

# Caspian Fauna in Fresh Waters outside the Ponto-Caspian Basin

by

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There are at least 335 species of metazoan animals in the Ponto-Caspian basin belonging to the autochthonous faunistic complex. This is known as the „Caspian complex” because almost all the species (330) inhabit the Caspian Sea and constitute the overwhelming part (more than 80 %) of its freeliving fauna. 140 caspian species are known in the Black Sea and the Sea of Azov, 5 or 6 of which are endemic for these seas, although they are closely related to those inhabiting the Caspian Sea<sup>1</sup>). The Caspian autochthonous fauna is the most peculiar and sharply differs from that of other seas by its poorness and the lack of many groups typical for sea; 7 or 8 families rich in species constitute its principal part (gammarids, gobies, pyrgulides, polyphemids, cardiid, shads). About  $\frac{3}{4}$  of this fauna originates from sea and  $\frac{1}{4}$  – from fresh waters, but all is well adjusted to the water of the Caspian Sea with its peculiar composition of salts (S/Cl – about 2,4, while the salinity is 13 ‰ or less). This fauna considerably worse endures sea water (of oceanic type) than highly freshened and fresh water. All or almost all Caspian species, inhabiting the Black Sea and the Sea of Azov, as well as many of those inhabiting the Caspian Sea, easily endure absolute fresh water and breed in it. Consequently the Caspian fauna inhabits both downstreams of the Ponto-Caspian rivers and the lakes, connected with them. Many Caspian species had spread far up the rivers: 25 or 30 species penetrated into their middle- and some of them even into the upper stream.

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<sup>1</sup>) A list of these species and the detailed analysis of the Caspian Sea fauna as well are given in my book (MORDUKHAY-BOLTOVSKOY, 1960).

The observations carried out during the last 50 or 60 years show that the spreading of the Caspian fauna is in progress at present too. Some of the species, the most euryhaline and of great endurance to the increasing of salinity, – mainly the fishes – have spread from the estuary regions into open parts of the Sea of Azov and of the Black Sea. But the main stream of spreading makes its way towards the fresh waters.

At least 22 species belonging to the Caspian complex are known at present, which were found outside the Ponto-Caspian basin<sup>1</sup>). These species can be divided into two groups.

Fifteen species belong to the first group: undoubtedly they have emigrated from the Ponto-Caspian not long ago, during the present geological or historical epoch. All these species do not differ morphologically from the representatives of the same species inhabiting the Ponto-Caspian and possess the effective means (active or passive) of spreading.

Six or seven species enduring the high salinity spread via sea ways, among them sturgeons *Huso huso* (L.), *Acipenser stellatus* PALL. (inhabit the basin of Adriatic sea), shads *Alosa (Caspialosa) caspia* (EICHW.), the goby *Proterorhinus marmoratus* PALL. (the basin of the Aegean Sea), the bryozoan *Victorella pavida* KENT, hydrozoans- *Cordylophora caspia* PALL. and *Moerisia maeotica* (OSTR.). The latter reached the Atlantic ocean (if it did not inhabit it earlier and really is a Ponto-Caspian autochthon), while *Victorella* and *Cordylophora* have settled even in the Pacific ocean basin. The other species could penetrate outside the Ponto-Caspian basin only through the river systems; this fact can be proved by the inability of these species to endure even mesohaline water and by their character of distribution as well. Only two of them – the sterlet (*Acipenser ruthenus* L.) and the coelenterate *Polypodium hydriforme* Uss., parasitizing the eggs of the former and enigmatical with respect to taxonomy – penetrated into the Arctic ocean basin – the Severnaya Dvina and (sterlet) Siberian rivers. Longfingered crayfish – *Astacus leptodactylus* ESCH. penetrated into this basin too. The latter chiefly spread into the Baltic sea basin, as well as dreissena (*Dreissena polymorpha* PALL.), amphipods *Corophium curvispinum* G. SARS and *Chaetogammarus ischnus* STEB. (= *tenellus* SARS), „white eyed” fish (*Abramis sapa* (PALL.)).

The penetration into the basin of the White Sea and Arctic ocean could occur through the channels connecting the basin of the Volga

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<sup>1</sup>) The Sea of Marmara I consider as belonging to this basin. A quite rich Caspian fauna was found in this basin by KOSSWIG (KOSSWIG, 1955) and later, in the samples collected by him, by myself. This fauna has the same character as that of the Black Sea and its lakes far off the large estuaries.

(the Kama and the Sheksna) with the basin of the Severnaya Dvina, and, perhaps earlier, through the system of lakes and floods which existed on the divides during the glacier thawing period.

The penetration into the Baltic sea basin was going on during the last century through the channels connecting the Volga basin, and particularly the Dnieper basin, with the rivers of the Baltic sea basin (the Zapadnaya Dvina, the Nieman, the Vistula). *Dreissena* appeared in the Baltic sea basin during the twenties of the XIX century and shortly after populated all Europe. *Corophium curvispinum* was found first in the Oder basin in about 1910 and later settled all the rivers of Baltic and reached England. *Chaetogammarus* was found in 1931 in the Vistula river. In 1954 these data were summarized by A. THIENEMANN (THIENEMANN, 1954), but the process of settling of the Caspian species continued afterwards as well. According to the report of I. F. ŠIVICKIS (1960) *Theodoxus pallasii* appeared in the Baltic basin during the last years.

The mass development and, during the first years, even „outburst” is characteristic for Caspian forms, appeared in the Baltic and Atlantic basins.

This fact is well known in particular for *Dreissena*, which caused a serious damage to hydrotechnical buildings. The new forms often turn out to be very powerful vitally and even supplant the native fauna (longfingered crayfish supplanted *Astacus fluviatilis*, *Chaetogammarus* – freshwater *Gammarus pulex*). The same is observed at the installation of the Caspian species into the water bodies of the Ponto-Caspian basin, which did not have such species before (in the basin of the upper part of the rivers, e.g. in lake Balaton).

It should be expected that the other Caspian forms of those reaching the upper stream of Ponto-Caspian rivers would appear outside the Ponto-Caspian basin. Some „candidates” of penetration into the Baltic can be named: gammarids *Dikerogammarus villosus* MART., *D. haemobaphes* EICHW., the isopod *Jaera sarsi* VALK., the gobies *Neogobius fluviatilis* (PALL.), *Proterorhinus marmoratus* PALL., and, may be, the psammophilous *Pontogammarus sarsi* SOW., *Paramysis ullskyi* (CZERN.). The latter penetrated already far into Sheksna river, flowing out of White Lake, connected with Onega Lake by the channel of the Mariinskaya system.

It is observed that the spreading of the Caspian species goes chiefly towards the west. Part of them penetrated into the basin of the North Polar seas, but the cold climate of these seas evidently prevented their settling and especially mass development. The abundance of the connecting channels between the rivers of the Ponto-Caspian and the Baltic promoted the distribution to the west as well. The lack of such connections prevented the distribution of the

Caspian species eastward. Only in the Aral Sea there is a quite numerous group (31 species) of Caspian species. This group represents the trace of the existence of a strait between the Aral and the Caspian seas in the past.

There are only the species enduring the high salinity and spread by sea way in the basin of the Mediterranean, as the river system of the latter and those of the Ponto-Caspian do not connect with each other.

There are 7 species related to the second group of the Caspian complex, dwelling outside the Ponto-Caspian, which were observed in isolated reservoirs having no connection with the Ponto-Caspian basin. These species are: dreissena and six species of crustaceans, five of which were found in the lakes of the Aegean Sea basin: mysids (*Mysidacea*) *Limnomysis benedeni* CZERN., *Paramysis lacustris turcica* BÄC., *P. kosswigi* BÄC. in Asia Minor, gammarids *Pontogammarus boeoticus* SCHEL. and *Dikerogammarus spandli* (KÄR.) in the lakes of the eastern parts of the Balkan Peninsula. One of the species – *Corniger lacustris* SPANDL (may be a peculiar form of *C. bicornis*?) – was found to the south of the Black Sea in the basin of the Euphrates. All these species evidently represent the relict of the ancient transgression of the Pont, dated from the period, when it was populated throughout by the fauna of the Caspian type. There are no geological data concerning such powerful transgression for the corresponding epochs of the Quaternary (New-Euxine, Old Euxine and others). It should be assumed that these forms are the traces of more ancient transgressions of the Pont, perhaps Upper-Tertiary ones. This assumption is confirmed by the fact that most of the forms indicated above (five) are well defined subspecies and species, though similar to those living in the Ponto-Caspian at present and undoubtedly related to this complex. The lakes of the Aegean basin are yet poorly studied and their more detailed study may show new relict forms. These zoogeographic data would help us to specify the outlines of the seas in the past and perhaps would have not less value for Paleogeography than geological data.

Only two Caspian species penetrated into the western hemisphere for the present: the hydroid *Cordylophora caspia* and the bryozoan *Victorella pavida* – both species, as being euryhaline, evidently penetrated here by sea way<sup>1)</sup>. It may well be true, that other species

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<sup>1)</sup> Quite unexplained is the fact of finding the polychaete *Hypaniola grayi* PETT. in the brackish bays near the Atlantic Coast of North America. This species, as being very similar to the endemic Ponto-Caspian species *H. kowalewskyi* (GR.), must be included in the same genus. One can not conceive neither the relict nature of *H. grayi*, nor the penetration of the *H. kowalewskyi* into America, as it does not endure high salinity and is not capable to spread up the rivers.

of the Caspian complex would appear. The improvement of the means of communication, the development of transport and energetics causing the building of hydroelectric power plants and artificial channels facilitate the distribution of water animals. This may be exemplified by the Caspian Sea. Its fauna is continuously being enriched by Mediterranean forms and not only by the way of premeditated installation, but owing to accidental transport as well, especially through the Volga-Don Navigation canal (ZENKEVICH, 1947, MORDUKHAY-BOLTOVSKOY, 1960). The same reasons have to intensify the process of emigration of autochthonous fauna of the Ponto-Caspian and its settling in the other basins.

#### SUMMARY

There are about 335 species belonging to the autochthonous Caspian complex and dwelling in the basin of the Caspian, Black, and Asov seas.

Not less than 22 species of this complex are known at present beyond the boundaries of the Ponto-Caspian basin. Most of them (15 species) have emigrated from this basin recently. Some fishes and two invertebrates penetrated into the Mediterranean or even into the oceans via the seas. Other species penetrated into fresh waters of the basin of the Baltic Sea and the Atlantic ocean (and partly of the Arctic seas) doubtless via the natural or artificial (canals) connections between the river-systems of adjacent basins.

Remarkably the caspian species which immigrated into the Baltic basin turn out to be very viable, develop in great quantities and depress even some indigenous species. As some of them appeared in the Baltic basin during the last decades and the process of spreading of the Caspian fauna goes on, the intrusion of some more Caspian species may be awaited.

There are, however, 6 or 7 species of Caspian origin, dwelling in isolated lakes of Asia Minor or the Balkan peninsula, probably relicts of the ancient (Tertiary?) transgressions of the Pont, what is confirmed by their taxonomic differentiation.

Only two Caspian species reached the western hemisphere till now (*Cordylophora caspia*, *Victorella pavida*).

#### ZUSAMMENFASSUNG

Im Bassin der Kaspischen, Schwarzen und Asowschen Meere leben ca. 335 dem autochthonen Kaspischen Komplex angehörende Arten.

Zur Zeit sind nicht weniger als 22 Arten dieses kaspischen Komplexes ausserhalb der Grenzen des Pontokaspischen Bassins bekannt. Von ihnen sind 15 Arten in der allerletzten Zeit aus diesem Bassin ausgewandert. Einige Fischarten und zwei Wirbellose sind auf Seewegen in das Mittelmeer oder sogar in Ozeane gelangt. Andere Arten sind in die Süsswasser des Baltischen und Atlantischen (teilweise auch des Arktischen) Bassins zweifellos mittels der natürlichen oder künstlichen (Kanäle) Verbindungen zwischen den Flussystemen eingedrungen.

Merkwürdigerweise erweisen sich die ins Baltische Bassin eingedrungenen kaspischen Arten als sehr lebensfähig, vermehren sich in grosser Anzahl und verdrängen sogar einige einheimische Tierarten. Da einige von ihnen im Baltischen Bassin erst in den letzten Jahrzehnten erschienen sind und da die Verbreitung der kaspischen Fauna sich immer weiter erstreckt, sind weitere Invasionen neuer kaspischer Arten zu erwarten.

Es gibt aber 6—7 Arten kaspischer Herkunft, die in isolierten Seen Kleinasiens und der Balkanhalbinsel wohnen und wahrscheinlich den Relikten der älteren (tertiären?) Transgressionen des Pont zuzuzählen sind, was auch durch ihre taxonomische Absonderung ersichtlich ist.

Nur zwei kaspische Arten (*Cordylophora caspia*, *Victorella pavida*) haben bisher die westliche Halbkugel erreicht.

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