/80 and 1984/85), in making quantitative calculations we decided to average the results for this transect, treating samples of both seasons and at approximative depth as subsamples (5 subsamples at depth 30 m and 150 m, 7 subsamples at depth 80, and 8 subsamples at depth 250 m). Distribution of the stations where tanaids were present or absent are presented in Fig. 2.

Results

Taxonomic note. — The preliminary list of Tanaidacea of Admiralty Bay included 12 species belonging to 4 families (Błażewicz and Jażdżewski 1996). During further study it was revealed that the *Tanais* sp. of Błażewicz and Jażdżewski (1996) is in fact *Zeuxoides ohlini*. Another tanaid species, *Typhlotanais* sp., which in the material of these authors was represented by only one, poorly preserved female with marsupium, is probably *Paratanais armatus*. The systematic position of

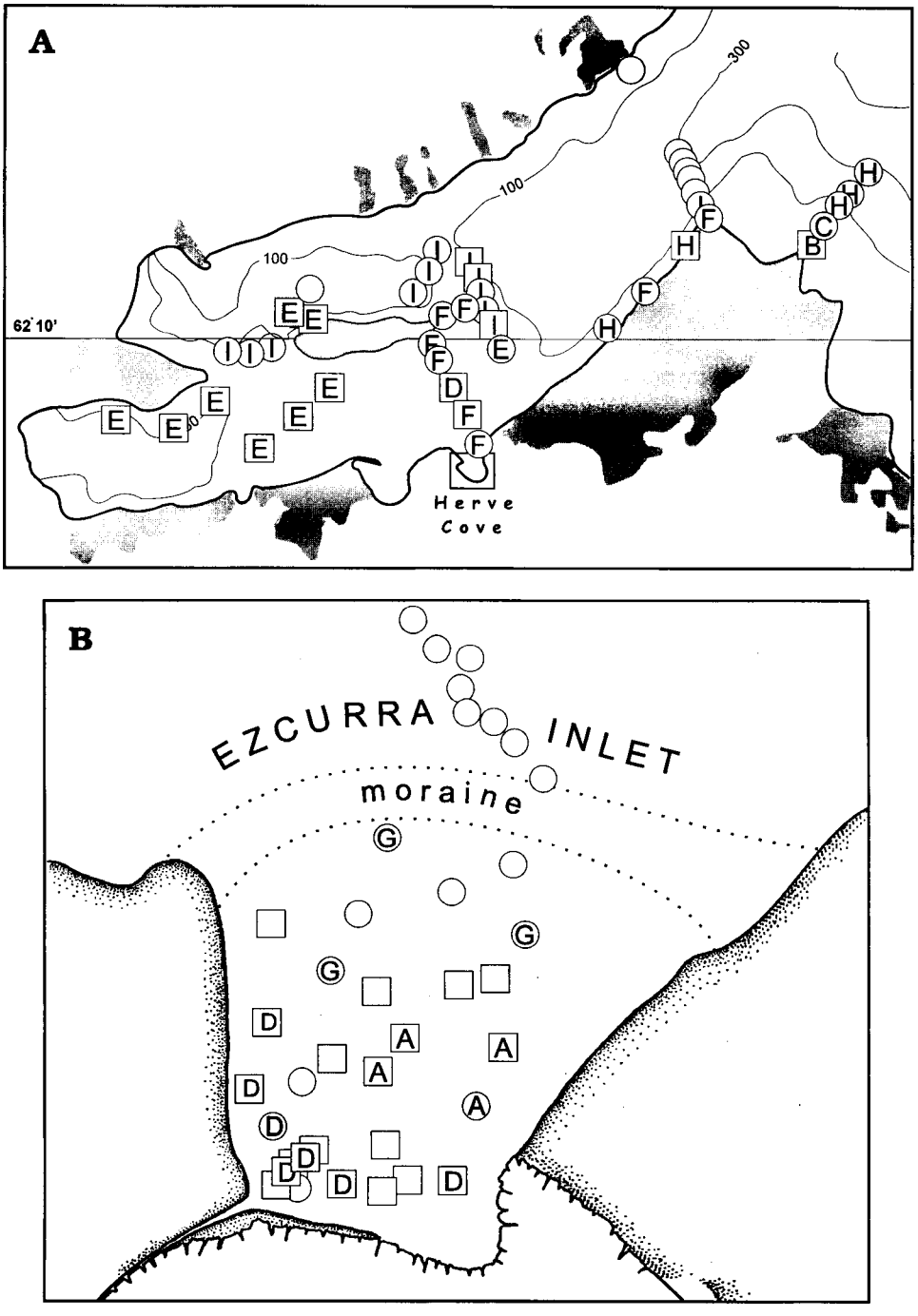

Fig. 2. Distribution of the stations inside Ezcurra Inlet (A) and inside Herve Cove (B): circle – tanaids present in the samples, square – tanaids absent in the samples. Letters indicate distribution of assemblages established by Siciński (1998). Stations without letters were omitted in study of Siciński (1998).

species determined by Błażewicz and Jażdżewski (1996) as *Leptognathia gracilis* Kröyer, 1847, also presents some problems and needs additional explanation. Shiino (1978) considered *L. gracilis* occurring in North Atlantic as a senior synonym of *L. australis* Beddard, 1886, from Kerguelen Island. Sieg (1986), after examination of the material from both hemispheres, distinguished "northern" and "southern" forms of this species and created a new genus for them, *Akanthophoreus*. The same author in his manuscript on the Tanaidacea of the Antarctic shelf [1] noted that the genus *Paraleptognathia* Kudinova-Pasternak, 1982 is an older synonym of *Akanthophoreus*. In the same manuscript Sieg definitely concluded also that both northern and southern forms of *L. gracilis* should be considered as separate species. Now it becomes clear that the *L. gracilis* of Błażewicz and Jażdżewski (1996) is in fact *Paraleptognathia australis*.

Quantitative analysis. — Tanaidacea were present in the central part of Ezcurra Inlet, inside Herve Cove, along transect II and in deeper stations of transect I (Fig. 2). On the other hand they were absent in the southwestern part of Ezcurra Inlet, in some stations in the central part of Ezcurra Inlet, at the shallowest station of transect I (15 m), and at two deeper stations of transect III (30 and 70 m) (Fig. 2).

In the central part of Ezcurra Inlet, in the vicinity of Dufayel Island (transect III), tanaids were usually rather abundant, with maximal density of 4030 ind.m^{-2} (Fig. 3). Also rather high density was also observed on the outer and inner slopes of the postglacial moraine of Herve Cove (Fig. 4). Near the entrance to the lagoon tanaids reached their maximal density for Admiralty Bay, 16024 ind.m^{-2}.[2] Despite the high density of Tanaidacea in that region, they were represented mainly by two species: *Nototanais antarcticus* and *Peraeospinosus* sp. A and at one station also by *L. gallardoi*. The first of these species is a eurytopic one, commonly occurring in many stations of Ezcurra Inlet, in transects I and II (Fig. 3). It is also noteworthy that it is the only tanaid species present in the innermost part of Herve Cove (Fig. 4). Another species – *Peraeospinosus* sp. A – occurred only at shallow stations, *e.g.* on the inner and outer slopes of the moraine separating Herve Cove (Fig. 4), in some shallow stations near Dufayel Island, Italian Valley, and in the shallowest station of transect II (Fig. 3). In the vicinity of Dufayel Island, Italian Valley, and in few stations of transect I and II *N. dimorphus* was also noted as an important component of tanaid fauna. In many cases this species was associated with *Paraleptognathia australis* and accompanied by *N. antarcticus* and *Peraeospinosus* sp. A

Tanaidacea were represented quite differently in stations of sections I and II (Fig. 3). There they were less abundant than inside the Ezcurra Inlet and with the exception of one station of transect II (30 m), where 244 ind.m^{-2} were noted, their

[1] This manuscript was kindly made available to the senior author by Dr Oliver Coleman from the Humboldt Museum in Berlin.

[2] In the paper by Błażewicz and Jażdżewski (1996) this value was wrongly calculated as 140 000 ind.m^{-2}.

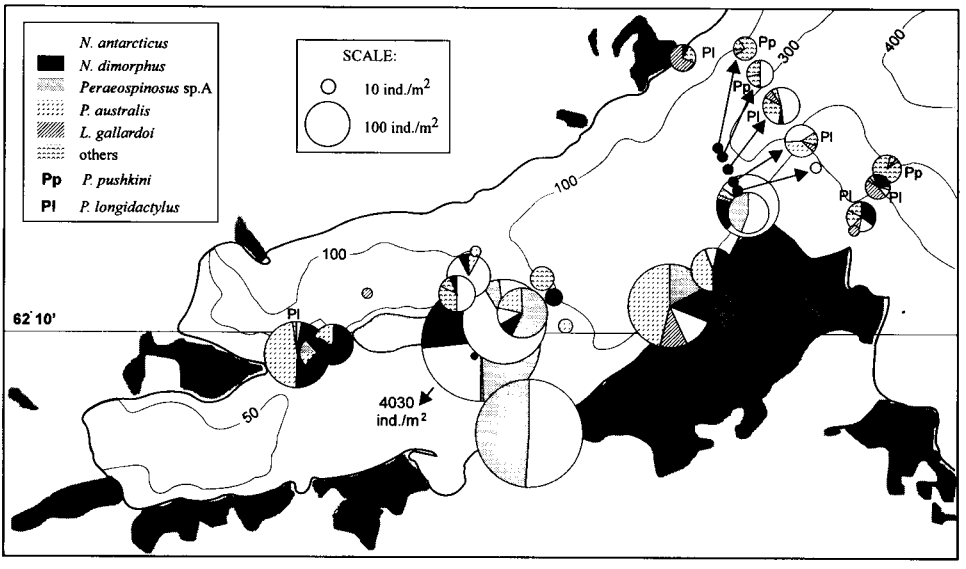

Fig. 3. Share of particular tanaid species at the stations (the largest circle with specified density does not maintain proportion).

density was usually below 100 ind.m^{-2}. Despite such a low abundance, the species diversity at these both transects was relatively high. From the list of 12 Tanaidacea species found in the whole Admiralty Bay by Błażewicz and Jażdżewski (1996) ten species were noted in these 2 sections. They were: *Paraleptognathia australis* (= *Leptognathia gracilis*), *Mirandotanais vorax, Araphura elongata, Peraeospinosus adipatus, P. pushkini, Peraeospinosus* sp. A, *Leptognathia gallardoi, Nototanais antarcticus, N. dimorphus* and *Protanaissus longidactylus*.

N. dimorphus, L. gallardoi and *P. longidactylus* were the dominant species among Tanaidacea at two stations (80 m and 150 m) of transect I (Fig. 3). On the contrary *Nototanais antarcticus* was the most abundant species at the majority of stations of transect II, while *Nototanais dimorphus, P. longidactylus* and *L. gallardoi* were accessory species there. The presence of *Peraeospinosus* sp. A was characteristic at only one, the shallowest station (15 m) of transect II, and *P. pushkini* in the deepest stations of both transects (170 m and 250 m). Except for the two stations inside Herve Cove, in Admiralty Bay *P. pushkini* has been never noted in depths shallower than 150 m.

Discussion

Tanaidacea, in comparison to some other groups of zoobenthos, *e.g.* Polychaeta, Bivalvia, Amphipoda or Isopoda, were usually a less frequent and numerous component of the bottom fauna of Admiralty Bay, although in some stations

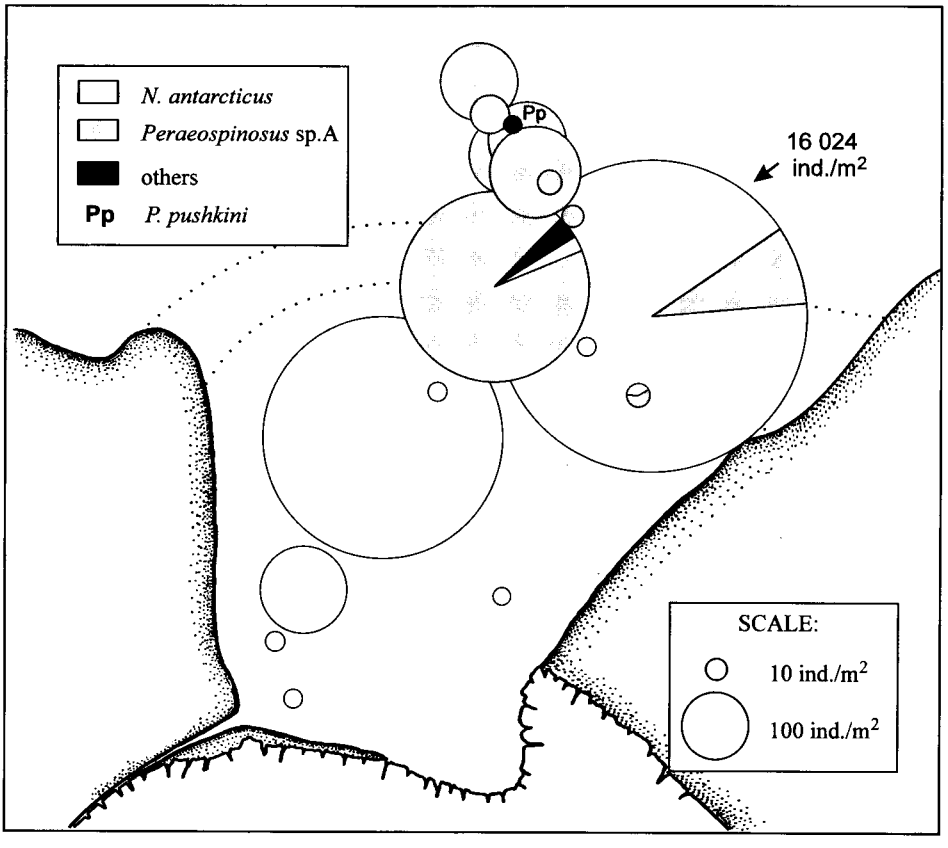

Fig. 4. Share of particular tanaid species at the stations in Herve Cove region (the largest circle with specified density does not maintain proportion).

their abundance was significant (Jażdżewski *et al.* 1986, Błażewicz and Jażdżewski 1996). For example Siciński *et al.* (1996), noted Tanaidacea in the outer part of Herve Cove, together with small Bivalvia, Ostracoda, and polychaete *Rhodine intermedia*, as a significant element of zoobenthos assemblage. It was also characteristic that in other parts of this small basin (surface about 12 ha) these crustaceans were absent.

An analysis of polychaete fauna by Siciński (1998) against the background of the bottom structure allowed this author to recognise nine polychaete assemblages distributed in the Ezcurra Inlet and in the vicinity of the *H. Arctowski* Station. The proportions of tanaid species in the areas inhabited by these assemblages as found in our study show their ecological relationship to particular polychaete assemblages.

Inside the Herve Cove Siciński (1998) distinguished three assemblages "A", "D" and "G" situated in inner, central and outer parts of that basin respectively. Assemblage "D" was characterised by the polychaete *Microspio moorei*; assemblage "G" – somewhat less clearly – by the polychaete *Rhodine intermedia*, whereas assemblage "A" was faunistically so impoverished that it was impossible to charac-

terise it positively by any species. Strong sedimentation, fresh water inflow (mainly in assemblage "D") and oxygen deficiency (mainly "A") undoubtedly preclude the presence of many zoobenthos taxa (Siciński *et al.* 1996), including tanaids. The only species that was present in that part of the basin was a eurytopic *Nototanais antarcticus*. The dominance of eurytopic taxa in Herve Cove was already emphasised by Siciński *et al.* (1996). A similarly strong sedimentation rate was observed outside Herve Cove, in polychaete assemblage "E", characterised by *Ophelina cylindricaudata* occurring in the southeastern part of Ezcurra Island, in the vicinity of northeastern Dufayel Island, and in the deepest station of transect III (70 m).

A different composition of tanaid fauna was observed in polychaete assemblage "G", situated in the northern part of Herve Cove, in assemblage "F" (*Apistobranchus*) occurring in the central part of Ezcurra Island, in the shallow station of Section II (at Thomas Point), and one station at Italian Valley. The fine porous sand of the bottom inhabited by the assemblage "G" (Siciński 1998) seems to be favourable for two tanaids: *N. antarcticus* and *Peraeospinosus* sp. A. Therefore despite the low diversity, tanaid abundance was rather high (over 16 000 ind.m^{-2}). A similar composition of tanaid fauna was observed in the region inhabited by polychaete assemblage "F", characterised by poorly sorted sediments, by the presence of drop-stones, and a significant bottom slope (Siciński 1998). Noteworthy is the special similarity of tanaid fauna in the shallow stations of transect II (at Thomas Point) and of transect III (at Herve Cove) to that observed in assemblage "G" of Siciński (1998). In stations of assemblage "F", situated at the entrance to Herve Cove and at the Italian Valley, *N. dimorphus* also played an important role. On the other hand this species, *Paraleptognathia australis* and *N. antarcticus*, were significant taxa in polychaete assemblage "I", characterised by *Tharyx cincinnatus*. Therefore, taking into account at least tanaid fauna composition, one station situated at Italian Valley and classified by Siciński (1998) to assemblage "F" fits rather to assemblage "I".

The most diverse polychaete assemblage in the study by Siciński (1998) was assemblage "H" whose characteristic species was *Tauberia gracilis*. The bottom inhabited by this assemblage was defined by the presence of drop-stones, a comparatively steep slope, and by poorly sorted sediments. Such a bottom structure resulted evidently in high tanaid diversity accompanied by a low value of their abundance. The region of this assemblage was also positively characterised by the presence of *Protanaissus longidactylus* and *Leptognathia gallardoi*, and in the deeper stations also by *P. pushkini*. Therefore it is quite possible that deeper stations of transect II not included in the study by Siciński (1998) would belong also to assemblage "H".

Finally, tanaids were absent or were very rare in polychaete assemblages "B" characterised by the presence of only two species – *Microspio moorei* and *Capitella capitata* and "C" characterised by *Scoloplos marginatus*, representing the

shallowest shelf of Admiralty Bay (stations 15 m and 30 m at section I). Undoubtedly the absence of tanaids was caused by the presence of coarse sand in these stations.

In general one can observe that tanaids avoid both coarser sediments, like large grain sand as well as very small grain size sediments, like delicate loam; their favourite sediments being very small grain size sand (ϕ 3–4) and coarse grain mud (ϕ 4–5).

Acknowledgements. — Thanks are due to Dr hab. Jacek Siciński and Dr Piotr Presler for making material available for the present study, as well as to Jerzy Żychliński M.Sc.who helped the junior author in SCUBA collecting.

References

BŁAŻEWICZ M. and JAŻDŻEWSKI K. 1996. A contribution to the knowledge of Tanaidacea (Crustacea, Malacostraca) of Admiralty Bay, King George Island, Antarctic. — Pol. Polar Res., 17: 213–220.

DAYTON P.K. and OLIVER I.S. 1977. Antarctic soft bottom benthos in oligotrophic and eutrophic environments. — Science, 197: 55–58.

DELILLE D., GUIDI L.D. and SOYER J. 1985. Nutrition of *Allotanais hirsutus* (Crustacea, Tanaidacea) at Kerguelen Islands. — *In*: Siegfried W.R., Condy P.R. and Laws R.M. (eds), *Antarctic nutrient cycles and food webs.* Springer-Verlag, Berlin; 378–380.

GALLARDO V.A., CASTILLO J.G., RETAMAL M.A., YANEZ A., MOYANO H.J. and HERMOSILLA J.G. 1977. Quantitative studies on the soft-bottom macrobenthic animal communities of shallow Antarctic bays. — *In*: Llano G.A. (ed.), *Adaptations within Antarctic ecosystems.* Proc. 3rd SCAR Symp. Antarct. Biol. Smith. Inst., Washington; 361–387.

GAMBI M.C. and BUSSOTTI S. 1999. Composition, abundance and stratification of soft-bottom macrobenthos from sellected areas of the Ross Sea shelf (Antarctica). — Polar Biol., 21: 374–354.

GAMBI M.C., LORENTI M., RUSSO G.F. and SCIPIONE F. 1994. Benthic associations of the shallow hard bottoms off Terra Nova Bay, Ross Sea: zonation biomass and population structure. — Antarct. Sci., 6: 449–462.

GRAY J.S. 1974. Animal – sediment relationship. — *In*: Barnes H. (ed.), *Oceanography and Marine Biology*, An. Rev., 12: 223–261.

JAŻDŻEWSKI K., JURASZ W., KITTEL W., PRESLER E., PRESLER P. and SICIŃSKI J. 1986. Abundance and biomass estimates of the benthic fauna in Admiralty Bay, King George Island, South Shetland Islands. — Polar Biol., 6: 5–11.

LIPSKI M. 1987. Variations of physical conditions and chlophyll *a* contents in Admiralty Bay (King George Island, South Shetland Islands,1979). — Pol. Polar Res., 8: 307–332.

LOWRY J.K. 1975. Soft bottom macrobenthic community of Arthur Harbour, Antarctica. — Antarct. Res. Ser., 23: 1–19.

MARSZ A.A. 1983. From surveys of the geomorphology of the shores and bottom of the Ezcurra Inlet. — Oceanologia, 15: 209–220.

PĘCHERZEWSKI K. 1980. Distribution and quantity of suspended matter in Admiralty Bay (King George Island, South Shetland Islands). — Pol. Polar Res., 1: 75–82.

PRUSZAK Z. 1980. Current circulation in the waters of Admiralty Bay (region of Arctowski Station on King George Island). — Pol. Polar Res., 1: 55–74.

RAKUSA-SUSZCZEWSKI S. 1980. Environmental conditions and functioning of Admiralty Bay (South Shetland Islands) as part of the near shore Antarctic ecosystem. — Pol. Polar Res., 1: 11–27.

RAKUSA-SUSZCZEWSKI S., BATTKE Z. and CISAK J. 1993. Morphometry of the Admiralty Bay shores and basin. — *In*: Rakusa-Suszczewski S. (ed.), *The Maritime Coastal Ecosystem of Admiralty Bay*. Department of Antarctic Biology. Polish Academy of Sciences, Warszawa; 216 pp.

RICHARDSON M.D. and HEDGPETH J.W. 1977. Antarctic soft-bottom macrobenthic community adaptations to cold, stable, highly productive, glacially affected environment. — *In*: Llano G.A. (ed.), *Adaptations within Antarctic ecosystems*. Proc. 3rd SCAR Symp. Antarct. Biol. Smith. Inst., Washington; 181–196.

SARUKHANYAN E.J. and TOKARCZYK R. 1988. Coarse-scale hydrological conditions in Admiralty Bay, King George Island, West Antarctica, summer 1982. — Pol. Polar Res., 9: 121–132.

SHIINO S.M. 1978. Tanaidacea collected by French scientists on board the survey ship *Marion Dufresne* in the regions around the Kerguelen Island on the other Subantarctic islands in 1972, '74, '75, '76. — Sci. Rep. Shima Marineland, 5: 1–122.

SAMP R. 1980. Selected environmental factors in the waters of Admiralty Bay (King George Island, South Shetland Islands). — Pol. Polar Res., 1: 53–66.

SICIŃSKI J., RÓŻYCKI O. and KITTEL W. 1996. Zoobenthos and zooplankton of Herve Cove, King George Island, South Shetlands Islands, Antarctic. — Pol. Polar Res., 17: 221–238.

SICIŃSKI J. 1998. Wieloszczety (Annelida, Polychaeta) antarktycznego sublitoralu w strefie proglacjalnej (wyspa King George, Szetlandy Południowe). — Wydawnictwo Uniwersytetu Łódzkiego, 122 pp.

SIEG J. 1986. Tanaidacea (Crustacea) von der Antarktis und Subantarktis. — Mitt. Zool. Mus. Univ. Kiel, 2: 1–80.

SZAFRAŃSKI Z. and LIPSKI M. 1982. Characteristic of water temperature and salinity at Admiralty Bay (King George Island, South Shetland Islands, Antarctic) during the austral summer. — Pol. Polar Res., 3: 7–24.

THORSON G. 1957. Bottom communities (sublittoral or shallow shelf). — *In*: Hedgpeth J.W. (ed.) *Treatise on marine ecology and palaecology*. Geological Society of America, Memoir 67: 461–534.

TRUCKER M.J. 1988. Temporal distribution and brooding behaviour of selected benthic species from the shallow marine waters off the Vestfold Hills, Antarctica. — Hydrobiologia, 165: 151–159.

Received: July 5, 2000
Accepted: October 2, 2000