An introduction to the branchiopod crustaceans

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Summary

The Branchiopods are a diverse and ancient class of crustaceans occurring in freshwaters, marine and (some genera) in hyper-saline environments. They include the Cladocera (or water fleas), fairy and brine shrimps, tadpole shrimps and clam shrimps. Morphologically heterogeneous, they are united by the structure of thoracic limbs which have flattened structures associated with respiration and swimming. An overview of the class is provided, including both extant and extinct orders, together with notes on their economic importance and the British fauna.

Introduction

The Branchiopods are an ancient and diverse class of the Crustacea characterised by flattened and foliaceous thoracic appendages (thoracopods); these structures have a respiratory (as well as other) function hence the name branchio- (breathing) poda (legs). The Class includes the Cladocera ('water fleas') and the 'phyllopod' orders; tadpole shrimps, fairy shrimps and clam shrimps, and has around 1,200 living species in 30 classes; a recent study has determined that there may actually be over twice this number of species [1]. The majority of species live in freshwaters varying from stagnant ephemeral pools to lakes and weakly-running waters. A number of species occur in saline waters, including inland hyper-saline lakes and world oceans. Most species are filter feeders, although the tadpole shrimps are benthic omnivores, several species are predators and one, *Anchistropus emarginatus* is an ectoparasite, feeding on the ectoderm of *Hydra*. Many species of the Cladocera are small to microscopic and are amongst the smallest crustaceans known (*Alonella nana* for example, typically has an adult body length of less than 0.2 mm) whilst the 'phyllopod' species are macroscopic, and can grow up to 70 mm (e.g. *Triops cancriformis*) or 100 mm in the case of the fairy shrimp *Branchinecta gigas*.

For a full account of the Branchiopoda, the reader is directed to the work of Dumont and Negrea [2].

Classification

The classification of the Branchiopoda has a long and mixed history. The term *Branchiopoda* was established by Latreille in 1817. Three sub-orders were recognised by Sars in 1867; the Phyllopoda (the 'large' branchiopods), Cladocera (the 'water fleas') and Apistodostraca (= Branchiura, no longer considered Branchiopods). Sars later modified this scheme (1890) to one that contains most of the extant names:

Suborder Phyllocarida (now classified with the Malacostracan crustaceans)

Suborder Phyllopoda
- Notostraca (tadpole shrimps)
- Conchostraca (clam or seed shrimps)
- Anostraca (fairy shrimps)

Suborder Cladocera (water fleas)
- Calyptomera
- Ctenopoda
- Anompoda
- Gymnomera
- Onychopoda
- Haplopoda.

Revision of the classification of branchiopods continued throughout the late 19th and 20th centuries until the modern basis for classification was developed by Fryer in 1987 [3], who dispensed with the supra-ordinal hierarchic levels and proposed eight extant and two fossil orders:

Order Anostraca
Order Lipostraca (extinct)
Order Spinicaudata
Order Laevicaudata
Order Anomopoda
Order Ctenopoda
Order Onychopoda
Order Haplopoda

Order Notostraca
Order Kazacharthra (extinct).

Since Fryer's publication, further studies have been performed using DNA analysis e.g. [4] for extant orders, and cladistics analysis for both living and extinct orders. One of the most recent phylogenies is by Olssen [5] who performed cladistics analysis on 19 living and 6 fossil species, scoring each against 80 morphological features. No doubt there will continue to be minor revision to the phylogeny of the branchiopods but it is generally accepted that the fairy shrimps (Anostraca) are an ancient sister group to the other seven branchiopod orders (Fig.1).

The 'Small' Branchiopod Orders

The 'small' branchiopods comprise the Cladocera – those animals loosely termed 'water fleas' and comprising the Anomopoda and Ctenopoda, which are predominantly filter feeders, and two predatory orders, the Onychopoda and Haplopoda. In size they vary from approximately 0.2mm in *Alonella* to 10mm in *Leptodora*. The majority are planktonic or benthic in freshwater habitats, ranging from temporary puddles and ditches to continental lakes; other habitats include wet mosses on the floor of cloud forests and tree trunks. Approximately 20% of species are now known to occur in ground-waters (possibly retreating there during adverse conditions) and a few species are stygbiotic (cave-dwelling). However, the 'typical' habitats for Cladocera are large, permanent lakes where all habitats are exploited including the pelagic, the littoral, the benthos and water-plant zones.

Most species reproduce parthogenetically most of the time. Embryo development begins and is usually completed in the brood chamber, a space between the body and the carapace. Egg clutch size typically varies with the size of the species, from one or two eggs in the smallest of species up to tens (or hundreds) of eggs in the largest of species. Live young are usually borne which have the same appearance as the adult. Growth is by moulting. Under conditions of environmental stress, such as reduction in the availability of food, over-crowding, or reduction

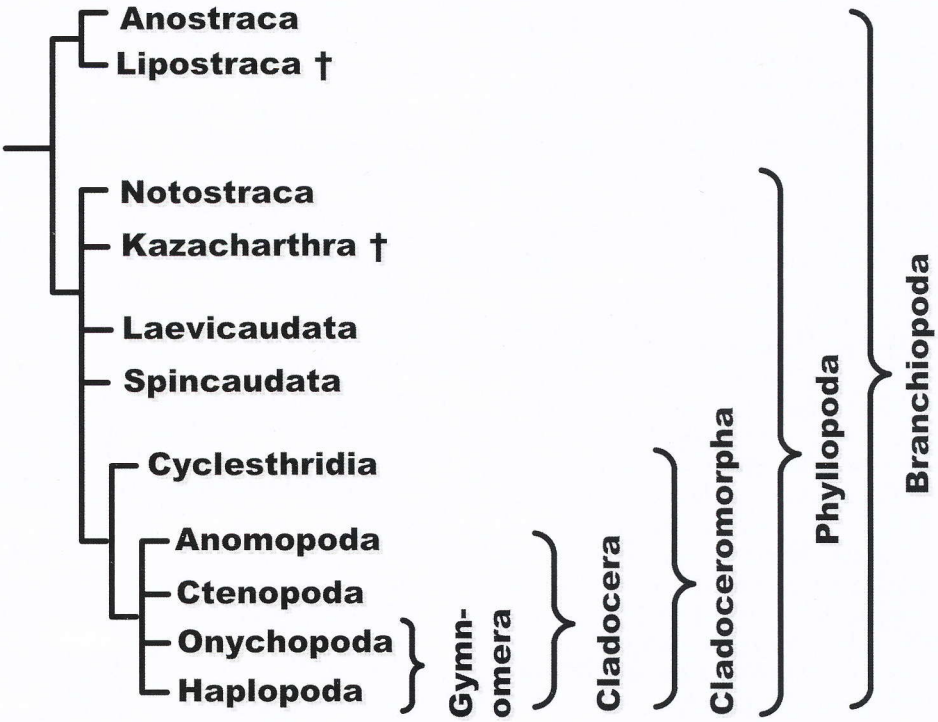

FIG. 1 **Current phylogeny of the Branchiopoda** [after Olssen].

in photoperiod, males are produced asexually which fertilise haploid eggs in the brood chamber. The diploid egg undergoes several cell division cycles after which development is arrested (diapause). These resting 'eggs' are resistant to freezing and drying and are further protected by an ephippial case, formed from a thickened part of the carapace. Most ephippia sink and attach to the substrate; those of *Daphnia* tend to float where they may be ingested by birds or fish as an aid to dispersal. Ephippia may survive for several years or decades; development of the embryo is stimulated by water, increasing day length and high oxygen concentrations. In the Haplopoda, however, the eggs hatch into nauplius larvae, rather than the miniature adults seen in other Cladocera.

Anomopoda

The Anomopoda is the largest Order within the Branchiopoda, with about 560 species in 10 families. Anomopods have a bivalve carapace that protects the trunk and limbs of which there are five or six pairs, of variable shape and size. The head is protected by a head-shield, which is usually well-developed (Fig.2). In most circumstances, the Anomopoda are the most common order of cladocerans, and include the genera *Daphnia*, *Chydorus* and *Bosmina*.

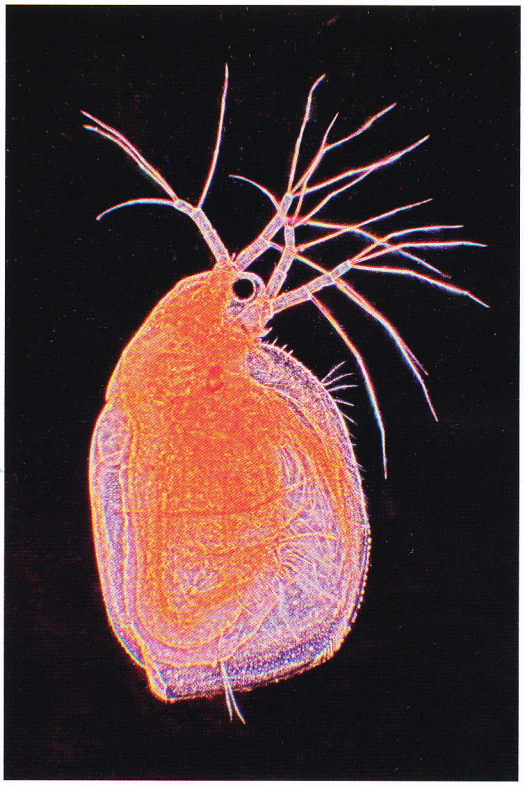

FIG. 2 **Amonopod cladoceran; *Simocephalus vetulus***
Commonly found associated with vegetation. Grizedale Forest, Cumbria, UK. Body length 1.6 mm.

Ctenopoda

The Ctenopoda (Fig.3) are distinct from the Anomopoda in not having head-shields and always having six pairs of trunk limbs which are similar in shape although the 6th pair is reduced in size. There are only two families; the Sididae with 50 described species in 8 genera and Holopediidae with one genus and two species.

Onychopoda

The Onychopoda (Fig.4) are all predatory Cladocera and are characterised by a much-reduced carapace leaving the limbs uncovered and typically large heads of which the eye occupies the major portion. They are very

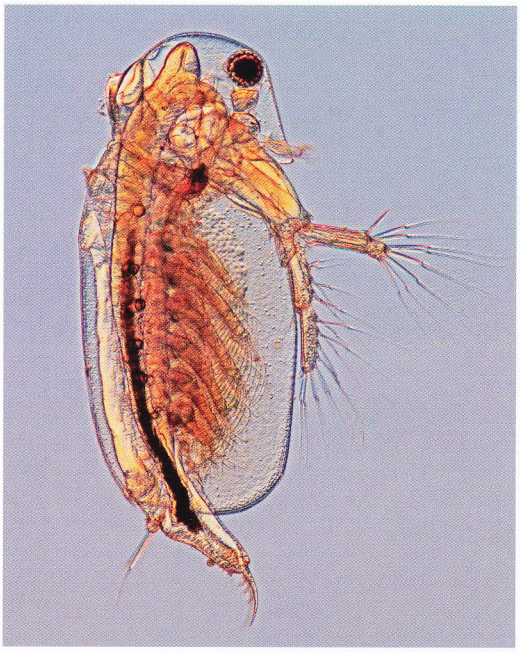

FIG. 3 **Ctenopod cladoceran; *Sida crystalline***
Widespread but not particularly common; occurs in larger lowland lakes, attached to the underside or stems of aquatic plants. Virginia Water, Surrey, UK. Body length 2.95 mm.

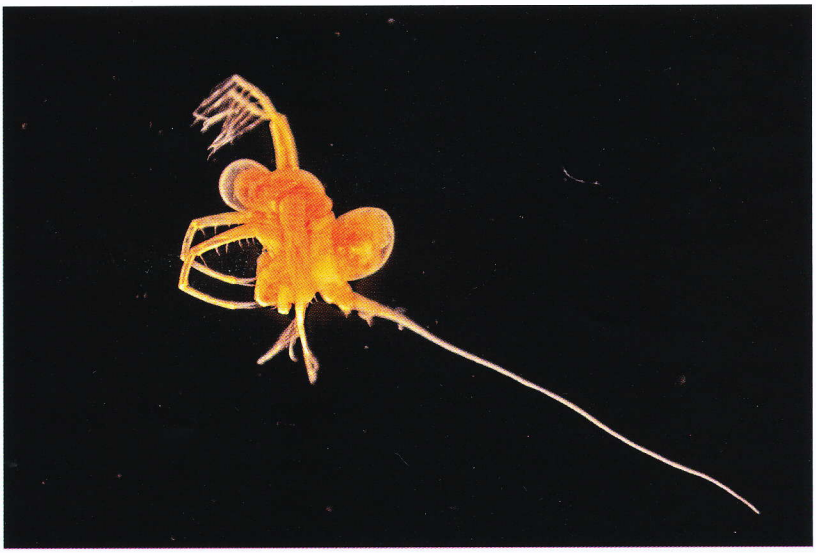

FIG. 4 **Onychophorna cladoceran; *Bythotrephes longimanus***
A predatory member of the plankton of larger lakes. Coniston Water, Cumbria, UK. Body length 2.4 mm excluding caudal spine.

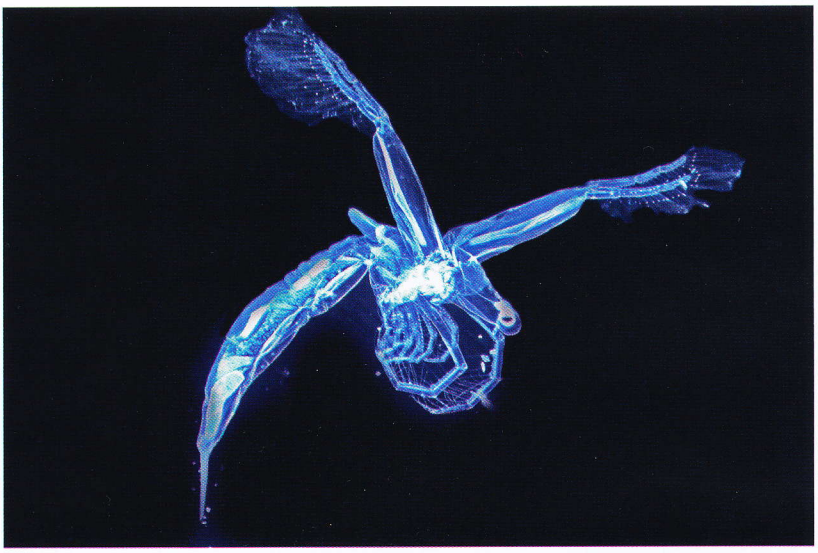

FIG. 5 **Haplopod cladoceran; *Leptodora kindtii***
The most hyaline non-marine organism, found in larger lakes. Very rare in the south and east. Coniston Water, Cumbia, UK. Body length 9.7 mm.

mobile animals, rapidly searching for, and grasping, prey. There are three families and a total of 33 described species.

Haplopoda

There is only one genus and species within the Haplopoda. *Leptodora kindtii* (Figure 5) differs from other 'water fleas' in having a very elongated body, an elongated head with a single large complex eye consisting of approximately 500 specialised, radially arranged ommatidia. *Leptodora* is predatory and is reputedly the most hyaline (transparent) non-marine animal; in plankton collections it is only detected by the water currents created by its swimming motion. The species is planktonic, usually restricted to larger lakes, although the author has found individuals in both the Liverpool and Manchester canals, and Rousselet reported the species as present on two occasions in the Regent's Canal, London [6].

The 'Large' Branchiopod Orders

The 'large' branchiopods – fairy and brine shrimps, tadpole shrimps and clam or seed shrimps – occupy only waters where fish cannot

survive (although there are reports of co-existence of the tadpole shrimp *Lepidurus arcticus* with fish in some deep Norwegian lakes). This restricts the large branchiopods to temporary or vernal waters such as freshwater rock pools, puddles and clay pans which are subject to cycles of flooding and drying and, in two genera of fairy shrimps, to hyper-saline environments such as inland salt lakes. The distribution of large branchiopods is therefore restricted to regions where these habitats occur; although some species occur in temperate countries species diversity is greatest in the desert regions of California and Western Australia. Species diversity is reduced in regions of regular or high rainfall. Environments subject to regular freezing can also support large branchiopod populations; the author has found Notostraca less than 600 miles from the North Pole (in the Svalbard archipelago) and the clam shrimp *Eulimnaddia* in thermal pools in Yellowstone, Wyoming. Large branchiopods all survive in temporary water bodies by laying resistant eggs which can survive for several years in dry sediment; survival periods of 5 to 25 years have been recorded. Once rain arrives, the eggs hatch, growth to sexual maturity is rapid and the life cycle completed with resting eggs laid before the water dries out. One problem with such a life cycle is predicting if sufficient water has flooded the habitat to allow the life cycle to be completed before the water dries. This risk is mitigated by large branchiopods in two ways. In some species egg hatching when wetted is delayed, with hatching taking around 5 days whilst in other species the population of eggs contains a distribution of individuals that require several cycles of wetting and drying before the eggs hatch.

The Tadpole Shrimps – Notostraca

Tadpole shrimps (Fig.6), when present, are the largest and most easily recognised of the fauna of temporary ponds. The body is elongated with a large flattened head covered by a thick cuticle and a trunk of 24-44 rounded segments. The eyes are paired at the front of the head, and an ocellus is present. There are about 15 species and distribution is world-wide (except Antarctica) in fresh- and sometimes brackish temporary waters.

The tadpole shrimps have a fossil record extending back at least 220 million years. Mostly disarticulated carapaces or telsons are found (e.g. Fig.7) but well-preserved entire animals are sometimes uncovered (Fig.8). Morphologically some of these fossils are very similar to the living genus *Triops*, which has consequently been termed a 'living fossil' (or relict) species [e.g. 20]. However, this has been discredited by Hegna [7] who compared decay experiments on recently-deceased individuals with fossil *Triops* and by Vanschoenwinkel et al [8] who concluded

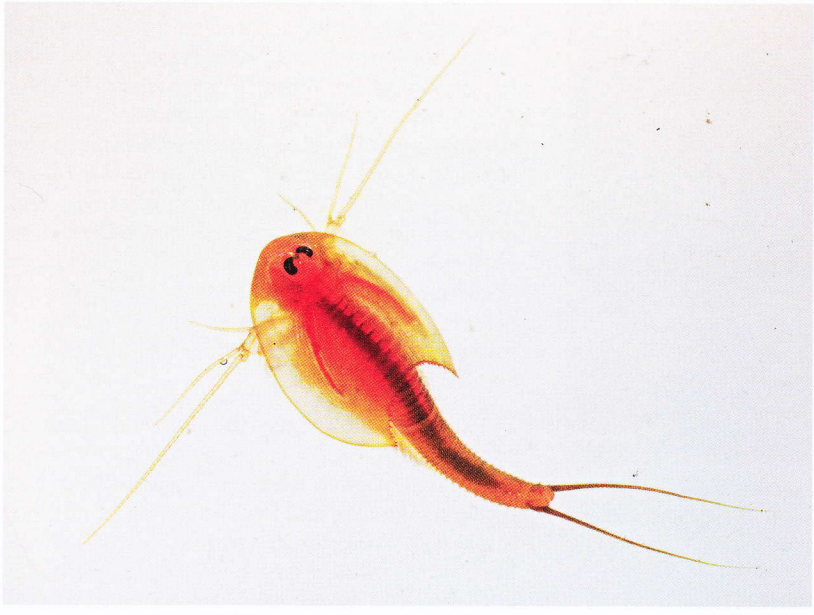

FIG. 6 **Tadpole shrimp (Notostraca); *Triops longicaudatus***
A typical inhabitant of temporary waters. Raised from a commercial kit. Body length approx. 56 mm.

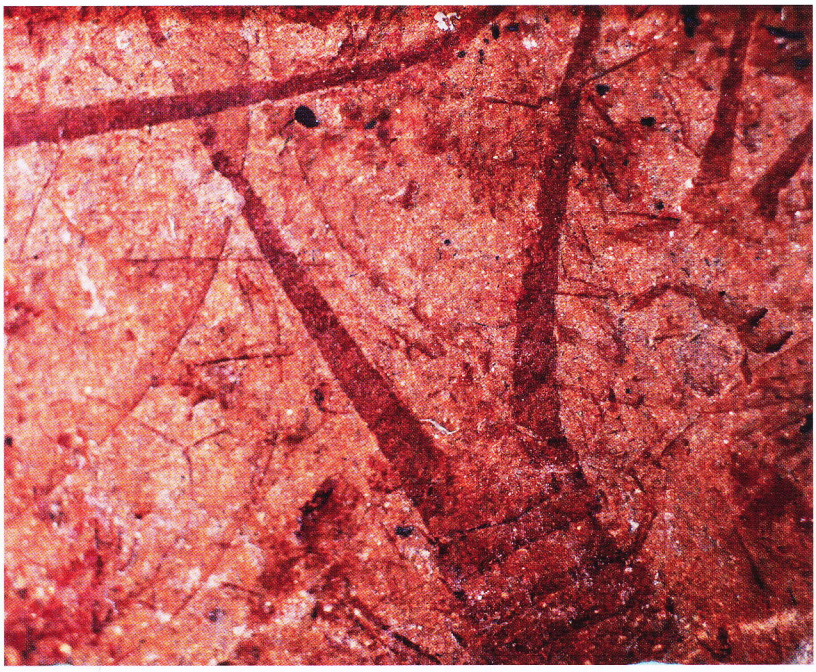

FIG. 7 **Fossil *Notostracan furca***
Jurassic, Victoria Land, Antarctica. Housed in the Natural History Museum, London. Photograph by the author, copyright Natural History Museum. Approx. length of segments present 0.55 mm.

FIG. 8 ***Fossil Notostraca; Chenops yixianensis***
Early Cretaceous, Yixian formation, Hebei Province, China. Housed at the Capitol Normal University, Beijing. Photograph by and copyright of Thomas A. Hegna. Body length approx. 45 mm.

from genetic analysis that the living species of tadpole shrimp are the result of a relatively recent radiation in the Cenozoic era and that similarities to 'ancient' Notostracan fossils are as a result of the highly conserved morphology within this group.

The Fairy and Brine Shrimps – Anostraca

Fairy shrimps are devoid of any form of carapace and have a distinct short head bearing stalked compound eyes, thoracic and abdominal regions with a total of 19 to 27 segments. The thoracic segments bear swimming legs which are used for filter-feeding whilst the abdominal region contains genital segments and terminates in two terminal lobes termed cercopods. There are approximately 290 anostracan species of which the majority are restricted to freshwaters. However, the genera *Artemia* of worldwide occurrence (except Antarctica and Australia before its introduction) and *Parartemia*, restricted to Australia (Figure 9) occur in saline and hyper-saline waters.

Fairy shrimps have the unusual habit of swimming upside-down. This has been claimed by the evolutionist Richard Dawkins [9] to be a recent adaptation and that, after tens of millions of years of evolution, anatomical features of the fairy shrimp would have changed sufficiently to challenge our concepts of dorsal and ventral.

FIG. 9 **Fairy Shrimp (Anostraca); *Parartemia contracta***
(specimen kindly identified by Prof. Brian Timms, University of New South Wales, Australia). Saline lake approximately 3 km NE of Hyden, Western Australia. Body length approx. 11 mm.

This suggestion has been firmly rebutted by Fryer [10], who notes that fairy shrimps have been swimming in this way for at least 130 million years (from the fossil record) and probably for all of the estimated 400 million years of existence of the order!

The Clam Shrimps – Laevicaudata, Spinicaudata and Cyclesthrida

The three orders of clam shrimps are typically 2–16 mm long and have 10– 32 pairs of thoracic legs enclosed in a carapace that wraps around the entire body. They swim with the legs down or forward, and swimming is performed in the same way as the Cladocera, using the second antennae which can be extended from the carapace. There are around 225 species of which *Laevicaudata* (e.g Fig.10) and *Spinicaudata* are 'typical' large branchiopods occurring in temporary freshwaters and of worldwide distribution (except the polar regions). *Cyclestherida*, however, are generally smaller (around 3 mm) and occur in both temporary and permanent waters, often associated with vegetation and appear restricted to the equatorial and tropic regions.

Like the Notostraca, clam shrimps have an extensive fossil record, extending at least to the Carboniferous, although usually only carapaces (and not whole animals) are found (Fig.11).

FIG. 10 **Clam Shrimp (Laevicaudata); *Eulimnadia* spp.**
Thermal lake at Mary Bay, Yellowstone National Park, USA. Body length approx. 5.5 mm.

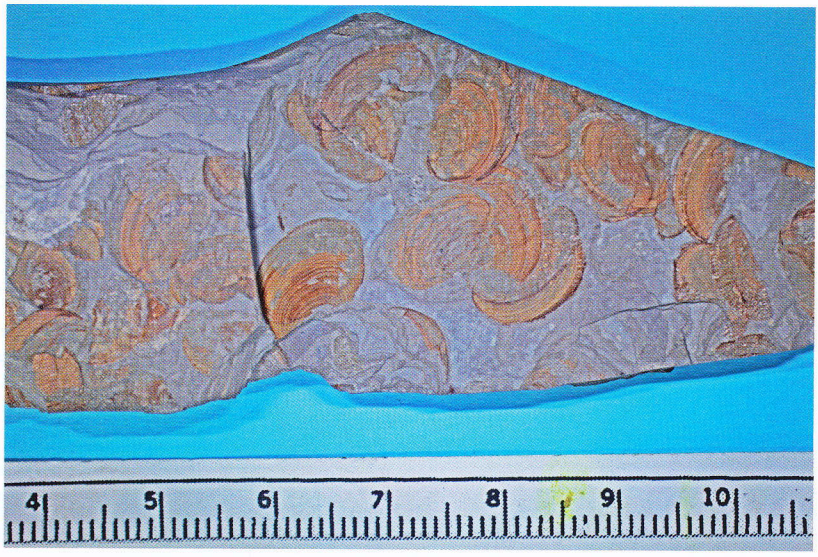

FIG. 11 **Fossil clam shrimps, *Eustheria* spp** Coal measures, Cefn Coed Colliery, Breconshire, UK. Housed in the Natural History Museum, London. Photograph by the author, copyright Natural History Museum. Body length approx. 1.1 to 1.4 mm.

Extinct Orders – Lipostraca and Kazacharthra

Lipostraca

The first fossil order to be recognised was identified by Scourfield in chert from Rhynie, Scotland [11, 12]. Rhynie is a small village approximately 50 miles north-west of Aberdeen. Between 400 to 420 million years ago, the region was geothermally active with hot springs and temporary pools where porous sinter rock was infused with silica, trapping communities of plants and microscopic animals. The resulting chert is a semi-transparent rock, from which fossils of a branchiopod-like animal were identified, similar to but distinct from the fairy shrimps. Scourfield erected the Order

FIG. 12 **Fossil Lipostraca; *Lepidocaris rhyniensis*** Housed in the Natural History Museum, London. Photograph by the author, copyright Natural History Museum. Rhynie chert field, Rhynie, Scotland. Approx. length of segments present 0.45 mm.

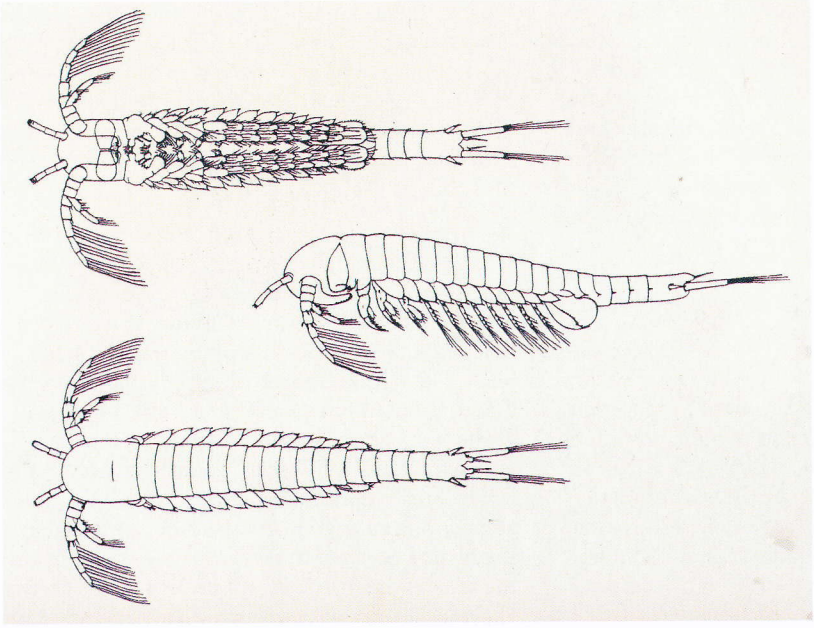

FIG. 13 **Reconstruction of the extinct *Lepidocaris rhyniensis*** (from Scourfield, 1927), found in the Rhynie chert fossil beds.

Lipostraca, and named the animal *Lepidocaris rhyniensis* (Figs.12,13). Research on the Rhynie beds and nearby Windyfield chert continues at the University of Aberdeen and several new branchiopod and branchiopod-like crustaceans have recently been identified.

Kazacharthra

The order Kazacharthra is only known from Jurassic and Triassic fossils found in Kazakhstan, Mongolia and parts of China. Currently about 25 species in 7 genera have been identified, of which *Almatium gusevi* is the most common (Fig.14). Morphologically the Kazachrathra have many similarities with the Notostraca and are classified as a sister group. They are however generally much larger (carapace length up to 5 cm) and the carapace is uniquely shaped and more sclerotized.

Economic Aspects

The economic impact of the branchiopods has not been calculated, but is certainly very high. Cladocera in particular serve as a major food source for larval fish in both natural freshwater

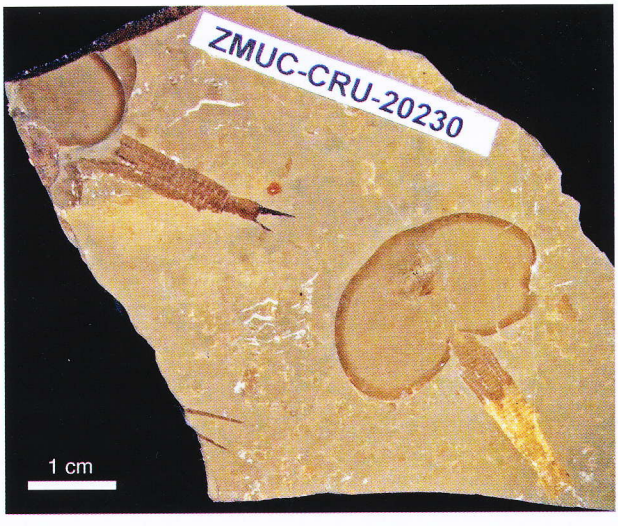

FIG. 14 **Fossil Kazacharthra; *Almatium gusevi*** Late Triassic, Xinjang Uygur Autonomous region, NW China. Housed in the Zoological Museum, University of Copenhagen. Photograph by and copyright of Thomas A. Hegna. Width of carapace approx. 2.7 mm.

environments and commercial farming of freshwater species. Cultivation of cladocerans, especially *Daphnia* species (*D. pulex* and *D. magna*) for the aquarium and fish farming trade appears largely to be a 'back yard' industry and the global value of this market has not been recorded. Some water utility companies actively manage fish stocks in drinking water reservoirs to encourage large populations of Cladocera, which control algal density by filter feeding; this significantly reduces the filtration requirements of the water during treatment.

As recently as 1989 tribes in the Fezzan region of the Libyan Sahara have been recorded eating *Artemia* brine shrimp which occur in dense populations in the salt lakes of that region; the tribes are called locally the Dawada, literally meaning the 'worm eaters'. It is also likely that native Americans also practiced such dietary utilisation of brine shrimp although this does not seem to have been documented. Brine shrimp are reported as having similar nutritional value to the larger Malacostracan shrimps.

Triops species are economically important in the cultivation of rice. In Japan, where rice is planted into paddy fields as young plants, *Triops* have been used as a biological agent to control weed growth [13]. They achieve this by disturbing the sediment surface whilst foraging or laying eggs, which uproots young weed seedlings; the consequent increase in water turbidity also cuts down light for weed photosynthesis and the seedlings themselves may be eaten by the omnivorous *Triops*. Conversely, in California and other regions where rice is sown directly into the paddy, *Triops* can be a pest due to the same foraging behaviour; *Triops granarius* was officially listed as a pest species in Swaziland for this reason. *Triops newberryi* has also been investigated as a potential biological control agent of immature mosquitoes [14].

Artemia cysts, harvested either from wild stocks or cultivated as part of solar sea-salt production, are supplied in large quantities for use in fish and shrimp farming; the cysts are hatched and raised to nauplius or adult stage as feed. The largest source of supply has been the Great Salt Lake, at Salt Lake City, Utah. This shallow hyper-saline lake occupies an area of approximately 1,700 square miles, although the total area fluctuates annually. Only two arthorpods survive in the lake in any numbers; the brine flies *Ephydra hyans* and *E. cinerea* and the brine shrimp *Artemia franciscana* (Figure 15). Harvesting of Artemia cysts, which float in drifts on the lake's surface, is performed on an industrial scale, and is tightly regulated by the Utah State Division of Wildlife who issue harvesting permits and monitor cyst levels to prevent over-harvesting . The harvest season extends from 1 October to 31 January each year, with spotter planes locating 'slicks' of cysts which are then collected using oil containment booms. Whilst the harvest varies significantly each year due to environmental factors, significant quantities are extracted annually; the 2008 – 2009 season harvested some 19,600,000 pounds of raw material. After processing (to remove waste material) the cysts are sold on to

FIG. 15 **The brine shrimp *Artemia franciscana***
From the Great Salt Lake, Utah, USA, where it occurs in significant densities and is the basis for industrial-scale harvesting of cysts for fish and crustacean farming. Body length approx. 9 mm.

hatcheries for the fish farming industry. Prices fluctuate annually, with the 2008 price being reported as $11 per pound [15]. Due to variable yields from the Great Salt Lake, harvesting operations have been extended to other hypersaline lakes in Russia, Iran and Asia. The total global market in processed *Artermia* cysts has been estimated at around 2,000 tonnes annually.

The British Fauna

The British Isles has a diverse fauna of 'small' branchiopods but a very impoverished 'large' branchiopod fauna. Surprisingly, the group has not been considered as a whole since Brady's work of 1850; publications since then have focused almost exclusively on the freshwater 'cladocera'. Brady [16] listed 30 species of Cladocera (including one marine) and 2 large branchiopods. Scourfield in 1903 and 1905 [6, 17] listed 83 species (including large branchiopods but exclusively freshwater species); the next major work was by Scourfield and Harding, listing 89 freshwater cladocerans in their most recent edition [18]. Recent work by the Cladocera Interest Group [19] to consolidate records has resulted in a total of 94 freshwater cladoceran species in 50 genera; combined with records for marine cladocerans and the two large branchiopod species present in the UK results in a total of 97 species [20]. It is highly likely this list will expand, as genetic analysis reveals that some currently recognised species are, in fact, species complex.

The number and diversity of cladoceran species is perhaps surprising, with all four Orders represented and nearly one sixth of all currently known species present. Unlike many groups, species diversity of the cladocerans increases away from the tropics, and peaks in the temperate zones [1].

Only two species of large branchiopods are now present in the UK; the fairy shrimp *Chirocephalus diaphanous* and the tadpole shrimp *Triops cancriformis*. Clam shrimps are not represented in the UK fauna. *Chirocephalus diaphanous* is found in temporary puddles and wheel tracks and appears randomly distributed in the south and east of the country, usually appearing in late summer after heavy rain. The most reliable locations for this species are the New Forest in Hampshire and Salisbury Plain in Wiltshire.

Triops cancriformis is exceptionally rare in the UK. Brady [16] described the species as present in a pond on Bexby [?Bexley] Common and in Devonshire; Scourfield [17] writing just over 50 years later stated that the species has "not been found apparently (in the UK) for more than half a century" and questioned whether it should be included in any modern list of British species. Fortunately, for most of the second half of the 20th century, *Triops cancriformis* was known from one protected pond in the northern New Forest in Hampshire and the animal is protected under Schedule 5 of the Countryside and Wildlife Act (1981). It was therefore a great surprise when a second population was discovered at the Caerlaverrock Wildfowl and Wetland Trust in Scotland in 2004. Two additional populations have since been discovered at the same location and funding has recently been secured to undertake a 3 year search for other UK populations [21].

A third large branchiopod species also occurred in the UK, but is now considered extinct. The brine shrimp *Artemia salina* was first described by Schlosser in 1756 from salt pans in the salterns at Lymington, Hampshire. At that time, Lymington was the main producer of sea salt in the UK; the industry possibly dated back to Roman times. Sea water was run into large lagoons and allowed to partially evaporate before the brine boiled in metal pans until the moisture was evaporated. Brine shrimp were still present when Brady wrote his monograph for the Ray Society in 1850 but disappeared when the sea salt industry collapsed due to competition from cheaper rock salt. Some of the saltern works at Lymington are still visible but the brine shrimps have gone. As other populations of *Artemia* have been allocated to other species, Fryer [10] considers *Artemia salina* now to be effectively extinct in the wild, with the possible exception of one population in Sardinia.

Acknowledgements

I am indebted to Claire Mellish, Natural History Museum, London for enabling access to the Museum's fossil branchiopod collections and for permission to publish photographs; to Bram Vanschoenwinkel of the Universiteit Leuven for assistance with references; to Thomas Hegna of Western Illinois University for assistance with references and for provision of Figures [8] and

A Checklist of the British Branchiopod Crustaceans

THE CLADOCERA INTEREST GROUP

The branchiopods are a well-known class of crustaceans occupying predominantly freshwater environments but also with some marine species. Despite there being an extensive history and literature associated with their study in the British Isles, there has not been a published checklist of the entire British fauna (marine and freshwater) since Brady's monograph of 1850 [1]. Previous checklists for the 'cladoceran' crustaceans have focused on the freshwater species and themselves have not been updated since 1966 [2]. This current checklist has been compiled by the Cladocera Interest Group [3], supplemented with published records of the 'large' branchiopod species and marine cladocerans. It is published here to place on record the current state of knowledge of the British fauna and in the hope that it will encourage further work on the distribution of these animals.

Superorder	**Sarsostraca**		
	Order **Anostraca**		
	Family **Chirocephalidae**		
	Chirocephalus	*Chirocephalus diaphanus*	Prévost 1803
Superorder	**Calmanostraca**		
	Order **Notostraca**		
	Family **Triopodae**		
	Triops	*Triops cancriformis*	(Bosc, 1801)
Superorder	**Leptodorida**		
	Order **Haplopoda**		
	Family **Leptodoridae**		
	Leptodora	*Leptodora kindti*	(Focke, 1844)
Superorder	**Cladocera**		
	Order **Ctenopoda**		
	Family **Sididae**		
	Diaphanosoma	*Diaphanosoma brachyurum*	(Lieven, 1848)
	Latona	*Latona setifera*	(Müller, 1785)
	Sida	*Sida crystallina*	(Müller, 1776)
	Family **Holopedidae**		
	Holopedium	*Holopedium gibberum*	Zaddach, 1855
	Order **Anomopoda**		
	Family **Daphniidae**		
	Ceriodaphnia	*Ceriodaphnia dubia*	Richard,1894
		Ceriodaphnia laticaudata	Müller, 1867
		Ceriodaphnia megops	Sars, 1862
		Ceriodaphnia pulchella	Sars, 1862
		Ceriodaphnia quadrangula	(Müller, 1785)
		Ceriodaphnia quadrangula f. hamate	(Sars)
		Ceriodaphnia reticulata	(Jurine, 1820)
		Ceriodaphnia setosa	Matile, 1890

Daphnia	*Daphnia ambigua*	Scourfield, 1946
	Daphnia atkinsoni	Baird, 1859
	Daphnia cucullata	Sars, 1862
	Daphnia curvirostris	Eylmann, 1887
	Daphnia galeata	Sars, 1864
	Daphnia hyalina	Leydig, 1860
	Daphnia longispina	Müller, 1785
	Daphnia magna	Straus, 1820
	Daphnia obtuse	Kurz, 1874
	Daphnia parvula	Fordyce, 1901
	Daphnia pulex	(DeGeer, 1778)
	Daphnia rosea	Sars, 1862
Megafenestra	*Megafenestra aurita*	(Fischer, 1849)
Scapholeberis	*Scapholeberis mucronata*	(Müller, 1785)
Simocephalus	*Simocephalus exspinosus*	(Koch, 1841)
	Simocephalus serrulatus	(Koch, 1841)
	Simocephalus vetulus	(Müller, 1776)
Family **Moinidae**		
Moina	*Moina brachiata*	(Jurine, 1820)
	Moina macrocopa	(Straus, 1820)
	Moina micrura	Kurz, 1874
Family **Bosminidae**		
Bosmina	*Bosmina coregoni*	Baird, 1857
	Bosmina longirostris	(Müller, 1785)
	Bosmina longirostris var. *cornuta*	(Jurine)
	Bosmina longispina	Leydig, 1860
Family **Ilyocryptidae**		
Ilyocryptus	*Ilyocryptus acutifrons*	Sars, 1862
	Ilyocryptus agilis	Kurz, 1878
	Ilyocryptus sordidus	(Lieven, 1848)
Family **Eurycercidae**		
Eurycercus	*Eurycercus glacialis*	Lilljeborg, 1887
	Eurycercus lamellatus	(Müller, 1785)
Family **Chydoridae**		
Acroperus	*Acroperus harpae*	(Baird, 1835)
	Acroperus angustatus	Sars,1863
Alona	*Alona affinis*	(Leydig, 1860)
	Alona costata	Sars, 1862
	Alona elegans	Kurz, 1874
	Alona guttata	Sars, 1862
	Alona intermedia	Sars, 1862
	Alona karelica	Stenroos, 1897
	Alona quadrangularis	(Müller, 1785)
	Alona rustica	Scott, 1895
	Alona weltneri	Keilhack, 1905

Alonella	*Alonella excisa*	(Fischer, 1854)
	Alonella exigua	(Lilljeborg, 1853)
	Alonella nana	(Baird, 1843)
Alonopsis	*Alonopsis elongata*	Sars, 1862
Anchistropus	*Anchistropus emarginatus*	Sars, 1862
Camptocercus	*Camptocercus lilljeborgi*	Schoedler, 1862
	Camptocercus rectirostris	Schoedler, 1862
Chydorus	*Chydorus gibbus*	Sars, 1890
	Chydorus latus	Sars, 1862
	Chydorus ovalis	Kurz, 1874
	Chydorus sphaericus	(Müller, 1785)
Coronatella	*Coronatella rectangula*	(Sars, 1862)
Disparalona	*Disparalona rostrata*	(Koch,1841)
Dunhevedia	*Dunhevedia crassa*	King, 1853
Graptoleberis	*Graptoleberis testudinaria*	(Fischer, 1848)
Kurzia	*Kurzia latissima*	(Kurz, 1874)
Leydigia	*Leydigia acanthocercoides*	(Fischer, 1854)
	Leydigia leydigi (Schoedler, 1862)	
Monospilus	*Monospilus dispar*	Sars, 1862
Oxyurella	*Oxyurella tenuicaudis*	(Sars, 1862)
Paralona	*Paralona pigra*	(Sars,1862)
Phreatalona	*Phreatalona protzi*	(Hartwig,1900)
Pleuroxus	*Pleuroxus aduncus*	(Jurine, 1820)
	Pleuroxus denticulatus	Birge, 1879
	Pleuroxus laevis	Sars, 1862
	Pleuroxus trigonellus	(Müller, 1785)
	Pleuroxus truncates	(Müller, 1785)
	Pleuroxus uncinatus	Baird,1850
Pseudochydorus	*Pseudochydorus globosus*	(Baird, 1843)
Rhynchotalona	*Rhynchotalona falcata*	(Sars, 1862)
Tretocephala	*Tretocephala ambigua*	(Lilljeborg, 1900)
Family **Ophyroxidae**		
Ophryoxus	*Ophryoxus gracilis*	Sars, 1861

Family **Acantholeberidae**		
Acantholeberis	*Acantholeberis curvirostris*	(Müller, 1776)
Family **Macrothricidae**		
Drepanothrix	*Drepanothrix dentata*	(Euren, 1861)
Lathonura	*Lathonura rectirostris*	(Müller, 1785)
Macrothrix	*Macrothrix hirsuticornis*	Norman & Brady, 1867
	Macrothrix laticornis	(Jurine,1820)
	Macrothrix rosea	(Jurine,1820)
Streblocerus	*Streblocerus serricaudatus*	(Fischer,1849)
Order **Onychopoda**		
Family **Polyphemidae**		
Polyphemus	*Polyphemus pediculus*	Linnaeus, 1761
Family **Podonidae**		
Evadne	*Evadne nordmanni*	Lovén, 1836
Pleopsis	*Pleopsis polyphemoides*	(Leuckart, 1859)
Podon	*Podon intermedius*	Liljeborg, 1853
	Podon lueckartii	Sars, 1862
Family **Cercopagidae**		
Bythotrephes	*Bythotrephes longimanus*	Leydig, 1860

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