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Branchiopoda and Copepoda (Crustacea) in Mongolian Saline Lakes

Miguel Alonso

Departament d'Ecologia, Facultat de Biologia, Universitat de Barcelona, Avda. Diagonal, 645 08028 Barcelona, Spain, e-mail: malonso@ub.edu

Abstract

This paper presents a very complete inventory of the branchiopods and copepods that inhabit the salt lakes (salinity >3‰) of Mongolia. The inventory was based on samples collected from 108 salt lakes over the course of seven limnological expeditions in most of the Mongolian territory between 2005 and 2009. The salinity of the lakes ranged from 3.4 to 76‰ S. A total of 43 taxa were identified: 7 Anostraca, 1 Spinicaudata, 1 Notostraca, 1 Leptodoridae, 1 Ctenopoda, 15 Anomopoda and 17 Copepoda. Thirteen taxa are limited to the Asiatic portion and the rest are known throughout the Palearctic region. One taxon, *Phallocryptus* sp. has not yet been described in scientific literature. The taxonomic position of *Artemia* sp. in Mongolia has still not been clarified. All of the species are eurysaline and, except for *Artemia* sp. and *Cletocamptus retrogressus*, which are the most halophile, they can live in waters with less than 10‰ S. Thirty-three species appear only in mesosaline waters (3–20‰ S), five do not exceed the mesosaline level (50‰ S) and five can live in hypersaline waters (>50‰ S).

Key words: branchiopoda, copepoda, saline lakes, Mongolia

Introduction

Planktonic and meiobenthic crustaceans spend their entire life cycle in lakes, making these organisms excellent indicators of both water quality and the ecological status of the lacustrine environment in general. Crustaceans are very old in terms of evolutionary history and have a great capacity for dispersion, allowing them to achieve an extremely high level of planetary diversification, which has been configured over time following biogeographical and ecological patterns.

Salinity is one of the factors with the greatest capacity for segregating organisms. In the aquatic environment, Hammer (1986) defined athalassic saline waters as having salinities equal to or greater than 3‰ S and established a classification system that is reflected in the biota: hyposaline waters (3–20‰ S), mesosaline waters (20–50‰ S); hypersaline waters (< 50‰ S). Many species tolerate a wide range of salinities (euryhalines), while others are limited to narrower ranges and can be assigned to specific salinity categories (stenosalines).

Branchiopods and copepods show great sensitivity to salinity which have been studied in previous researchs (Williams, 1990; Alonso, 1990; Hammer, 1993). In general, the organisms most resistant to salinity are the euryhalines, which can live in environments ranging from hyposaline to hypersaline, which is understandable given that the hypersaline environments generally display an evolution in salinity in accordance with the phases of their hydrologic cycle. Nevertheless, freshwater branchiopods and copepods are not typically found in saltwater lakes. This estenoic aspect also makes them very good ecological indicators and they can be used as sensors of medium and long-term changes. Cladocerans in particular, which leave behind permanent remains in the sediment, are very useful for paleolimnological analysis in studies of global change. (Paterson, 1994; Bredesen *et al*., 2002; Sarmaja-Korjonen, 2003).

This paper describes the branchiopod and copepod fauna in the saltwater lakes (over 3‰ S) of Mongolia, a country that is rich in lakes despite its relatively high aridity. The Tserensodnom catalog (2002) includes 3,060 permanent lakes of over 10 ha, but this number could increase considerably if temporary lakes are also considered. And, more importantly, the majority of these lakes are well preserved, which reduces the sources of variability in studies such as this one, which is designed to establish species-habitat relationships. Many of the Mongolian lakes are saline; two types of saline lakes can be established in Mongolia: 1) large deep permanent hyposaline-mesosaline lakes; these lakes are found mainly in the northwest of the country, the majority in the Valley of the Great Lakes (Dulmaa, 1979), and they are the remains of much larger lakes, probably with less mineralized water than those of today, that existed in the Tertiary and Quaternary periods (Egorov, 1993); 2) shallow saline lakes undergoing strong hydromorphological fluctuations, showing temporal saline evolution that sometimes reaches hypersaline levels (>50‰); these lakes are widely distributed in Mongolian semideserts and steppes.

Data on branchiopods and copepods in Mongolian saline lakes have been provided by Flosnner *et al.* (2005) and Penkova *et al.* (2005). Both authors supplied lists of taxa, the former from three lakes in the Valley of the Great Lakes (Uureg nuur, Baga nuur and Uvs nuur), and the latter from lakes in Central Gobi, indicating their range of tolerance to salinity but not the origin of the inventoried biota.

Materials and Methods

Samples were collected during an extensive survey performed throughout the Mongolian territory (Table 1 and Fig. 1), taking in all of its natural zones (Alpine belts, taiga, forest-steppe, steppe, semidesert and desert zones) between 2005 and 2009. Approximately 450 lakes were sampled, 107 of which were saline (salinity >3‰). Abbreviate descriptions of all the lakes and pictures can be seen at http://geodata.es/mongolian_lakes. The surveys were conducted in September-October, after the rainy season and before freezing of the lake surface; in this period, the crustacean communities reach their peak of maturity and males and gamogenetic females appear in the cladoceran populations. Salinities ranging from 0 to 100‰ S were measured using a handheld refractometer. Samples were obtained from representative habitats in each lake (littoral areas, open water, among vegetation) using two handheld nets with aperture sizes of 100 µm for cladocerans and copepods and 1 mm for large branchiopods. Specimens were preserved in 4% formaldehyde. In the laboratory most taxa were identified to species.

Results

Forty-three taxa were identified of which nine were large branchiopods, 17 cladocerans and 17 copepods (Table 2).

Among the anostracans the most abundant and purely halophile species is *Artemia* sp., whose taxonomical status still remains unclear; it always forms bi-sexual populations, normally in the more saline (hypersaline) and persistent waters.

Table 1. Saline lakes sampled in different Mongolian provinces indicating the field salinity on the sampling date. D.P.S: Deep permanent saline; S.T.C.S: Shallow, temporary, turbid by suspended clay and saline; S.T.H: Shallow, temporary hypersaline.

Arkhangay

Code	Name	Type	‰ S
242	Nariin nuur	S.T.C.S	4.7
248	Tariat sum	S.T.C.S	6.5
252	Ar nuur	S.T.C.S	19.4
253	Shorvog nuur	S.T.C.S	20.1

Bayanhongor

Code	Name	Type	‰ S
288	Orog nuur	S.T.C.S	4.7
16	Davst nuur	S.T.H	100.0
23	Boon Tsagaan nuur	D.P.S	3.4

Bayan-Olgii

Code	Name	Type	‰ S
49	Buraatyn Davaa	S.T.C.S	6.4
70	Tsengel sum, close to Khoton nuur	S.T.C.S	9.1
71	Khujirtai nuur	S.T.C.S	10.3

Dundgovi

Code	Name	Type	‰ S
266	Khangiin Shuuduu nuur	S.T.H	62.7
385	Bulangiin nuur	S.T.C.S	4.1
392	Shiliin nuur	S.T.C.S	16.0
393	Khar nuur	S.T.H	55.7

Gobi-Altai

Code	Name	Type	‰ S
28	Olon nuur	S.T.C.S	5.7
30	Close to Altai city	S.T.C.S	4.9
31	Olon nuur	S.T.H	76.0
32	Olon nuur	S.T.H	61.5
33	Olon nuur	S.T.H	32.8
34	Olon nuur	S.T.H	55.1
37	Darvi nuur	S.T.H	44.2
38	Holboo nuur	S.T.H	56.1
291	Taigan nuur	D.P.S	26.6
292	Kholiin nuur	D.P.S	11.6

Hentiy

Code	Name	Type	‰ S

Ovorkhangay

Code	Name	Type	‰ S
275	Khutul nuur	S.T.C.S	4.7
279	Gun nuur	S.T.C.S	11.9
282	Dund nuur	S.T.H	62.0
283	Nert nuur	S.T.H	59.0
284	Baruun Bayan-Ulaan sum	S.T.H	73.7

Suhbaatar

Code	Name	Type	‰ S
105	Uyzen nuur	S.T.C.S	9.2
108	Ganga nuur	D.P.S	4.2
109	Kholboo nuur (small)	S.T.C.S	6.3
111	Dariganga sum	S.T.C.S	21.5
112	Tsaydam Rashaan nuur	S.T.C.S	13.3

Uvs

Code	Name	Type	‰ S

73	Khuitenii Khujir nuur	S.T.C.S	5.7
59	Chomogt nuur	S.T.C.S	8.2
311	Khoh nuur	S.T.C.S	8.7
314	Duruu nuur	D.P.S	4.6
315	Khoh nuur	S.T.H	49.3

Dornod

Code	Name	Type	‰ S
115	Matad sum	S.T.C.S	6.7
116	Bayan Burd nuur	S.T.H	33.2
117	Khalkh gol sum, Atar II	S.T.C.S	4.8
121	Mendbayar nuur	S.T.C.S	21.8
122	Khalkh gol sum, Khalkh gol bag	S.T.H	42.4
123	Khalkh gol sum, Khalkh gol bag	S.T.C.S	16.6
126	Khalkh gol sum, close to Buir nuur	S.T.H	49.2
128	Menengiin tal	S.T.H	35.6
129	Choibalsan city	S.T.H	47.3
130	Choibalsan sum	S.T.C.S	21.1
131	Choibalsan sum	S.T.H	39.7
132	Choibalsan sum	S.T.C.S	6.3
135	Goluut nuur	S.T.C.S	29.3
136	Busiin nuur	S.T.C.S	11.2
138	Gurvan Zagal sum	S.T.C.S	8.2
139	Sumiin Bulagiin nuur	S.T.C.S	5.6
140	Sergelen sum, Khuren honhor	S.T.C.S	5.5
141	Galiin Tsagaan nuur	S.T.C.S	13.0
142	Close to Gurvan Bulagiin nuur	S.T.C.S	4.0
143	Gurvan Bulag nuur	S.T.C.S	26.4

148	Duhiin Tsagaan nuur	S.T.C.S	17.9
153	Jargalthaan sum	S.T.H	37.6
154	Tsagaan nuur	S.T.C.S	15.9
354	Derst Khonkhor	S.T.C.S	9.6
358	Toson nuur	D.P.S	12.7
359	Shorvog nuur	S.T.H	32.9
362	Uvuriin Burd nuur	S.T.H	61.4
95	Bor Ondor sum	S.T.C.S	6.4

Khovd

Code	Name	Type	‰ S
40	Tsetseg nuur	S.T.C.S	3.8
41	Tsetseg nuur	S.T.H	59.4
46	Yamaat uul Erdene Buren sum	S.T.C.S	9.5
443	Durgun nuur	D.P.S	5.2
293	Nogoon nuur	D.P.S	21.5
304	Huduu nuur	S.T.C.S	9.7
309	Zuun Khooloi nuur	D.P.S	8.0

Khuvsgol (182-215), Bulgan (172) and Selenge (160)

Code	Name	Type	‰ S
182	Achmag nuur	D.P.S	18.8
203	Khurts Tokhom nuur	S.T.C.S	8.8
204	Dund Tokhom nuur	S.T.C.S	5.0
206	Khujirtai nuur	S.T.H	49.9
207	Erhel nuur	D.P.S	19.8
208	Erheliin Khondii nuur	S.T.C.S	19.3
210	Sangiin Dalai nuur	D.P.S	4.1
214	Tunamal nuur	D.P.S	4.1
215	Khar nuur	S.T.C.S	10.0
172	Khunt nuur	D.P.S	11.5
160	Shargyn Tsagaan nuur	S.T.C.S	15.6

78	Baga nuur	D.P.S	11.7
79	Shaazgai nuur	D.P.S	6.5
81	Bor Khag nuur	S.T.C.S	13.0
82	Olgii nuur	D.P.S	8.7
85	Uvs nuur	D.P.S	20.6
86	Ulaangom city, close to Uvs nuur	S.T.C.S	4.7
341	Uureg nuur	D.P.S	5.0
344	Khyargas nuur	D.P.S	7.4
346	Ikh Yashuur nuur	S.T.H	23.6
347	Ikh Gashuun nuur	S.T.H	35.5
348	Airag nuur	D.P.S	4.6
350	Sangiin Dalai nuur	S.T.H	47.5

Zavhan

Code	Name	Type	‰ S
219	Oigon nuur	D.P.S	25.4
220	Oigon nuur	D.P.S	29.5
222	Sant nuur	S.T.C.S	25.0
223	Dovongiin nuur	S.T.C.S	6.5
226	Airag nuur	D.P.S	25.3
227	Davsnii nuur	S.T.H	55.0
228	Nehii Ugaadag nuur	S.T.C.S	9.8
229	Nogoon nuur	S.T.C.S	5.2
234	Tsegeen nuur	D.P.S	8.7
237	Telmen nuur	D.P.S	5.9
425	Khag nuur	S.T.C.S	9.1

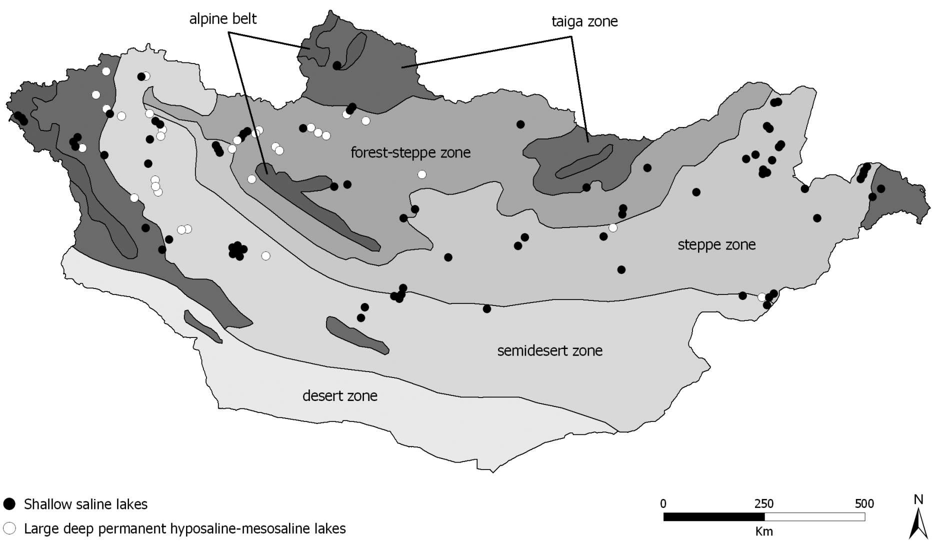

Figure 1. Natural areas in Mongolia and distribution of surveyed saline lakes, differentiating deep permanent hyposaline-mesosaline lakes from shallow saline (hiposaline, mesosaline and hypersaline) lakes.

Species inhabiting hyposaline water bodies are *Branchinecta orientalis*, *Branchinectella media*, *Galaziella murae* and *Phallocryptus* sp. *B. orientalis* appear in a wide range of environments, habitually in muddy shallow water bodies but it was surprisingly seen forming a well established population in Toson nuur in Hentii, a large permanent deep not turbid lake. *B. media* was

Table 2. Branchiopoda and Copepoda in Mongolian saline lakes. For each taxa, the number of records is indicated. Number of sampled lakes: 108.

Taxa	Number of records
Anostraca	
Artemia sp.	30
Branchidopsis affinis Sars, 1901	4
Galaziella mongoliana (Uéno, 1940)	2
Galaziella murae Alonso & Naganawa, 2008	4
Branchinecta orientalis Sars, 1901	16
Phallocryptus sp.	8
Branchinectella media (Schmankewitsch, 1873)	14
Spinicaudata	
Eocyzicus davidi (Simon, 1886)	2
Notostraca	
Triops numidicus (Grube, 1865)	6
Leptodoridae	
Leptodora kindtii (Focke, 1844)	2
Ctenopoda	
Diaphanosoma mongolianum Uéno, 1938	6
Anomopoda	
Daphnia triquetra Sars, 1903	4
Daphnia carinata King, 1853	15
Daphnia magna Straus, 1820	42
Daphnia longispina var. *turbinata* Sars, 1903	2
Ceriodaphnia reticulata (Jurine, 1820)	2
Moina salina Daday, 1888	60
Moina brachiata (Jurine, 1820)	33
Moina macrocopus (Straus, 1819)	6
Macrothrix hirsuticornis Norman & Brady 1867	5
Macrothrix laticornis (Jurine, 1820)	2
Bosmina longirostris (Müller, 1776)	5
Chydorus sphaericus (Müller, 1776)	27
Coronatella rectangula Sars, 1861	23
Alona floessneri Sinev *et al,* 2009	27
Oxurella tenuicaudis (Sars, 1862)	2
Diaptomidae	
Hemidiaptomus ignatovi Sars, 1903	4
Arctodiaptomus (A) wierzjeskii (Richard, 1888)	4
Arctodiaptomus (R.) salinus (Daday, 1885)	29
Arctodiaptomus (R.) rectispinosus Kikuchi, 1940	22
Metadiaptomus asiaticus (Ul'yanin, 1875)	66
Neutrodiaptomus lobatus (Lilljeborg, 1889)	2
Mixodiaptomus incrassatus (Sars, 1903)	1
Cyclopidae	
Cyclops mongolensis Einsle, 1992	4
Megacyclops viridis Jurine, 1820	14
Eucyclops serrulatus (Fischer, 1851)	2
Eucyclops dumonti Alekseev, 2000	26
Metacyclops minutus (Claus, 1863)	4
Metacyclops gracilis (Lilljeborg, 1853)	2
Thermocyclops kawamurai Kikuchi, 1940	19
Microcyclops varicans (Sars, 1863)	2
Harpacticoida	
Harpacticiods sp.pl	7
Cletocamptus retrogressus Schmankewitsch, 1875	10

considered not common in Mongolia; it was firstly discovered in Dundgovi province (Naganawa & Zagas, 2002) but according to present data its distribution can been enlarged to Tov, Dornod, Arkhangai and Suhbaatar provinces. *G. murae*, a Mongolian endemic species has been only seen in two localities, one in Bayan-Olgii and the another in Arkhangai. *Phallocryptus* sp. is a relatively widely distributed taxon (Tov, Dornod, Arkhangai and Suhbaatar provinces), has not been yet described for science and represents a new record for Mongolia; it is close to *P. spinosa* (Milne-Edwards, 1840) with differences in morphology of its antennal appendages and post-genital segments. *Branchidopsis affinis* and *Galaziella mongoliana* usually occur in fresh waters but occasionally appear in the lower limit of hyposaline waters.

Other large branchiopods, *Eocyzicus davidi* (Spinicaudata) and *Triops numidicus* (Notostraca), are very common in freshwater, shallow and muddy water bodies in Mongolia, and they can also live in the same type of lakes although somewhat more saline.

Leptodora kindtii was only collected from the Airag nuur. This species is rare in Mongolia and had been reported by Flossner et al. (2005) in a freshwater lake also in the Valley of the Great Lakes (Bayan nuur).

Diaphanosoma mongolianum is considered a freshwater species that can also live in brackish water bodies and even in marine bays (Korovchinsky, 1992), however in Mongolia it has been found close to the lower limit of hyposaline lakes.

The most characteristic and abundant euryhaline species of Anomopoda are *Alona floessneri*, a Mongolian endemism, and *Moina salina*, which live in both mesosaline and hypersaline waters. Probably *A. floessneri* was reported from Uvs nuur by Flössner *et al.* (2005) as *A. elegans* Kurz, 1865 (Sinev *et al.*, 2009). *Moina salina* is a well-known halobiont species widely distributed in the Palaearctic region (Negrea, 1983; Alonso, 1996) and the identity of the Mongolian populations and the westernmost populations, which of the Iberian Peninsula have

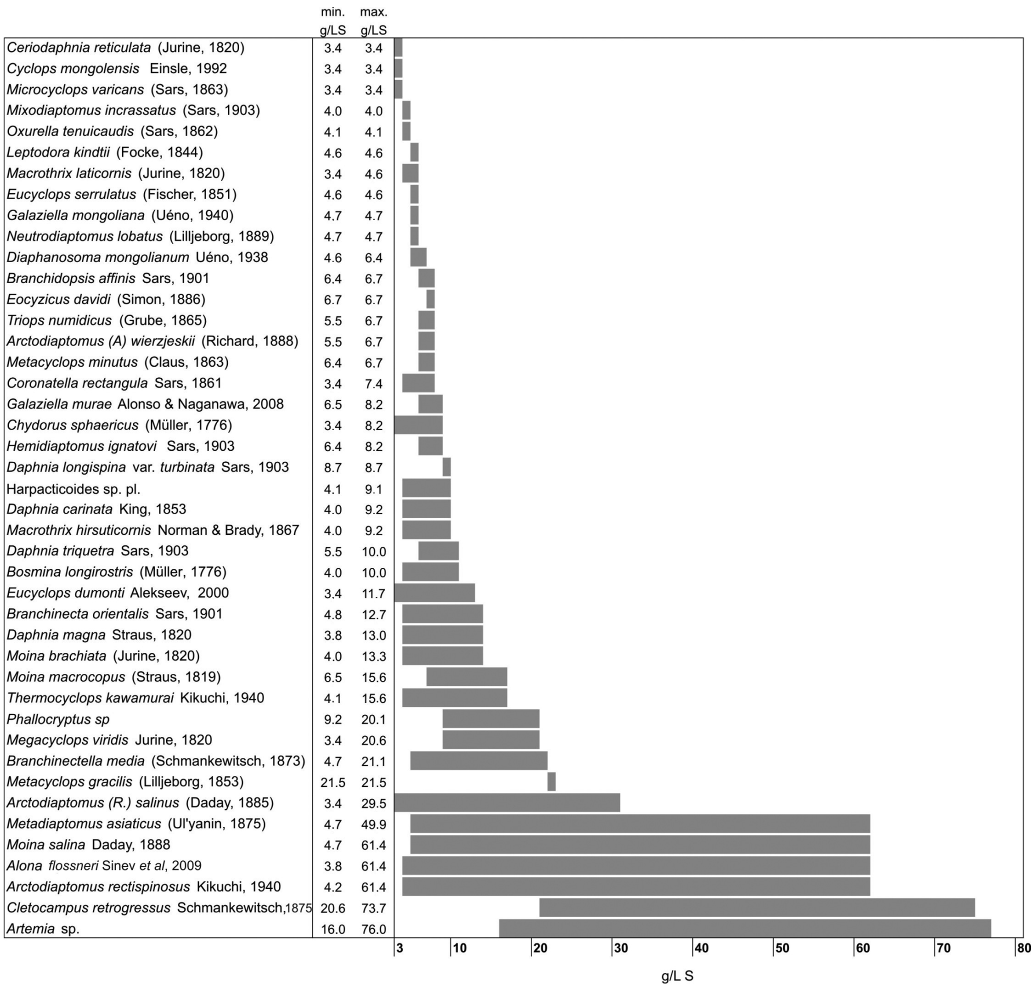

Figure 2. Range of field salinities at saline lakes were each taxon was collected.

been checked in this work. Among the *Daphnia* genus, *D. magna* has the highest capacity for colonizing a wide range of environments and is a very frequent species in Mongolia. *D. triquetra,* a Central Asian species, has been always considered a typical halobiont (Sars, 1903; Benzie, 2005). *D. carinata* was supposedly a freshwater species (Benzie, 2005) with 4,200 µS/cm (about 3–4‰ S) as its upper limit of water mineralization (Dumont & Van de Velde, 1975). However this study records a salinity range for this species that reaches 9.2‰ S and Penkova (2005) reported a upper limit of 55‰ S. *Moina brachiata*, *M. macrocopus* and *Macrothrix hirsuticornis* are common in shallow steppe freshwater and hyposaline lakes, appearing in Mongolia in the quite mineralized waters. Other species reported in this paper are weakly represented in saline environments although their presence in the less concentrated waters is not a rarity since they are very eurioic and cosmopolitan, as in the case of *Chydorus sphaericus*, *Coronatella rectangula* and *Bosmina longirostris*, which occasionally have also been found in some Mongolian hyposaline lakes.

Arctodiaptomus rectispinosus, *Metadiaptomus asiaticus* and *Cletocamptus retrogressus* are the most characteristically euryhaline copepods, occurring in lakes ranging from hyposaline to hypersaline. *A. rectispinosus* is a common species but had not been reported before in Mongolia, perhaps because it was mistakenly identified as *A. bacillifer* (Koelbel, 1885). *Megacyclops viridis*, *Eucyclops dumonti* and *Thermocyclops kawamurai* are somewhat frequent and can live in the upper range of hyposaline waters. The rest of copepods are freshwater species living in shallow and sometimes temporary lakes with waters that can experience phases with somewhat high mineralization.

Discussion

The relationship between salinity and species richness of crustaceans is well established in the literature (De Deckker & Geddes, 1980; Hammer, 1986; Williams, 1990), and it is generally accepted that the number of species declines rapidly in the 0–10‰ salinity range and slowly in more saline waters. This general conceptual model can be applied to Mongolian lakes (ca 450) in which a total of 121 branchiopod and copepod species have been identified (unpublished data). This number of species can be distributed accordingly to salinity ranges as follows: 76 species in the 0–3‰ S, 33 species in the 3–20‰ S, 5 species in the 20–50‰ S range and 5 species in waters over 50‰ S.

All species found in Mongolian saline lakes are euryhaline, although three major groups can be distinguished based on the salinity ranges where they are found (Fig. 2). The first group comprises 33 species which appear in mesohaline waters (3–20‰ S). Within this group two types of species coexist: typically freshwater species such as *Macrothrix laticornis*, *Chydorus sphaericus*, *Coronatella rectangula*, *Eucyclops serrulatus* and *Microcyclops varicans*, which were collected in the large permanent hyposaline lakes, and species that live in shallow, often temporary waters in deserts and steppes and are characteristically adapted to a wide range of salinities. The best examples of the latter type are *Mixodiaptomus incrassatus* and *Moina brachiata.*

The second group comprises five saline species that do not exceed the upper mesosaline limit (50‰ S) and which have been found both in large hyposaline permanent lakes, with *Arctodiaptomus salinus* being the most abundant species in such environments, and in shallow mesosaline desert and steppe lakes.

The third group comprises five species that can live in hypersaline lakes with over 50‰ S, all of them located in deserts and steppes; within this group of species, *Artemia* sp. and *Cletocamptus retrogressus* are the most halophile, always appearing in waters with over 15‰ S.

Of the whole of branchiopods and copepods recorded in the Mongolian saline lakes, 13 of them are Asiatic namely: *Branchidopsis affinis*, *Galaziella mongoliana*, *G. murae*, *Eocyzicus davidi*, *Triops numidicus*, *Daphnia triquetra*, *Hemidiaptomus ignatovi*, *Arctodiaptomus rectispinosus*, *Metadiaptomus asiaticus*, *Neutrodiaptomus lobatus*, *Cyclops mongolensis*, *Eucyclops dumonti* and *Thermocyclops kawamurai*. The rest of the species have a wide distribution in the Palaearctic region, reaching the Iberian Peninsula (Alonso, 1998).

Community structures in the Mongolian saline lakes are similar to those in other parts of the world, suggesting the existence of vicarious taxa. If we focus on the most halophile (hypersaline) species of calanoids, we find illustrative relationships. In Mongolia the species are *Metadiaptomus asiaticus* and *Arctodiaptomus* *rectispinosus*; in Australia (Victoria) (Williams, 1990) *Calamoecia clitellata* Bayly, 1962 and *C. salina* (Nicholls,1944); in Canada (Hammer, 1993), *Diaptomus connexus* (Light, 1938) and *Hesperodiaptomus. nevadensis* (Light, 1938); in South America, *Boeckella poooensis* Brehm, 1956 (Hammer, 1986); and on the Iberian Peninsula, *Arctodiaptomus salinus*. It is remarkable that *A. salinus* is the only halophile species in the western Palaearctic that inhabits such a wide range of salinities, from freshwater to hypersaline waters, suggesting that this species has enlarged its ecologic valence because of the absence of other halophile competitors. In fact, in Mongolia, *A. salinus* is restricted to mesosaline waters. In the case of the halophile branchiopods, the species assemblages are less similar. Mongolian hypersaline lakes have *Artemia* sp. and halophile *Moina*- species which are widely distributed genera living in the same environments around the world, however these lakes do not have true halophile *Daphnia*-species like *D. mediterranea* (Alonso, 1985) in the Mediterranean countries (Margaritora, 1985; Alonso, 1998) or *D. pusilla* (Serventy, 1929) in Australia.

Given the great climatic differences between Mongolia and the countries of the western Palaearctic, particularly those of the Mediterranean, the significant faunistic affinities that exist are remarkable. This clearly establishes that the strategies of the species that inhabit these environments can be different to fulfill common needs. For example, the large branchiopods in the Mediterranean countries are obligate temporary water species (except *Artemia* sp.), which has always been interpreted as a strategy to avoid the domain of predators. However, in Mongolia, these organisms also appear in lakes that do not dry up, but in which the entire water mass can freeze completely (lakes with less than 2 m deep), fulfilling the same objectives for their survival.

Salt lakes are very sensitive to environmental changes. They possess a very characteristic biota which is adapted to specific salinity conditions and which can be displaced with relatively minor modifications. In the shallow saline lakes, it is very difficult to monitor the changes due to the enormous variability that the local microclimates introduce and the yearly meteorological phenomena. For example, there are many salt lakes in the Mongolian Gobi that are flooded only very occasionally. The large deep saline lakes have much greater stability and, fortunately, the majority are subjected to few pressures, which makes them excellent candidates for monitoring the effects of global change. The paleolimnological work of Soninkhishig *et al*. (2003), which clearly establishes the fluctuations in salinity that the Telmen nuur has undergone and describes situations in the distant past that are very similar to the current ones, is of particular interest.

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Хураангуй

Энэхүү өгүүлэлд Монгол орны давстай нууруудад (давсжилтын хэмжээ >3‰ S) амьдардаг заламгай хөлт хавч ба сэлүүр хөлт хавч хэлбэртний судалгааны дүнг танилцуулав. Судалгааны ажил 2005-2009 онуудад явагдсан 7 удаагийн нуур судлалын экспедицийн хүрээнд Монгол орны 107 нуураас цуглуулсан дээжинд тулгуурлан хийгдсэн юм. Нууруудын давсжилтын хэмжээ 3.4–76‰ S байв. Судалгааны дүнд нийт 43 зүйлийг илрүүлсний 7 зүйл нь Anostraca, 1 Spinicaudata, 1 Notostraca, 1 Leptodoridae, 1 Ctenopoda, 15 Anomopoda, 17 Copepoda тус тус илрэв. Эдгээрээс 13 зүйл нь зөвхөн Азид тархсан бол бусад зүйлүүд Палеарктикийн мужид түгээмэл тархалттай. *Phallocryptus* sp. нь одоогоор шинжлэх ухаанд илрээгүй байгаа зүйл юм. *Artemia* sp. зүйлийн ангилал зүйн статус өнөөг хүртэл шийдэгдээгүй байна. *Artemia* sp., *Cletocamptus retrogressus* зэрэг зүйлүүд бага давсжилттай (<10‰ S) усан санд, харин бусад зүйлүүд их давсжилттай усан санд амьдардаг. Тэдгээрээс 33 зүйл нь дунд зэргийн давсжилттай (3-20‰ S) усанд амьдардаг байхад 5 зүйл нь дунд зэргийн давсжилтын дээд түвшний агууламж бүхий (50‰ S) усан санд, харин 5 зүйл нь хэт их давсжилттай усан санд (>50‰ S) тохиолдоно.

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