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First British record of *Potamocypris humilis* (Sars, 1924), a freshwater ostracod with a disjunct distribution in Europe and southern Africa

David J. HORNE
Dept of Geography
Queen Mary, University of London, UK

Robin J. SMITH
Department of Earth Sciences
Kanazawa University, Japan

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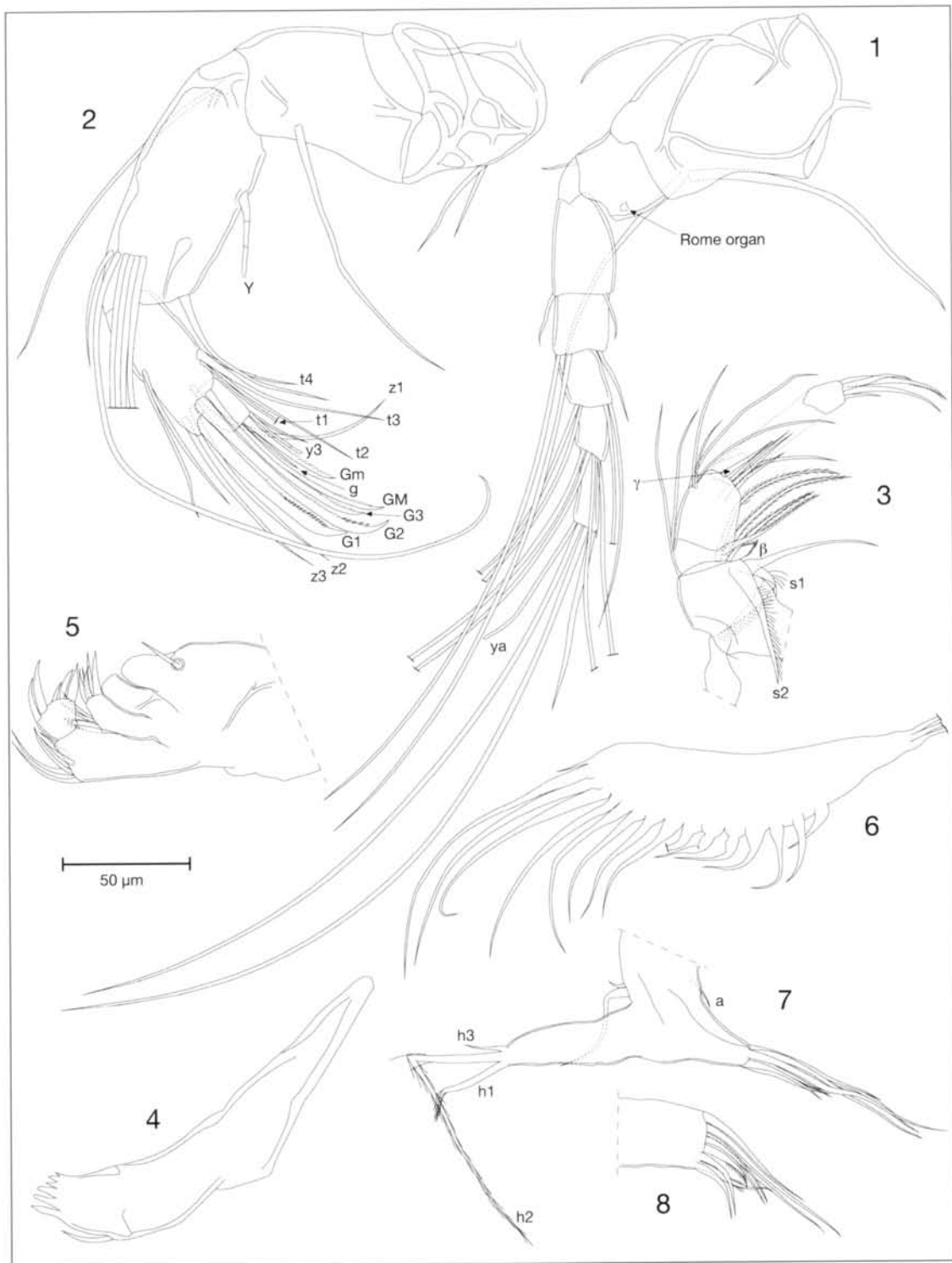
ABSTRACT – The freshwater ostracod *Cyprilla humilis* Sars, 1924 was first described from the Cape Province of South Africa, together with four other species of *Cyprilla* Sars, 1924, a genus subsequently considered by other authors to be a subgenus or a junior synonym of *Potamocypris* Brady, 1870. It was argued that *Cyprilla humilis* at a single locality on the southern coast of Finland represented a possibly short-lived population, perhaps originating from a single parthenogenetic female, transported from southern Africa by migratory terns which nest in the Finnish archipelago and overwinter in the Cape Province. Subsequent records from the same Finnish locality and another nearby led to the alternative suggestion that it was a long-term resident that had simply been overlooked. Our discovery of a population in a coastal rockpool on an island off the West coast of Scotland provides the first British record and an opportunity for further description and illustration of its morphology and ontogeny. Notable characteristics include: long swimming setae on the antennae; adult carapace with a sharply truncated posterior margin in lateral view and strongly pitted ornament; prominent anterior and posteroventral marginal flanges in the adult left valve; and the occurrence in juvenile carapaces of prominent tubercles which are completely absent in adults. None of these characteristics is considered adequate to merit the retention of *Cyprilla* as a separate genus or subgenus, however. We consider possible explanations for its disjunct distribution and discuss the evidence for dispersal of ostracods by birds.

RIASSUNTO – [Primo ritrovamento per la Gran Bretagna di *Potamocypris humilis* (Sars, 1924), ostracode d'acqua dolce con distribuzione disgiunta in Europa e Sud Africa] – L'ostracode d'acqua dolce *Cyprilla humilis* Sars, 1924 è stato descritto per la prima volta nella Provincia del capo in Sud Africa, insieme ad altre quattro specie di *Cyprilla* Sars, 1924, un genere in seguito considerato da altri autori come un sottogenere, o un sinonimo junior, di *Potamocypris* Brady, 1870. È stato ipotizzato che il ritrovamento di *Cyprilla humilis* in un'unica località della costa meridionale della Finlandia potesse rappresentare una popolazione di recente insediamento, forse originatasi da una singola femmina partenogenetica trasportata dal Sud Africa da sterne migratrici che nidificano nell'Arcipelago Finlandese e svernano nella Provincia del Capo. Successivi ritrovamenti nella stessa località finlandese ed in un'altra vicina hanno portato all'ipotesi alternativa che si trattasse di popolazioni insediate da lungo tempo e semplicemente non ancora segnalate. Il nostro ritrovamento di una popolazione in una pozza di scogliera di un'isola al largo della costa occidentale della Scozia costituisce la prima segnalazione per la Gran Bretagna e fornisce l'opportunità per ulteriori descrizioni morfologiche e per lo studio dell'ontogenesi di questa specie. I caratteri salienti sono: lunghe sete natatorie sulle antenne; in visione laterale, carapace degli adulti con margine posteriore bruscamente troncato e fortemente ornamentato con cavità; valva sinistra con bordi prominenti sul margine anteriore e posteroventrale; larve con carapace provvisto di evidenti tubercoli, completamente assenti nelle forme adulte. Nessuna di queste caratteristiche è tuttavia considerata sufficiente per mantenere *Cyprilla* come genere o sottogenere separato. Sono considerate possibili spiegazioni per questa distribuzione disgiunta e viene discussa la dispersione di ostracodi ad opera di uccelli.

INTRODUCTION

In the summers of 1945 and 1947, while based at the Tvärminne Zoological Station in the Gulf of Finland, K.J. Purasjoki undertook a survey of ostracods in rock pools on some of the many islands in the area. In rain-fed pools on a small, bare rock island called Storshundsharen he found a species which he assigned to *Potamocypris*, noting that it differed from other European species of the genus in details of its shell. Purasjoki sent some specimens to the German ostracod specialist Walter Klie who identified it as *Cyprilla humilis*, a species described by Sars (1924) from the Cape Province of South Africa and not previously recorded in Europe (Purasjoki, 1948). Noting that Klie (pers. comm. to Purasjoki) considered *Cyprilla* to be, at most, a subgenus of *Potamocypris*, Purasjoki drew attention to the distinctive ornament of the juvenile stages (which exhibit pointed tubercles not seen in the adult) and suggested that, if this was a characteris-

tic of the other four species of *Cyprilla* described by Sars, this might be a valid reason to separate it from *Potamocypris*. Considering the occurrence of this species so far outside its African distributional area, Purasjoki (1948) proposed that his Tvärminne population must have been transported directly to Finland by migratory birds, citing Common and Arctic terns, both of which migrate by coastal routes and wintering in the southern hemisphere and nesting in the Tvärminne archipelago. The species was subsequently found again in the Tvärminne area by Hagerman (1967) on Storshundsharen and also on a second island, Spikarna; recording it as *Potamocypris* (*Cyprilla*) *humilis* (Sars) he expressed reservations about the idea of transport by birds from Africa, suggesting that the possibility that it was native to the Gulf of Finland should not be overlooked. Here we report on the first recorded occurrence of *Cyprilla humilis* Sars, 1924 in the British Isles, taking the opportunity to supplement its description (with particular attention to the ontogenetic



Text-fig. 1 - Appendages of *Potamocypris humilis*, adult females from Harris, Scotland (BMNH nos). 1) antennula, 2004.418; 2) antenna, 2004.426 (only one of the five long swimming setae is shown at full length); 3) mandibular palp, 2004.428; 4) mandibular coxa, 2004.428; 5) maxillular endopodite and endites, 2004.427; 6) maxillular branchial plate, 2004.429; 7) fifth limb (maxilliped), 2004.431; 8) detail of endopodite (palp) of fifth limb, 2004.430, rotated 90° relative to (7); all x460 (scale bar = 50 µm).

development of its valve ornamentation), review its generic assignment and consider explanations for its bi-hemispherical distribution.

MATERIAL AND METHODS

Our specimens were collected on July 8th 2002, from a rock pool on the West coast of Harris in the Outer Hebrides, about 300 m South of a small headland called Rubha Romaigdh and immediately South of a small rocky bay called Geòdha Martainn (lat. 57° 51' 20" N, long. 6° 59' 59" W; British National Grid reference: NG 034961). Ostracods were collected by sweeping a hand-held sieve (75 µm mesh size) through the water and the sediment on the bottom of the pool; the animals thus obtained were kept alive in a screw-topped jar, filled with water from the pool, until the evening of the same day, when they were examined under a binocular microscope before being extracted with a pipette; specimens were then preserved in ethanol (approximately 70%) for future study. The pool, measuring approximately 2 x 1 m at the surface and 0.1 m deep, is on bare rock (Lewisian gneiss), an estimated 3-5 m above extreme high water mark (judging by the intertidal algae and supratidal lichens at the site) and at the foot of a gentle grassy slope extending up to the road. It contained dark brown mud (predominantly fine organic detritus) and loose stones on the bottom but no algae or aquatic plants; the margins were a mixture of bare rock and patches of grass. At the time of sampling (mid-afternoon) the water temperature was 19°C. On the day of our collection the water in the pool was fresh; however, although protected to some extent by the island of Taransay to the Northwest and the headland of Gob an Tobha to the Southwest, the rocky coast at Rubha Romaigdh is exposed to Atlantic swell approaching from due West, and it is therefore probable that the introduction to the pool of salt spray from breaking waves is a fairly frequent occurrence. The pool appeared to be fed partly by rain and partly by seepage from the grassy slope above it; the possibility that it dries out occasionally cannot be ruled out but the fact that it was full in summer (July) suggests that drying is infrequent.

Associated ostracod taxa were *Ilyocypris bradyi* Sars, 1890 and *Cypria ophtalmica* (Jurine, 1820), both of which are common in the British Isles; a similar, slightly larger pool at the same locality was also sampled but yielded only *Cypria ophtalmica*.

South African specimens were provided by Koen Martens (Royal Belgian Institute of Natural Sciences, Brussels) who has collected *P. humilis* at several localities in the Cape Province; the specimens illustrated herein are from near Blinkvlei, Van Rhynsdorp (sample no. RSA/01/004), lat. 31° 43' 55" S, long. 18° 55' 31" E, collected on 7th September 2001.

Illustrated specimens have been deposited in the Natural History Museum, London (BMNH nos).

THE GENUS *CYPRILLA* SARS, 1924

Sars (1924) described the new genus *Cyprilla* on the basis of five new species, all obtained from samples, or raised from dried mud, collected at localities in the Cape Province of South Africa: *C. arcuata*, *C. gibbula*, *C. deflexa*, *C. humilis* and *C. producta*. *Cyprilla arcuata*, being the first to be described, may be regarded as the type species although it was not designated as such by Sars. *Cyprilla* may be considered to be a valid genus (e.g. Sars, 1924; McKenzie, 1971a, 1977; Ghetti & McKenzie, 1981), or it may be regarded as subgenus (e.g. Hagerman, 1967) or a junior synonym of *Potamocypris* Brady (e.g. Gauthier, 1939a, b; Meisch, 1985); Martens *et al.* (1996), assigning a South African species to *Cyprilla humilis* (Sars, 1924), noted all three possibilities. Sars (1924) commented on the similarity of *Cyprilla* to *Potamocypris*, considering the two genera to differ in the general appearance of the shell and its ornament as well as in the valve overlap relationships. His generic description of *Cyprilla* draws attention to the fact that the right valve is generally higher than the left, overlapping it along much of the dorsal margin, while the left valve overlaps the right anteriorly and posteroventrally (by virtue of the left valve's prominent marginal flanges). Another character that may be of generic significance, not mentioned by Sars (1924), but described and illustrated by Purasjoki (1948), is the occurrence of prominent tubercles on the valves of juvenile instars (A-1 and A-2) in *C. humilis* from Finland. In our material from Scotland we have identified juveniles back to the A-5 stage; the A-5 to A-1 instars all bear tubercles (Pl. 2), including a rather swollen one in the anterodorsal (post-ocular) region and a particularly prominent posterodorsal group which appear to be enlarged pore conuli, but there is no trace of tubercles in adults (Pl. 1), which bear only the finely reticulate/pitted ornament seen in all the instars. Purasjoki (1948), mentioning Gauthier's (1934) doubts about the validity of *Cyprilla*, stated that Klie (pers. comm. to Purasjoki) considered it to be at most a subgenus of *Potamocypris*. However, noting that tuberculate juveniles are not known in any species of *Potamocypris*, Purasjoki suggested that if they could be shown to be characteristic of other species of *Cyprilla* then there would be a good case for keeping the two genera separate. Gauthier (1939a, b) later concluded that *Cyprilla* should be synonymised with *Potamocypris*. Hagerman (1967) considered *Cyprilla* to be a subgenus of *Potamocypris*, probably following the opinion of Klie as cited by Purasjoki. Meisch (1985) assigned *C. humilis* to *Potamocypris*, considering it to have the diagnostic features of the latter genus: the ventral overlap of the right valve over the left, the anterior and posterior flanges of the left valve, and the spatula-like distal podomere of the maxillular palp (see Text-fig. 1). He noted, nevertheless, that it was set "somewhat apart in the genus" (Meisch, 1985; p. 74) by the carapace shape with its nearly

straight dorsal margin and especially by the tuberculate ornament of the juveniles. Recently George & Martens (2002) have described a new species of *Potamocypris* from India, which they assigned to the "*Cyprilla*" group because of its prominent anterior and posterior flanges in the left valve. We concur with their argument that the characteristic cited by previous authors in support of the generic or subgeneric status of *Cyprilla* (prominence of left valve flanges) differs only in degree from the left valve margin characteristics of all *Potamocypris* species. Intermediate forms exist; the European *Potamocypris unicaudata* Schäfer, 1943, for example, has a left valve in which the selva is peripheral anteriorly (so that there is no flange, as in many *Potamocypris*) but posteriorly displaced inwards resulting in a prominent flange which overlaps the margin of the right valve (as in *Cyprilla*) (Meisch, 2000). Remarking on other variable characters (including long or short swimming setae on the antennae, and the number and form of setae on the distal maxillary palp segment) George & Martens (2002) concluded that *Cyprilla* is potentially a polyphyletic taxon which should not be used as a formal genus or subgenus. In accordance with this opinion we assign *humilis* to *Potamocypris*.

There are two groups of *Potamocypris*, one comprising species with short swimming setae on the antennae, the other group having long swimming setae (Meisch, 1984, 1985); *P. humilis* belongs to the latter group (see Text-fig. 1). In our collection from Harris, both adults and juveniles were observed (by hand lens

in the field and under a low-power binocular microscope later the same day) to be active swimmers.

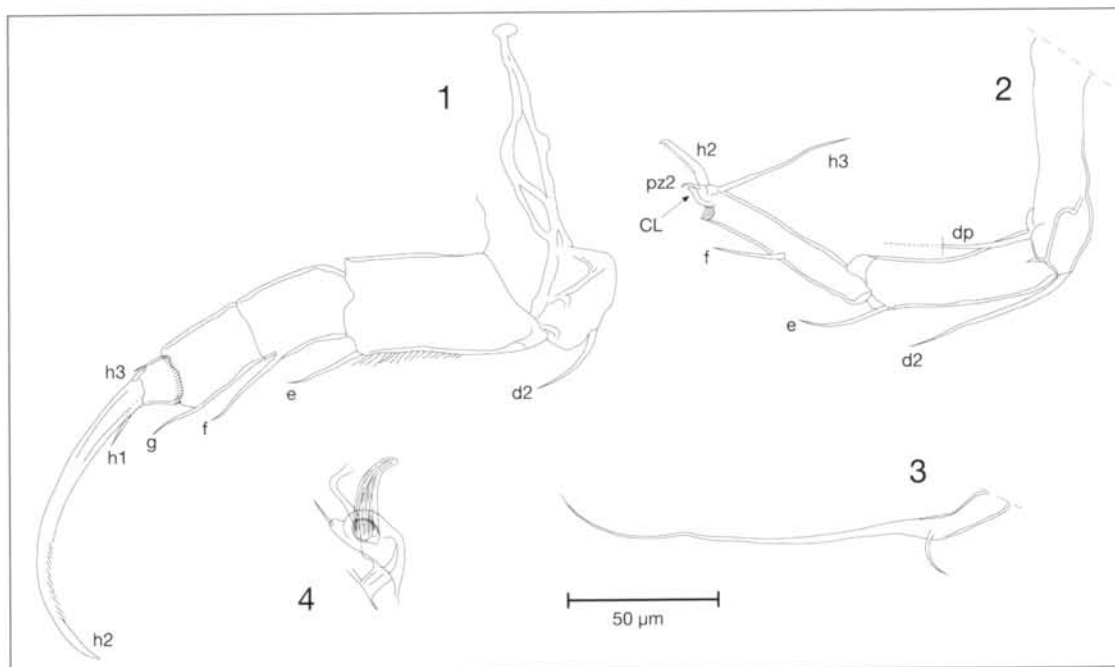
The question of the significance of the tuberculate juveniles, however, remains unresolved. Purasjoki (1948) suggested that if this character were demonstrated in other *Cyprilla* spp. juveniles, it would provide a good reason to maintain *Cyprilla* as a separate genus. We have been unable to find any indication, in the available literature, of the presence or absence of such ornament in the juveniles of the other four species assigned to *Cyprilla* by Sars (1924), or, for that matter, in any *Potamocypris* species. Such ornament is not uncommon in cypridoidean ostracods (it is seen in adults and juveniles of many *Ilyocypris* species, for example), but the total loss of prominent tubercles in the final moult appears to be unusual, although it has been reported in other taxa, for example in *Ilyocypris bradyi* Sars, 1890 (Scharf, 1981; Meisch, 2000).

SYSTEMATICS

Order PODOCOPIDA Sars, 1866
Suborder CYPRIDOCOPINA Jones, 1901
Superfamily CYPRIDOIDEA Baird, 1845
Family CYPRIDIDAE Baird, 1845
Subfamily CYPRIDOPSINAE Kaufmann, 1900

POTAMOCYPRIS HUMILIS (Sars, 1924)
Pl. 1, figs 1-14; Pl. 2, figs 1-8; Text-figs 1-2

Type material – Sars Collection, Zoological Muse-



Text-fig. 2 - Appendages of *Potamocypris humilis*, adult female from Harris, Scotland, BMNH no. 2004.426. 1) sixth limb (walking leg); 2) seventh limb (cleaning leg); 3) furca; 4) genital hook; all x 460 (scale bar = 50 µm).

um, Oslo, Norway, slide no. F10922, Mp464 (4 syntypes); South African Museum spirit tube no. S.A.M. A11306 (2 poorly preserved syntypes); no holotype designated. This type material was examined by Meisch (1985) who did not consider it necessary to establish a lectotype.

Type locality – Dam at Faure, Cape Flats, South Africa, lat. 33° 52' S, long. 18° 22' E.

Diagnosis – Adult carapace in lateral view with a long, straight (left valve) to slightly convex (right valve) dorsal margin sloping down to a distinctively truncated posterior margin, with which it makes an angle of approx. 110°; anterior margin broadly rounded, ventral margin weakly concave. Maximum height one quarter of the length from the anterior. External surface of carapace pitted/finely reticulate, with numerous normal pores from which sensilla extend, giving the carapaces a hirsute appearance. Normal pores tending to form small pore conuli, especially near the margins of the valves. Right valve overlaps left valve along dorsal and ventral margins; left valve with anterior and posterior marginal flanges extending beyond a well-developed selvage, especially prominent in the posteroventral corner and the lower two-thirds of the anterior margin, so that the left valve overlaps the right in these regions; selvage peripheral along the ventral margin. Weak dorso-median (post-ocular) sulcus in left valve only.

Antenna with long natatory setae extending well past ends of the terminal claws. Beta seta of mandibular palp broad, leaf-shaped with marginal setules. Female copulatory hook proximally straight, with maximum curvature in the distal third.

Juvenile carapaces with prominent tubercles in addition to pitted/reticulate ornament: a prominent swollen post-ocular tubercle (near the dorsal margin just behind the dorsal angle at maximum height) distally pointed and slightly curved towards the posterior; a cluster of pointed tubercles (near the dorsal margin, close to the angle with the posterior margin) which overhang the dorsal margin in the lateral view; a ventro-lateral row of several small, rounded tubercles sub-parallel to the ventral margin; and several other small, scattered tubercles. The majority of the tubercles appear to be formed by the expansion of certain pore conuli and the associated reticulation. A distinct adductor muscle node is also developed in smaller juveniles (A-3 - A-5). Reticulation relatively coarser in smaller juveniles (A-4, A-5), with development of secondary pitting in the fossae, especially in the anterior region.

Remarks – Morphological differences are apparent between the adult specimens from Finland (illustrated by Meisch, 1985, figs 26, 27) Scotland (herein, Pl. 1, figs 1, 2, 4, 6, 10) and South Africa (herein, Pl. 1, figs 3, 5, 7-9, 11). The carapaces of the Finnish specimens

are less elongate, have a more sharply truncated posterior margin, and have narrower marginal flanges than either the Scottish or the South African specimens. The Scottish specimens are, in turn, slightly less elongate and slightly more tapered posteriorly, in lateral view, than those from South Africa, but they have somewhat broader marginal flanges. We have had no opportunity to examine variation in large populations, however, and in comparison with the range of intraspecific variation described for other *Potamocypris* species (e.g. Meisch, 1985) the above-noted differences seem quite minor. To the best of our knowledge, the presence of spiny tuberculate ornament in juveniles but not adults is unique to *P. humilis*. We offer two tentative functional explanations for the ontogenetic development of the ornament. Firstly, it may be to protect juveniles against predators that do not prey on the larger adults. Secondly (and much more speculatively), the spinose tubercles may render juveniles more easily caught among birds' feathers, thus facilitating their dispersal (see discussion of distribution below); adults are likely to be either about to lay eggs, or having laid them, have no further reproductive potential, so would gain no advantage from being picked up and dispersed, whereas juveniles thus transported to another pond could survive to reach adulthood and reproduce.

DISJUNCT DISTRIBUTION OF *POTAMOCYPRIS HUMILIS*

As already mentioned, Purasjoki (1948) proposed transport by migratory Arctic and Common terns to explain the occurrence of *P. humilis* in Finland and South Africa. The potential for dispersal of ostracods by migratory birds is well known (e.g. McKenzie, 1971b; Sandberg & Plusquellec, 1974; De Deckker, 1977; Grigg & Siddiqui, 1993). Cypridoidean (and at least some cytheroidean) ostracods are predisposed to such passive dispersal by virtue of their desiccation-resistant eggs (which can remain viable for years) and the ability of adults to survive adverse conditions (for at least days or weeks) in a torpid state (Horne & Martens, 1998). Eggs and individuals (especially small juveniles) might easily become stuck to the feet or feathers, or survive passage through the digestive tracts of birds that bathe, drink or feed in the water bodies inhabited by the ostracods. However, although some ostracod distributions have been shown to match the routes of bird migrations (see, e.g. De Deckker, 1977), the evidence for such dispersal remains circumstantial. Proof of a specific ostracod being dispersed in this way by a specific bird has yet to be obtained.

The Arctic Tern (*Sterna paradisaea*) undertakes the most extensive migrations of any bird; its breeding grounds are circumpolar in the northern hemisphere, and in the non-breeding season it migrates to Antarctic waters, involving a return journey of up to 20,000 km (Monaghan, 2002). Birds from northern Europe follow the western coasts of Europe and Africa. Breed-

ing populations have been recorded in Scotland, including Harris, in May–August; birds ringed in Britain and Ireland have been recorded at many locations along the coasts of West and South Africa (Text-fig. 3) from August to June. At least parts of the migrations are believed to occur at high altitude, possibly thousands of metres. Birds ringed on the coast of Finland, including the Tvärminne area, have subsequently been recovered in the British Isles (Monaghan, 2002). The Common Tern (*Sterna hirundo*) has similar but less extensive migrations, and birds ringed in Britain and Ireland have been recovered in South Africa (Norman, 2002). The Sandwich Tern (*Sterna sandvicensis*) is a third possibility: birds ringed in the British Isles have been recovered at many locations along the coasts of western and southern Africa (Noble-Rollin & Redfern, 2002). The known occurrences of *P. humilis* thus fall within the migratory routes of three species of terns, the best match being with the Arctic Tern (Text-fig. 3). Most records of *P. humilis* are from coastal areas, but the record from Namibia is several hundred kilometres inland, in an upland area, which might seem to raise an objection to the hypothesis of dispersal by terns; however, although the great majority of British migrant terns have been recovered in coastal regions, there are a few inland recovery sites as well (Wernham *et al.*, 2002).

The seasonal distribution of the birds also corresponds well with that of the ostracods. Purasjoki (1948) described, illustrated and discussed *Cyprilla humilis* mainly on the basis of specimens collected on the island of Storshundsharen in the Tvärminne area in the summer of 1947, adding as a footnote that he had also found it on the same island in summer 1945 but had taken little notice of it at the time. An additional collection of about 50 specimens from the Tvärminne area, attributed to K.J. Purasjoki, July 1954, was listed by Meisch (1985) as being in the Klie collection (it is not certain whether this collection was from Storshundsharen or another locality). In July 1966, it was found again on Storshundsharen and also on Spikarän, another island in the Tvärminne archipelago, by Hagerman (1967). It has therefore been recorded four times on the same Finnish island over about 20 years, suggesting that it is not simply a rare or occasional

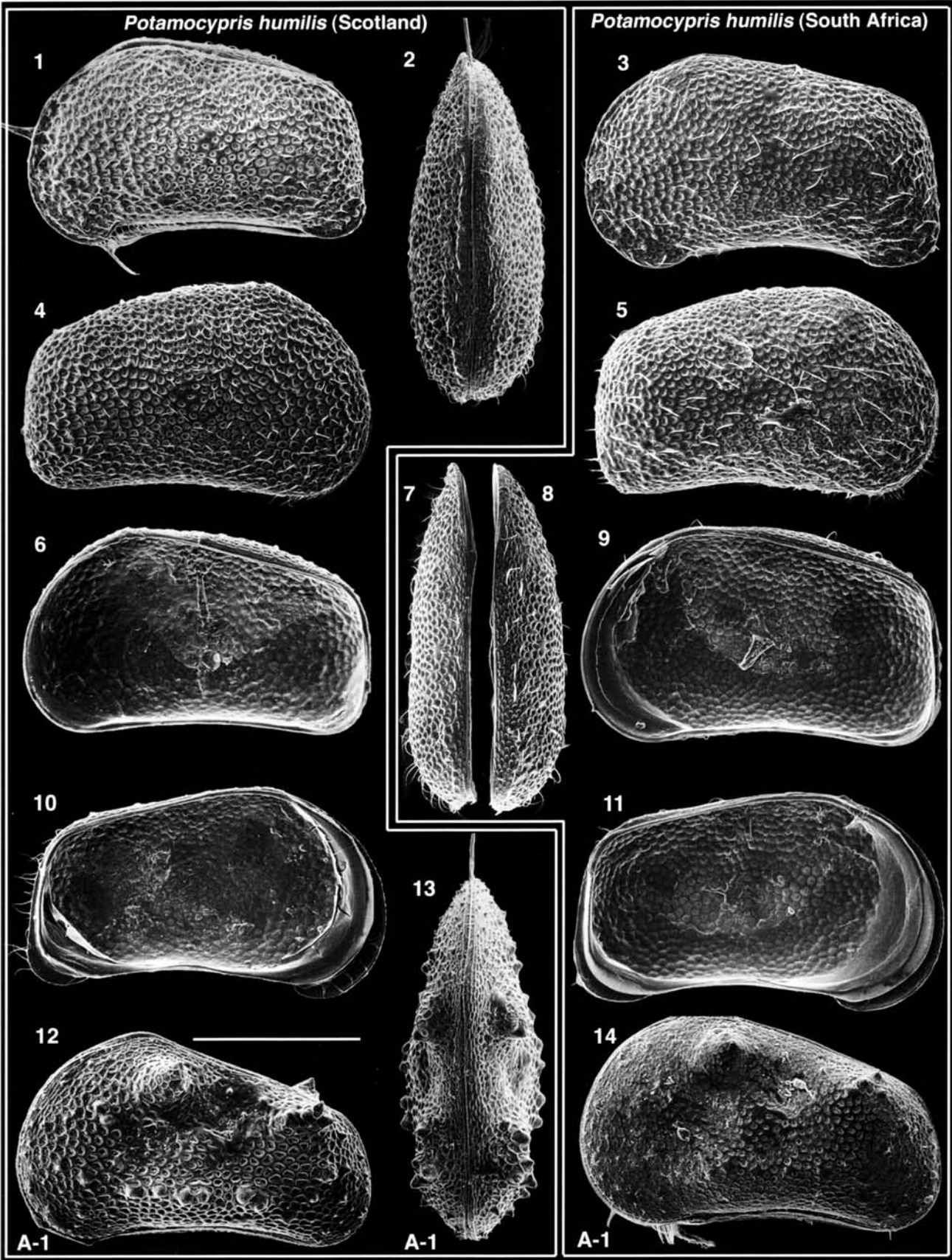
visitor introduced by migrating birds. Sars (1924) gave no information about the time of year in which his *Cyprilla* specimens were collected, but Meisch (1985) cited one collection of *humilis* in the South African Museum as having been collected (near Lilyfontein) in September 1932 by R. Lawrence. More recently, Martens *et al.* (1996) recorded it (as *Cyprilla humilis*) in a semi-estuarine coastal lake, Verlorenvlei (Western Cape, South Africa) in April 1993, during the dry season; Martens (pers. comm.) has also found it in this area (near Van Rhynsdorp) in September (specimens illustrated herein) as well as in several other Western Cape localities in April, September, October and December, and near Windhoek in Namibia in September.

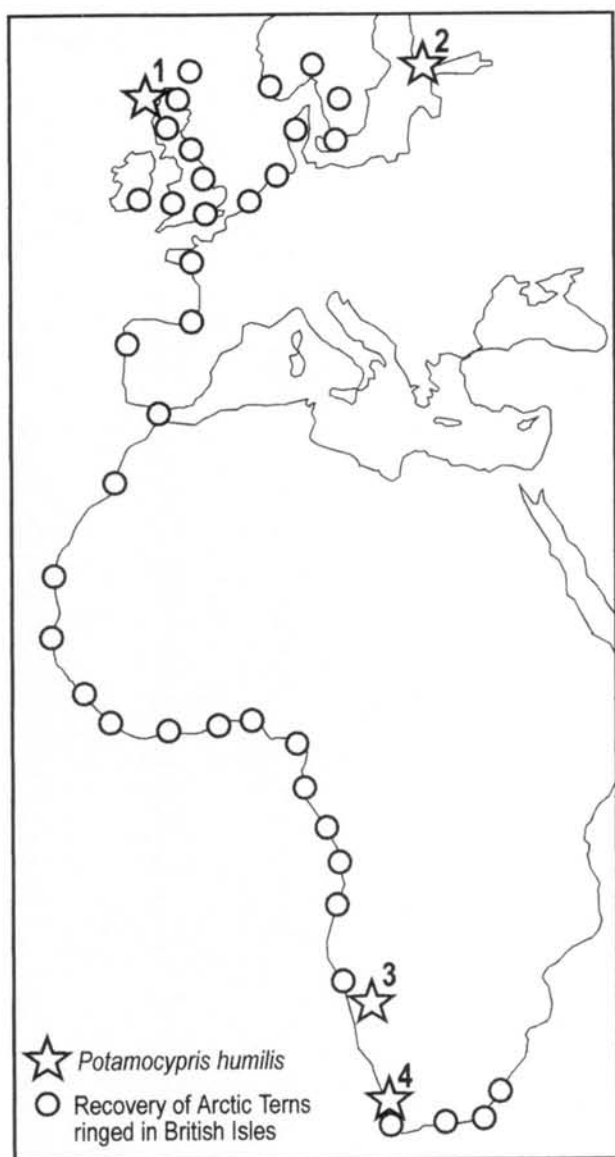
We found no males in our Scottish population and none were reported in the Finnish collections by Purasjoki (1948) and Hagerman (1967); Sars (1924) stated that a single male specimen was present in the type material of *Cyprilla humilis* from Faure (Cape Flats) in South Africa, but he only illustrated a female, and there have been no other reports of males (Meisch, 1985). We consider it probable, therefore, that *Potamocypris humilis*, like most cypridid ostracods, has mixed reproduction and can occur in all-female populations as well as (more rarely) populations containing a mixture of sexual and parthenogenetic individuals (Martens, 1998).

There is no justification for regarding *P. humilis* as a South African species that has been introduced to Europe, simply because it was first described formally from a South African locality; nor, indeed, is there any good reason to prefer the opposite interpretation: that it is a European species introduced to South Africa. We consider at least equally likely that it is a species with a true bi-hemispherical distribution, living in similar habitats and climatic conditions in both northern and southern hemispheres, and with interchange between the two areas maintained by eggs transported by migrating birds. The combination of parthenogenesis and desiccation-resistant eggs (the latter possessed by most, if not all, cypridoidean ostracods) is highly advantageous for dispersal, since it only takes one egg to start a new population in a new habitat (Horne & Martens, 1998, 1999). The fact that Sars

EXPLANATION OF PLATE 1

- Figs 1, 2, 4, 6, 10, 12, 13 - *Potamocypris humilis* (Sars, 1924), Harris, Scotland; BMNH nos. 1) adult female CC left lateral view, 2004.415; 2) adult female CC dorsal view, 2004.415; 4) adult female CC right lateral view, 2004.419; 6) adult female RV internal lateral view, 2004.418; 10) adult female LV internal lateral view, 2004.418; 12) juvenile (A-1) CC left lateral view, 2004.421; 13) juvenile (A-1) CC dorsal view, 2004.416. Figs 1, 2, 4, 6, 10 all x 121 (scale bar = 247 µm); figs 12, 13 x 146 (scale bar = 205 µm).
- Figs 3, 5, 7-9, 11, 14 - *Potamocypris humilis* (Sars, 1924), Blinkvlei, South Africa. 3) adult female LV external lateral view, 2004.432; 5) adult female RV external lateral view, 2004.432; 7) adult female LV dorsal view, 2004.434; 8) adult female RV dorsal view, 2004.434; 9) adult female RV internal lateral view, 2004.433; 11) adult female LV internal lateral view, 2004.433; 14) juvenile (A-1) CC, left lateral view, 2004.435. Figs 3, 5, 7-9, 11 all x 121 (scale bar = 247 µm); fig. 14 x 146 (scale bar = 205 µm).





Text-fig. 3 - Distribution map: stars indicate localities/areas in which *Potamocypris humilis* has been recorded: 1) Scotland; 2) Finland; 3) Namibia; 4) South Africa; see text for further details. Circles indicate approximate locations of recoveries of Arctic Terns ringed in the British Isles (based on Monaghan, 2002).

(1924) actually reared four of his five species of *Cyprilla* (but not *humilis*) from mud sent from South Africa and placed in aquaria in Norway is clear evidence that this particular group of *Potamocypris* species possesses desiccation-resistant eggs, even if the dispersal medium in this case was the postal service and not birds. Nothing is known of the life-cycle of *P. humilis*, but the population age-structure of our July collection in Scotland (A-5 to A-1 juveniles plus adults), together with the fact that adults and late-stage juveniles in

Finnish collections were also found in July, would be consistent with the idea that the eggs hatch in May-June and the new adults lay eggs in July-August. The South African occurrences for which dates are recorded show that adults can be found between September and April. The available data are consistent with the notion that this species is a seasonal form which grows and lives in the summer/dry season in both hemispheres, overwintering as eggs.

Nevertheless, while the available data offer strong support for the idea that *P. humilis* owes its dispersal to terns, it must be emphasized that the evidence is only circumstantial. It is also worth pointing out that while there is a good match between the distribution of *P. humilis* and the migratory routes of the terns, it is perhaps unlikely that these are the only birds responsible for the ostracod's dispersal. Other possible vectors include Sandwich Tern (*Sterna sandvicensis*), Sanderling (*Calidris alba*), Red Knot (*Calidris canutus*), and Barn Swallow (*Hirundo rustica*) (R. Prys-Jones, pers. comm.; Wernham *et al.*, 2002). The hypothesis that *P. humilis* is a "frequent traveller" could be tested by mapping its clonal genetic diversity, by means of allozyme analysis (e.g. Rossi *et al.*, 1998) and DNA (nuclear and mitochondrial) analysis (e.g. Schön & Butlin, 1998). Proof that it is actually transported by terns (or any other birds) is only likely to be obtained if individuals or eggs can be found on birds arriving after migratory flights.

CONCLUSIONS

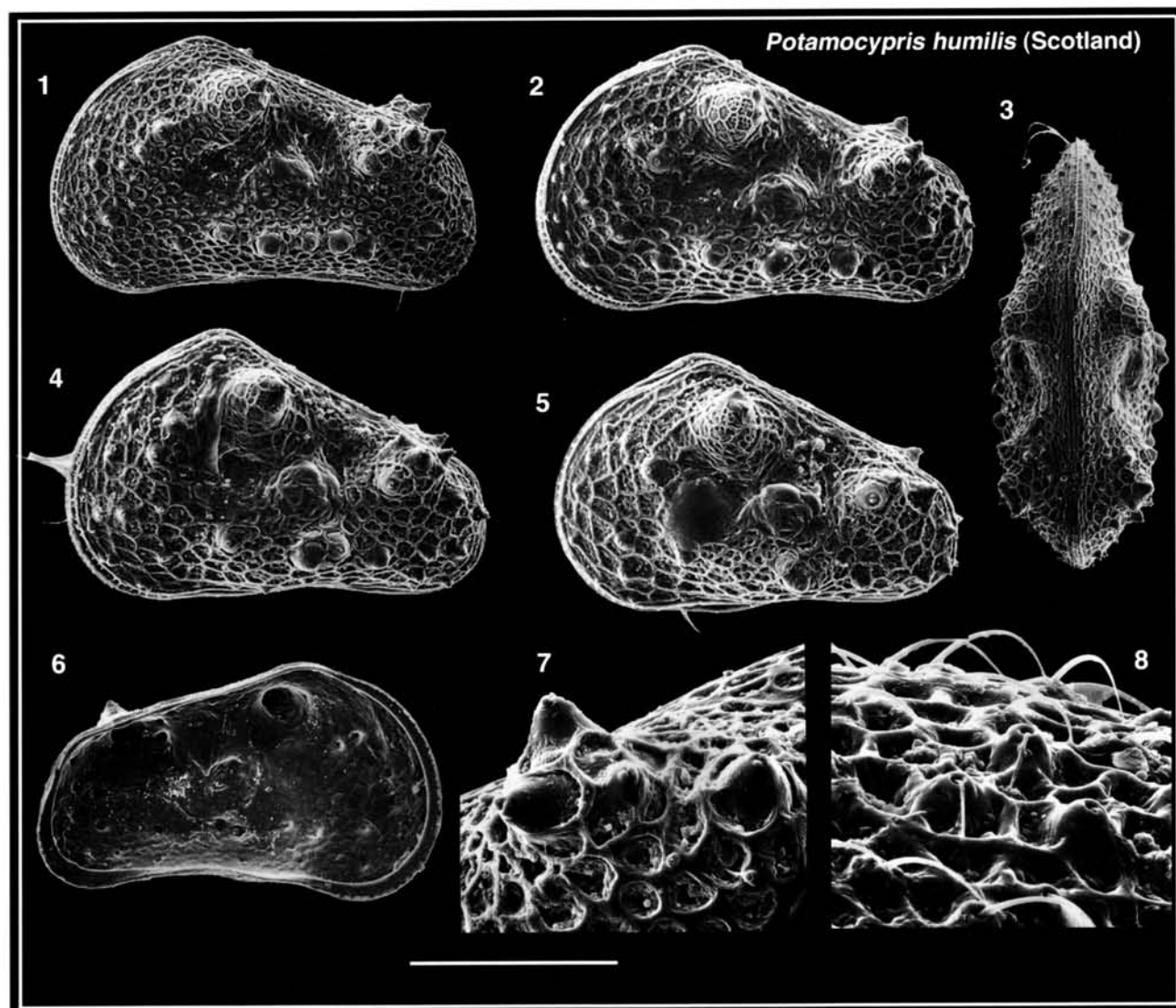
The genus *Cyprilla* Sars, 1924 is considered to be a junior synonym of *Potamocypris* Brady, 1870.

Potamocypris humilis has an ontogenetic development of carapace ornament that has so far not been described in any other cypridoidean species: the presence in juveniles (at least A-5 to A-1) of prominent tubercles, some of them spinose, as well as a fine reticulation/pitting, while adults are only finely reticulate all over, the tubercles being totally lost in the final moult.

Potamocypris humilis is found in the northern hemisphere in Finland and Scotland, and in the southern hemisphere in South Africa; it appears to be a summer form in each hemisphere. This disjunct distribution may be explained by dispersal by seasonally migrating seabirds, possibly Arctic Terns, a process facilitated by the fact that the ostracod has desiccation-resistant eggs and reproduces (mainly) parthenogenetically.

ADDENDUM

The rockpool near Rubha Romaigidh was revisited by the first author (DJH) on 8th June 2004, when abundant ostracods were collected; preliminary results indicate the presence of *P. humilis* (adults and juveniles), *Ilyocypris bradyi* and *Cypria ophtalmica*. On the



EXPLANATION OF PLATE 2

Figs 1-8 - *Potamocypris humilis* (Sars, 1924), Harris, Scotland; BMNH nos. 1) juvenile (A-2) CC, left lateral view, 2004.422 (x 167, scale bar = 180 μ m); 2) juvenile (A-3) CC, left lateral view, 2004.423 (x 200, scale bar = 150 μ m); 3) juvenile (A-2) CC, dorsal view, 2004.417 (x 167, scale bar = 180 μ m); 4) juvenile (A-4) CC, left lateral view, 2004.424 (x 240, scale bar = 125 μ m); 5) juvenile (A-5) CC, left lateral view, 2004.425 (x 286, scale bar = 105 μ m); 6) juvenile (A-1) LV internal lateral view, 2004.420 (x 146, scale bar = 205 μ m); 7) juvenile (A-1) RV, detail of posterodorsal region (lateral view) showing expansion of pore conuli and reticulation to form tubercles, 2004.420 (x 545, scale bar = 55 μ m); 8) adult female carapace, detail of ornament in posterodorsal region (dorsal view) showing reticulation, pore conuli and sensilla, 2004.415 (x 857, scale bar = 35 μ m).

same day several other adjacent pools were sampled and appeared to be barren of ostracods, but a second population of *P. humilis* was found in another rock-pool approximately 100 m South of the original one (NG 034960), together with *Ilyocypris* cf. *bradyi*, *Candona* cf. *candida* (O.F. Müller, 1776) and juveniles of *Heterocypris* cf. *salina* (Brady, 1868). Exploring the rocky coast about 1 km North towards Aird Niosaboist (NG 045976) the first author was then mobbed by large numbers of terns (probably Arctic Tern), behaviour

taken to be indicative of the close proximity of a breeding colony; in view of the increasing agitation of the birds further investigation was considered inadvisable.

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David J. HORNE

Department of Zoology
The Natural History Museum
Cromwell Road
London SW7 5BD, UK
and
Dept of Geography
Queen Mary, University of London
Mile End Road
London E1 4NS, UK

Robin J. SMITH

Department of Earth Sciences
Kanazawa University, Kakuma
Kanazawa 920 - 1192, Japan