

The fishes of the Amur River: updated check-list and zoogeography

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In the present paper, we compile the newest data to give a description of the Amur [Heilongjiang] River fish diversity. Based on our data, the native fishes inhabiting or entering the Amur drainage are at least 123 species belonging to 23 families. Cypriniformes are the main component among which the Gobioninae is the most numerous (19 species in 11 genera) subfamily. Then, with 11 species and 5 genera, the Salmonidae is the second largest family. The Amur fishes (11 marine and occasional visitors excluded) can be grouped according to their general distribution as endemic (16 species), spawning endemic (3), endemic or Manchurian (10), near endemic (5), Manchurian (25), Palaearctic or Manchurian (2), northern (17) and southern (34). Two monotypic genera, *Pseudaspius* and *Mesocottus* are the most peculiar elements of the Amur River, shared with only neighboring coastal rivers. Based on the distribution pattern of the Amur fishes, the Amur drainage can be divided in five zoogeographic units: Argun River Districts, Shilka River District, Middle Amur District, Sungari River District and Lower Amur District. These District are described in terms of their topography and fish taxa composition. The systematic status and nomenclature of all species have been reevaluated and an updated annotated list of taxa is presented.

Introduction

The Amur River (Hara-Muren in Mongolian, Heilongjiang, Heilung Jiang, Heilungkiang, Heihe in Chinese; Silkar in Tungussian, Sahaliyan Ula in Manchurian; ancient names Yushui, Wanshui and Heishui) flows across Mongolia, Russia, and China. The entire length of the Amur is about 4,370-4,510 km, making it the 9-11th largest river in the world (depending on different estimations). It drains a remarkable watershed that includes

diverse landscapes of desert, steppe, tundra, and taiga, its drainage area being up to 2,050,000 km², ranking the 10th largest in the world. The average annual discharge varies from 6,000 m³·s⁻¹ to 12,000 m³·s⁻¹, leading to an average 9,819 m³·s⁻¹ or 310 km³ per year (Shiklomanov, 1999). The headstreams include the northern source, Shilka River, which is formed by the confluence of the Onon and Ingoda, the Onon originating from the eastern foothills of the Mont Kent [Khentii Mountains] in Mongolia, and the southern source,

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Argun River [Argun, Ergun He], which originates from the western slope of the Hinggan Mountains in northeast China. After the confluence of Shilka and Argun at the very border of Russia (Chita Province, Ust'-Strelka Village) and China (Inner Mongolia Autonomous region, Xiluoguhe Village), the river is known as Amur proper, whose length is 2,874 km. It flows eastward and northward and finally empties into the Amurskiy Liman, the most northern part of the Tatar Strait [Gulf of Tartary, Mamiya Strait] of the Sea of Japan, connecting the Sea of Japan to Sakhalin Gulf of the Sea of Okhotsk. The mouth of the river is defined as a line connecting the Ozerpakh and Pronge capes (Sokolov, 1952; Kotlyakov, 2003). The Amur River has more than 200 tributaries in total, of which the largest ones include the Sungari [Songhua Jiang, Songari], Ussuri [Wusuli], Zeya, Bureya and Amgun (Fig. 1).

The Amur drainage and the watersheds of the southern coast of the Sea of Okhotsk, Shantar-skiye Islands, Sakhalin Island, southern Kuriles, Japanese Islands, continental coast of the Sea of Japan, Korean Peninsula and the upper reaches of Yalu-he and Liao-he rivers (belonging to the Yellow Sea basin) has been known since very first ichthyological explorations of the area as a "transition" zoogeographical zone characterized by the absence of major faunal break between the Oriental and Palaearctic realms with respect to the distribution of freshwater fishes and a specific taxonomic composition of 'northern' and 'southern' taxa (Warpachowski & Herzenstein, 1887; Gratzianow, 1907; Berg, 1909; Taranetz, 1938; Chereshev, 1998; Bogutskaya & Naseka, 1997). Berg (1909, 1933, 1949b) defined the whole area as the Manchurian (Amur) Transitional Region in which Palaearctic and Sino-Indian (Oriental) freshwater biotic components overlaps. Bănărescu (e.g. 1972a) ascribed the whole East Asia including the Amur in the north and the Song-Koi in the south to his East Asia Subregion of the Oriental (or Sino-Indian) Region.

The Manchurian (Amur) Transitional Region has been the object of special studies (Mori, 1936; Taranetz, 1938; Chereshev, 1998; Shedko, 2006), which showed its heterogeneity and complexity, and the region was hierarchically structured as a number of provinces and districts. Based on geomorphology, the Amur River valley is divided into three main sections, upper (downstream to

the mouth of Zeya River; headwaters and about 880-900 km of Amur proper), middle (from Zeya downstream to the Ussuri River mouth, about 975 km) and lower (from Ussuri downstream to Nikolayevsk-na-Amure, about 970-1,000 km) (e.g. Borutsky 1952; Kotlyakov, 2003). Taranetz (1937d,e, 1938) was the first to give a clear support for zoogeographic divisions of the Amur drainage into districts, which do not exactly coincide with the geomorphological divisions. He defined four districts, Upper Amur, Upper Argun, Middle Amur and Lower Amur. Upper Amur sensu Taranetz included the Shilka and Argun drainages, excluding the basins of the Buir Nur and Hulun Nur lakes, which were assigned to the Upper Argun district. The upper boundary of the Middle Amur was, thus, identified, as the confluence of Argun and Shilka, and the lower boundary as a section of Amur where the Bureinskiy Range and Xiao Hinggan Ling [Malyy Khingan Range] approach the Amur (420-600 km upstream from Khabarovsk at about 48°-48°30'N).

There is still a number of nomenclatural problems regarding the fishes of the Amur, most of which cannot be solved without an examination of type materials of some species as well as new collections from adjacent areas in Mongolia, China and Korea. More revisional works are required before we can estimate the number of species present in the area with some degree of confidence. However, we try to present updates and improvements to prior publications. The present work reports results from work conducted since 1980s and, especially, in 2006-2008 within a project funded by The Russian Foundation for Basic Research "Freshwater fish fauna of the Amur River basin: composition and origin".

The objectives of this paper are to: 1) summarize patterns of distribution and diversity of the fishes of the Amur drainage based on current data of fish taxonomy and occurrence; 2) describe the districts delimited within the drainage; and 3) provide an updated list of the taxa.

NGB is responsible for the preparation of the manuscript and its design; NGB and AMN prepared the general descriptions of the fish fauna and the districts; all the co-authors provided data for the checklist, which were compiled by NGB and SVSh. Photos are by AMN except for Figures 5 and 40 by SVSh.

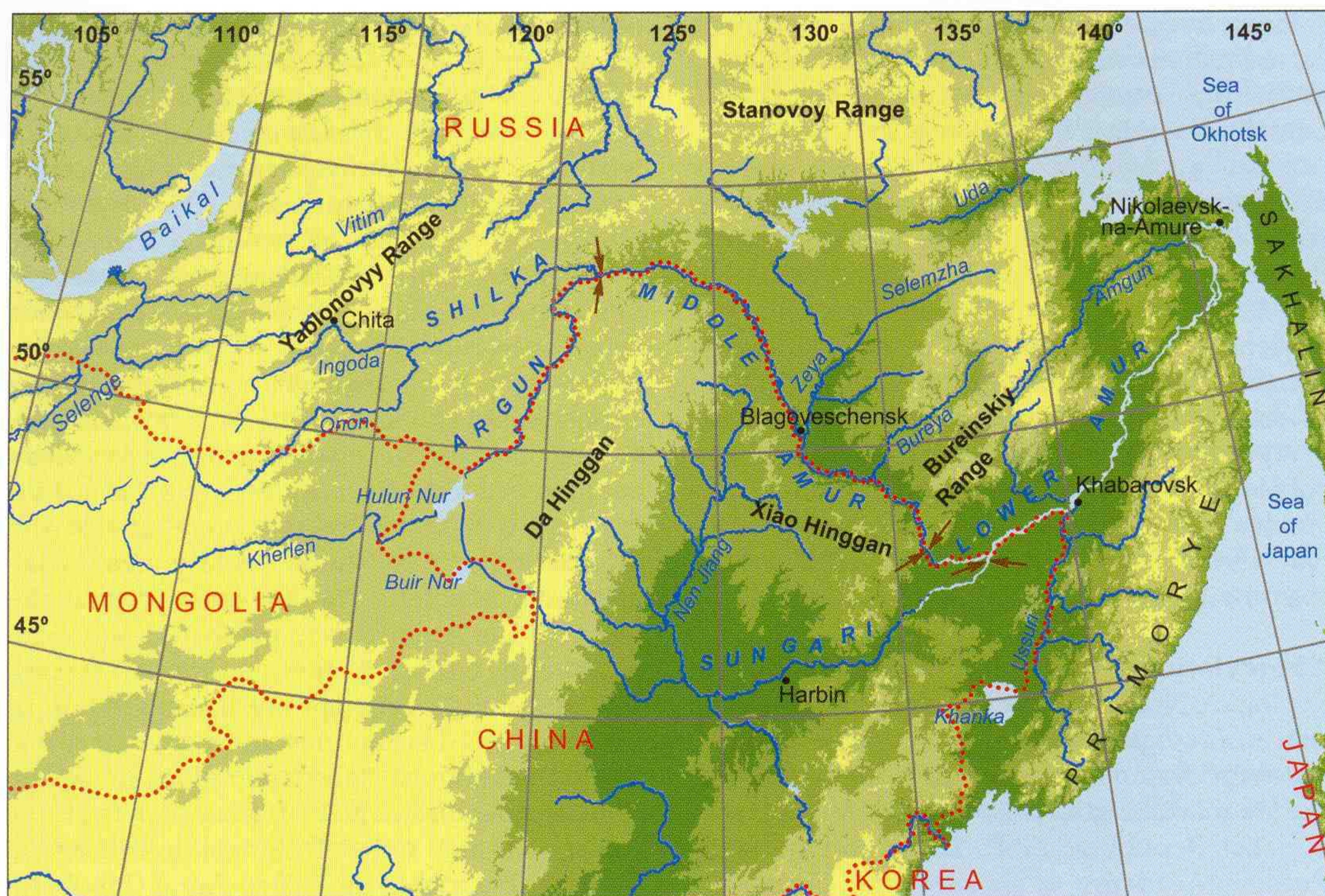


Fig. 1. Amur River drainage. Arrows show boundaries of the Middle Amur and the lower boundary of Sungari.

Materials and methods

Zoogeographic and taxonomic conclusions are primarily based on the examination of materials collected during numerous field trips in 1993–2008 conducted by the co-authors as well as of older collections preserved in natural history museums and research institutes in St. Petersburg, Vladivostok, Moscow, Berlin, London, Paris and New York, and a critical review of the existing literature.

We follow whenever possible the evolutionary species concept (e.g. Mayden & Wood, 1995; Mayden, 1997) or an operational species concept (Kottelat, 1997; Lundberg et al., 2000) if there is an obvious lack of data for any phylogenetic conclusions. The logic of this approach does not need the recognition of subspecies for the species is the smallest diagnosable unit. The synonymies include only references to original description of junior synonyms based on material from Amur and East Asia, and from other Asian Pacific and Arctic drainages if necessary for the understanding of the taxonomy.

The classification follows Nelson (2006) with

some exceptions such as the treatment of Salmonidae, Coregonidae and Thymallidae as distinct families rather than subfamilies of Salmonidae, and the re-evaluated rank of Nemacheilidae and Botiidae. Genera and species occurring in or reported from Amur drainage were categorized as I) native (indigenous) and non-native (non-indigenous); II) a) anadromous, b) freshwater, c) freshwater and anadromous, d) freshwater and brackish, e) marine and brackish, f) occasional anadromous visitor, g) occasional marine visitor; and III) a) endemic, b) endemic (spawning), c) near-endemic, d) Manchurian, e) northern, f) southern, depending on different categories of criteria. Endemic (spawning) species are defined as those occurring in (or migrating to) a few areas adjacent to Amur (belonging to the Coastal Amur Region) but not known as spawning outside of Amur drainage. Near-endemics are defined as those species inhabiting (including spawning in) the Amur and a few adjacent areas specified in the respective species accounts. Non-native taxa were omitted from the richness and endemism totals reported here.

We analysed the whole Amur drainage and

adjacent hydrological basins in order to estimate its uniqueness and similarities. These data are taken from a recent review of ecoregions of North Eurasia (Naseka & Bogutskaya, 2007).

Toponymy. Many geographic features in the Amur drainage area and in the historical territories called Mongolia and Manchuria [Mandzhuria] have several names. Some historic and modern variants of geographic names (and their variable spellings) in the synonymies and names of landscape features in the main text are given in square brackets. Variants of names of water bodies and populated places are given in Appendix in order to ease the reading, with coordinates. In the case of rivers, coordinates refer to their mouth.

Abbreviations. Code, International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999); MNHN, Muséum National d'Histoire Naturelle, Paris; SL, Standard length; USSR, The Union of Soviet Socialist Republics; ZISP, Zoological Institute, Russian Academy of Sciences, St. Petersburg; ZMB, Museum für Naturkunde, Berlin.

The Amur River fish fauna

The Amur River is the northernmost large monsoon river of East Asia. Its topography changed several times through the history, especially during the post-Pliocene time (Lindberg, 1955; Lebedev, 1995; Grosswald & Hughes, 2005). 123 native fish species belonging to 23 families and 72 genera have been recorded in the Amur drainage. Table 1 shows species richness per family.

Four species are marine occasionally entering freshwater [*Salangichthys microdon*, *Mugil cephalus*, *Chelon haematocheilus*, *Platichthys stellatus*] and six are occasional anadromous visitors [*Acipenser mikadoi*, *Tribolodon hakonensis*, *Oncorhynchus kischutch*, *Oncorhynchus tshawytscha*, *Parasalmo mykiss*, *Salvelinus leucomaenis*] of the Amur drainage. Taking this into account, the total number of freshwater, brackish water and anadromous fishes inhabiting the Amur is 113, and the most numerous group is the Cyprinidae with 33 genera and 55 species. Among the Cyprinidae, the most abundant group is the Gobioninae, which comprise 19 species in 11 genera. With regard to general distribution of families and genera in

consideration, these 113 species are grouped in six categories.

The following 15 species are **endemic** to the Amur drainage: *Rhodeus amurensis*, *Rhodeus mantschuricus*, *Chanodichthys abramoides*, *Hemiculter lucidus*, *Hemiculter varpachovskii*, *Microphysogobio* (*Rostrogobio*) *amurensis*, *Microphysogobio* (*Rostrogobio*) *anudarini*, *Sarcocheilichthys czerskii*, *Sarcocheilichthys lacustris*, *Squalidus chankaensis*, *Tachysurus mica*, *Tachysurus herzensteini*, *Thymallus burejensis*, *Thymallus grubii*, *Pungitius bussei*. Three species are **spawning endemics**: *Acipenser schrenckii*, *Huso dauricus* and *Coregonus ussuriensis*. Five species are **near endemic**: *Pseudaspius leptcephalus*, *Esox reichertii*, *Coregonus chadary*, *Cottus szanaga* and *Mesocottus haitej*. Two monotypic genera, *Pseudaspius* and *Mesocottus*, are the most peculiar elements of the Amur River, are shared only with neighboring coastal rivers of south Sea of Okhotsk and rivers of the adjacent north-western part of Sakhalin. This distribution may be secondary due to repeated short-distance migrations caused by considerable discharge of fresh water from the Amur or it may reflect historical links between former tributaries of the Palaeo-Amur (Lindberg, 1955). It is not known if *Gobio soldatovi* and *Gobio* sp. are endemic or have northern distribution.

Twenty five species, permanently inhabiting the drainage, have a **Manchurian** distribution, i.e. spread mostly within the limits of different districts of the Manchurian Region sensu Berg (1909, 1949b). Among them, twenty are freshwater species (*Rhodeus sericeus*, *Carassius* sp., *Gobio cynocephalus*, *Gobio tenuicarpus*, *Ladislavia taczanowskii*, *Sarcocheilichthys soldatovi*, *Leuciscus waleckii*, *Parabotia mantschurica*, *Cobitis lutheri*, *Misgurnus nikolskyi*, *Lefua costata*, *Lefua pleskei*, *Tachysurus sinensis*, *Silurus soldatovi*, *Thymallus flavomaculatus*, *Thymallus tugarinae*, *Pungitius* sp., *Gymnogobius* (*Chloe*) sp., *Gymnogobius* (*Taranetziola*) *operiens*, *Rhinogobius sowerbyi*), one is anadromous (*Gasterosteus* sp.), two include both freshwater and anadromous populations (*Hypomesus nipponensis*, *Salvelinus curilus*), one includes freshwater and brackish water populations (*Pungitius kai-barae*), and one includes marine and brackish water populations (*Megalocottus taeniopterus*). For eleven species (*Acanthorhodeus asmussii*, *Acanthorhodeus* sp., *Hemiculter* cf. *lucidus*, *Gnathopogon mantschuricus*, *Squalidus mantschuricus*, *Phoxinus* sp., *Cobitis choii*, *Misgurnus mohoity*, *Barbatula* sp., *Tachysurus brashnikowi*, *Rhinogobius lindbergi*) there is no sufficient data to know whether they are

Manchurian or have a more restricted distribution (endemic or near-endemic).

Sixteen species belong to the **northern** group (mostly Palaearctic and Nearctic taxa) as they have ranges extending further northward from the Amur. They are anadromous (*Lethenteron camtschaticum*, *Osmerus dentex*, *Oncorhynchus gorbuscha*, *Oncorhynchus keta*, *Oncorhynchus masou*, *Pungitius pungitius*), freshwater (*Lethenteron reissneri*, *Rhynchocypris czekanowskii*, *Cobitis melano-leuca*, *Thymallus baicalolenensis*, *Brachymystax lenok*, *Brachymystax tumensis*, *Hucho taimen*, *Lota lota*), and freshwater and anadromous (*Hypomesus ol-idus*, *Pungitius sinensis*). It is not clear whether *Rhynchocypris* cf. *percnurus* and *Barbatula toni* (Dybowski, 1869) are restricted to the Manchurian Region or extend to Siberia.

The most numerous (34 species) and diverse group is the **southern** (mostly Sino-Indian) group which encompasses taxa distributed in the south from the Amur: *Acanthorhodeus chankaensis*, *Chanodichthys dabryi*, *Chanodichthys erythropterus*, *Chanodichthys mongolicus*, *Chanodichthys oxycephalus*, *Culter alburnus*, *Hemiculter leucisculus*, *Megalobrama mantschuricus*, *Parabramis pekinensis*, *Cypri-nus rubrofuscus*, *Abbottina rivularis*, *Gobiobotia pappenheimi*, *Hemibarbus labeo*, *Hemibarbus macu-latus*, *Pseudorasbora parva*, *Saurogobio* (*Armatogobio*) *dabryi*, *Elopichthys bambusa*, *Hypophthalmichthys molitrix*, *Rhynchocypris lagowskii*, *Rhynchocypris oxycephala*, *Aphyocypris chinensis*, *Opsariichthys bidens*, *Ctenopharyngodon idella*, *Mylopharyngodon piceus*, *Squaliobarbus curriculus*, *Plagiognathops microlepis*, *Xenocypris macrolepis*, *Tachysurus ussuri-*

Table 1. Fishes of Amur River drainage. Number of genera and species per family.

family	subfamily, tribe	number of genera	number of species
Cyprinidae	Gobioninae	11	19
	Cultrinae	5	12
	Leuciscinae	5	8
	Pseudaspinini	4	7
	Leuciscini	1	1
	Acheilognathinae	2	6
	Xenocypridinae	2	2
	Cyprininae	2	2
	Rasborinae	2	2
	Insertae sedis (Elopichthyini, Hypophthalmichthyini, Squaliobarbinae)	5	5
Salmonidae		5	11
Gasterosteidae		2	6
Cobitidae		2	6
Bagridae		2	5
Thymallidae		1	5
Osmeridae		3	4
Gobiidae		2	4
Cottidae		3	3
Acipenseridae		2	3
Nemacheilidae		2	3
Odontobutidae		2	2
Mugilidae		2	2
Petromyzontidae		1	2
Siluridae		1	2
Coregonidae		1	2
Botiidae		1	1
Esocidae		1	1
Gadidae		1	1
Sinipercidae		1	1
Osphronemidae		1	1
Channidae		1	1
Pleuronectidae		1	1

ensis, *Silurus asotus*, *Siniperca chuatsi*, *Micropercops cinctus*, *Perccottus glenii*, *Macropodus ocellatus* and *Channa argus*.

Endemic, near endemic and Manchurian species are most numerous (59) (Table 2). Palaearctic (Manchurian and northern) and Sino-Indian species are almost equally numerous, 33 and 34, respectively. The number of Sino-Indian (southern) genera is higher than the number of Palaearctic genera (32 vs. 28). We suppose that these numbers illustrate well a transitional zoogeographic character of the Amur drainage. However the number of Manchurian and southern species and genera are markedly higher than those of the taxa of other categories, and this fact supports the zoogeographic scheme of Bănărescu (e.g. 1972a, 1992b) who included the Amur drainage into his Sino-Indian Region rather than into the Holarctic Region.

The taxa of the different categories given in Table 2 are unevenly spread over the drainage. The data on distribution provide good reasons for delineating of zoogeographic units within the drainage. These units and their fish faunas are described below.

Twenty four **non-native** species have been recorded in the Amur drainage. Among them, 16 introduced species have successfully established in the drainage: *Acanthorhodeus* cf. *gracilis*, *Rhodeus ocellatus*, *Rhodeus* cf. *uyekii*, *Megalobrama amblycephala*, *Pseudobrama simoni*, *Carassius auratus*, *Aristichthys nobilis*, *Rutilus rutilus*, *Misgurnus anguillicaudatus*, *Paramisgurnus dabryanus*, *Protosalanx chinensis*, *Coregonus migratorius*, *Parasalmo gairdnerii*, *Oryzias sinensis*, *Perca fluviatilis* and

Sander lucioperca. Six species have been used for intentional introductions and aquaculture but did not form self-sustainable populations: *Acipenser baerii*, *Acipenser ruthenus*, *Ictalurus punctatus*, *Coregonus peled*, *Coregonus pidschian* and *Coregonus sardinella*. Two species are known by single records from the Khanka Lake only and most probably represent unintentional introductions: *Puntius semifasciolatus* and *Ochetobius elongatus*. Non-native taxa are omitted from species accounts given below.

Zoogeographic districts in the Amur drainage

Re-examination of the fish distribution patterns confirms some well-known patterns and provide additional support for the scheme of Taranetz (1938).

The Upper Amur area has very different climatic conditions from the other parts of the Amur drainage. It occupies the most elevated part of the Amur drainage (350-2,500 m asl) and is characterized by lower humidity, severe continental climate, and a taiga-steppe landscape. The Da Hinggan Ling [Bol'shoy Khingan Range] stops the monsoons, and represents the orographic boundary of the area.

Shilka River. The Shilka River District includes the entire system of the Shilka River formed by the Onon (Fig. 2) and Ingoda rivers. It extends downstream until it meets the Argun River. Both the southern and southeastern boundaries of the district follow the divide between the Shilka and Kherlen with left-hand tributaries of the Argun River (Dutugtu Uul Range in the west, and the Nerchenskiy Khrebet and Borshchovochnyy Khrebet ranges in the east). In the west, the district (Ingoda system) is adjacent to the Yenisei system (Ob' River drainage). The Khilok River, a tributary of the Selenge River, is the closest tributary of the Yenisei along the Yablonovyy Khrebet Range. Along its entire course, the Shilka River and its tributaries have a fast current, roughly 0.4 to 3.0 m·s⁻¹. The river is mainly fed by summer rainfall and floods after winter snow-melt. Extreme flooding also occurs during periods of heavy rain from July until August. The water begins to freeze over at the end of October, and melts again in early May.

The northern Shilka system is clearly different from the southern region of the Upper Amur

Table 2. Fishes of Amur River drainage. Number of species, genera and families and their distribution category (marine and occasional visitors not included).

category	species	genera	families
endemic	15	—	—
endemic (spawning)	3	—	—
endemic or northern	2	—	—
endemic or Manchurian	11	—	—
near endemic	5	2	—
Manchurian	25	2	—
northern or Manchurian	2	2	—
northern	16	24	6
southern	34	32	6
wider distribution	—	5	11



Fig. 2. Upper Amur: Ilya River, a tributary of Onon River, upstream from Dul'durga village, 50°43'N 113°35'E.



Fig. 3. Middle Amur: Amur River at Blagoveshchensk (Russia) and Heihe (across the river, China), 50°15'N 127°29'E.

(Argun and Kherlen systems), evident in a somewhat contrasting fish fauna. Five species widely distributed in the Amur (*Acipenser schrenckii*, *Tachysurus sinensis*, *Tachysurus herzensteini*, *Tachysurus ussuriensis*, *Thymallus grubii*) are absent from the Argun but present in the Shilka, while the Shilka lacks six species occurring in the Argun (*Acanthorhodeus asmussii*, *Chanodichthys erythropterus*, *Culter alburnus*, *Hemiculter varpachovskii*, *Saurogobio dabryi*, *Lefua costata*). There is a total of 39 species (in 32 genera and 13 families) in the district, and, in general, the Shilka is characterized by the predominance of rheophilic species, and has a single probable endemic species, *Gobio* sp. from the Onon. The true *Barbatula toni* is also reliably known only from this district. Fourteen species (36 %) in the district are of southern distribution or, being endemic or Manchurian, belong to southern higher taxa, such as the Gobi-oninae (except for *Gobio*).

Argun River. The Argun River District includes the whole system of the Argun River, the Uldz Gol River, lakes and marshes of the Barun-Torey and Zun-Torey Depressions that are now endorheic. The southern part of the district includes the Kherlen River, which flows from the southern slopes of the Altan Ulugui Range [Altan Olgiy Nuruu]. In the east, the Da Hinggan Ling divides the Argun District (Khalkh, Haylar [Hailar He], Gan He), the Middle Amur District (Amur He, Humar He) and the Sungari District (Nen Jiang). In the north-west, the Argun District is separated from the Shilka District by the Dutugtu Uul Range and the Nerchenskiy Khrebet Range. The Argun River is mostly fed by a number of mountainous streams, which are quite similar to the head waters of the Ingoda and Onon rivers (Shilka District). In the upper reaches of the Argun, there are two large lakes, Buir Nur and Hulun Nur. Buir Nur is of oval configuration and elongated from north to south. Its coasts are only slightly indented and flat; there are relatively steep coasts only along the very north-eastern part of the lake. The lake is relatively shallow, with an average depth of about 5 m. The Orshon River flows from Buir Nur to Hulun Nur. There are several smaller isolated and salty lakes along the eastern coast of Buir Nur. Hulun Nur is larger than Buir Nur and much deeper. The Kherlen River flows into the south-western end of Hulun Nur. The outlet of Hulun Nur has very little water or no water at all in some years; it is called Mutnaya Protoka in

Russian (that means a turbid channel). It joins the Haylar River, and their confluence forms the Argun River proper. The total length of the Argun (with Haylar) is about 1,520 km and the watershed is about 232,000 km². By the landscape, the district is mostly steppe on the plateau highlands, which is hilly here and there.

The fish fauna of the Argun River is made of 40 species. It lacks most migratory species characteristic for the lower reaches of the Amur and five species occurring in the Shilka. In general, the district is characterized by the predominance of limnophilous species. One of them, *Hemiculter varpachovskii*, is endemic to the district, and there might be five additional endemic species in lakes Hulun Nur and/or Buir Nur although, for lack of accurate data, we followed a conservative approach and still treat them here as local forms of more widely distributed species (*Acanthorhodeus asmussii*, *Chanodichthys erythropterus*, *Chanodichthys mongolicus*, *Culter alburnus*, *Saurogobio dabryi*). These five species as well as 14 more species distributed in the district belong to genera of the southern group. Thus, southern species account for 48 % of the total number, that is higher than in the Shilka District.

The species diversity of the Kherlen and the Barun-Torey and Zun-Torey is relatively poor. The Kherlen lacks most lacustrine species of the district. Shallow intermittent lakes of the Torey Depression with Ul'dza and Imalka tributaries support only those small-sized fishes adapted to difficult conditions of intermittent water bodies such as *Rhynchocypris* cf. *percnurus*, *Carassius* sp., *Misgurnus mohoity*, *Lefua pleskei*, or those escaping in the upper reaches such as *Rhynchocypris lagowskii* and *R. czekanowskii*.

Middle Amur. The Middle Amur District encompasses the widened bed of the Middle Amur from the confluence of Shilka and Argun to a section downstream from Blagoveshchensk where the Amur passes through mountains, the Malyy Khingan in the south and the Bureinskiy Khrebet Range in the north (at about 48°N) (Fig. 1). In the north, the boundary of the catchment area goes along the northern slopes of the Bolshoy Khingan Range, which separates the Middle Amur District from the Argun District (Haylar River system). The Malyy Khingan Range divides the Sungari catchment area and the right-hand tributaries of the Middle Amur. The left-hand tributaries of the Middle Amur have very extensive catchment

areas delimited in the north by a number of ranges separating the district from the Shilka and the headwaters of rivers of the Arctic basin (Aldan River system in the Lena River drainage) and of the Sea of Okhotsk basin (Uda River drainage).

Downstream from the confluence of the Shilka and Argun, the Amur flows through mountainous terrain between high rocky banks and has fast current. After the confluence with the Kumara River, the Amur enters a broad plain. Near Blagoveshchensk (Fig. 3) it receives the Zeya on the left. Downstream from Blagoveshchensk the river flows mostly through a broad valley in a channel with swampy banks and forms many anabranches. After its confluence with the Zeya, the Amur flows for 270 km and is joined by the Bureya. At this point the Amur plain narrows abruptly. This is the boundary with the Lower Amur District.

The Zeya is one of the largest tributaries of the Amur. It is 1,210 km long and has a catchment area of 233,000 km². It originates on the southern slopes of the Stanovoi Range. The headwaters entering the Zeya upstream of the confluence with the Seledmzha have a mountainous character, especially in the Tukuringir Mountains where the river flows in a deep rocky gorge. Further downstream, the Zeya reaches the plain (Fig. 4). The Bureya is the second largest northern tributary of the Amur River. It originates on the northern slope of the Bureinsky Ridge, is 716 km long, and has a catchment area of about 70,000 km². The upper reaches of the Bureya, approximately up to the Paikan Station, have a mountainous character; banks are rocky in some places and the current velocity can be 2 m·s⁻¹ and more. In the lower reaches, the Bureya flows along the Zee-Bureinskaya Plain, where the river is anastomosed. There is no large lake in the drainage of the Middle Amur River; small lakes are concentrated mainly in the Zeya drainage. The district is characterized by a high flow; the total annual average flow of both Zeya and Bureya can attain 1,800 m·s⁻¹. Melting snow and summer rains commonly result in catastrophic floods. In winter, the Zeya and Bureya retain very little water since they flow through a permafrost zone. The fluctuations of the water level can reach 9-10 m. Freezing-over lasts about 6 months.

The fish fauna of the Middle Amur District includes 70 species, a number that markedly exceeds the number of taxa in the Upper Amur due to a marked increase in the number of taxa

of southern origin, which are present in the Lower Amur proper and its southern tributaries, and the appearance of the anadromous *Lethenteron camtschaticum* and *Oncorhynchus keta*. There is one endemic species (*Thymallus burejensis*) and another species (*Thymallus baicalolenensis*) has a wide distribution but, in the Amur, it is present only in the northern tributaries of the Middle Amur. All other species are distributed further downstream in the Amur. The severe climate in the headwaters of Zeya and Bureya explains the low number of species; the fauna is much more diverse in the main course of the Middle Amur. The Bureya River is unique for possessing four sympatric species of the genus *Thymallus*.

Lower Amur. The Lower Amur District is defined as the lowland section of the Amur River down to the estuary (Fig. 5). In the west, the Yam-Alin, Dusse-Alin and Bureinskiy Khrebet Ranges form the divide between the Lower Amur (Urmi and Amgun rivers) and the Middle Amur (Bureya and Zeya headwaters). The eastern boundary of the district goes along the dividing ranges of the Sikhote-Alin Mountains. The southernmost extremity of the district is formed by the Khanka Lake basin, which is located between the Arsen'yevka River (headwaters of the Ussuri) and the Muling He catchment area. The southern and western boundaries of the Lower Amur catchment are formed by the Khrebet Przheval'skogo Range and the north-eastern slopes of the Nangang Mountains. Immediately downstream of the rapids through the Malyy Khingan (in the south) and the Bureinskiy Khrebet Ranges (in the north) the Amur enters the wide Lower Amur plain and become anastomosed and forms lakes and a wide floodplain. There are numerous lakes, of a complex topography, in the lower section (lakes Bolon', Ommi, Evoron, Udy, Orel, and others). The river here has a low gradient and the lakes are shallow and densely vegetated. Their size and pattern of interconnection and connection to the river vary greatly depending on water discharge.

Most tributaries of the Ussuri flow from the slopes of the Sikhote-Alin Mountains and are typical mountainous streams with rapid current and cold water. The lower Ussuri proper down to its confluence with the Amur goes through a valley which is up to 3 km wide. The Amgun is the largest tributary of the Lower Amur, 665 km long, with a catchment area of 54,900 km². It re-



Fig. 4. Middle Amur: Zeya River upstream from Blagoveshchensk, 50°19'N 127°37'E.



Fig. 5. Lower Amur at the mouth, 53°N 141°06'E



Fig. 6. Lower Amur: Ussuri River system, Khanka Lake at Kamen' Rybolov, 44°44'N 132°03'E.

sults of the confluence of the Kholuk and Ayakit on the Verkhne-Amgunskoye Plateau. Almost the whole Amgun watershed is characterized by a rather severe climate. The Ussuri River, the second (after Sungari) largest southern tributary of the Lower Amur, is formed by the confluence of the Ulahe and Arsenievka Rivers. It is 590 km long and has a catchment area of about 187,000 km².

The Khanka Lake lies on the Khankayskaya Plain (Fig. 6). The lake is connected to the Ussuri River by a long narrow channel called Sungacha [Song'acha] River. It is the largest lake of the Amur drainage and principally differs from the flood lakes of the Lower Amur by being isolated from the Ussuri River and not influenced by its floods. It is very shallow despite its large area (approximately 4,000 km²). The average depth is around 4 to 5 meters; the maximal depth is 6.5 to 10 meters depending on irregular periodical water level changes and this results in variations of the water surface area between 3,700 and 4,400 km². Variation in the water volume is about 40 %. There are 26 inflowing rivers to the lake, 9 draining from China and 17 from Russia. A number of adjacent lakes are either isolated, or con-

nected with lake Khanka during periods of high water level. The largest of these adjacent lakes is Xiao Xingkai Hu [Malaya Khanka] located in China. It is separated from the Large Khanka by a sand bar up to 10 m high in some places.

The Lower Amur District is situated in the area of temperate monsoon climate. The depressions are characterized by warm weather in summer but accumulate cold air in winter. The mean July temperature is about 20 °C. In Khanka Lake, steady southern winds create a system of surface currents. The winter in the Khankayskaya Plain is rather severe. Nearly the entire water column is mixed up by strong winds during the ice-free period. The peculiarity of physical-chemical characteristics of the lake water is its low transparency (up to only 0.15-0.30 m by Secchi disc) and high concentration (up to 200 g·m⁻³) of mineral suspended matter. In winter, turbidity gradually reduces reaching 0.7 m by Secchi disc.

There are 100 native species in the district, including two occasional visitors (*Oncorhynchus tshawytscha*, *Salvelinus leucomaenis*) and one species (*Rhodeus mantschuricus*) whose occurrence in the Lower Amur is questionable. Eleven species are strictly anadromous or freshwater and anadro-

mous; all of them, except for one (Manchurian *Salvelinus curilus*) belong to the northern group of species (including two spawning endemics, *Acipenser schrenckii* and *Huso dauricus*). There are 86 strictly freshwater species. Among them, genera of the southern group predominate (*Chanodichthys*, *Culter*, *Hemiculter*, *Megalobrama*, *Parabramis*, most Gobioninae, *Elopichthys*, *Hypophthalmichthys*, *Opsariichthys*, *Plagiognathops*, *Xenocypris*, *Siniperca*, *Perccottus*, *Channa*). Nine species (*Chanodichthys oxycephalus*, *Hemiculter* cf. *lucidus*, *Gobio soldatovi*, *Squalidus mantschuricus*, *Mylopharyngodon piceus*, *Plagiognathops microlepis*, *Misgurnus nikolskyi*, *Lefua pleskei*, *Rhinogobius lindbergi*) are shared only with the Sungari River and four more (*Acanthorhodeus* sp., *Rhodeus amurensis*, *Sarcocheilichthys czerskii*, *Pungitius bussei*) are probably shared since there are no exact data on their occurrence in the Sungari River.

Sungari River. The Sungari District is defined as the whole catchment area of the Sungari [Songhua] River, which is the largest tributary of the Amur, with a total length of 1,657 km and a catchment area of over 550,000 km². In the north, the boundary follows along the Xiao Hinggan Ling, which is the divide between the headwaters of the Nen Jiang and Hulan He (Sungari system) and the tributaries of the Middle Amur. In the northeast, the Sungari District is separated from the Ussuri (Lower Amur District) by the Nadan-Khada-Alin [or Wanda Shan] Range. Further south, the Laoelin [Laoye Ling] Range separates the Mulin He [Dalin He] River and the Mudanjiang River catchment areas of the Sungari District from the Lower Amur District (the Ussuri system). In the south, the Sungari District is contiguous with the Yalu Jiang [Amnok-kang] and Liao He drainages. In the west, the Da Hinggan Ling divides the Sungari drainage and the Hailar He [Haylar] watershed (Argun District).

The Songhua rises in the mountains near the North Korean-Chinese border and flows northwest through a region of dense forests until it is joined by the Nen Jiang, its largest tributary, near Da'an. At this point the Sungari turns sharply eastward until it joins the Hulan He near Harbin. It goes further in a northeastern direction through the Amur River Plain, joining the Amur at Dongjiang [T'ung-chiang].

The majority of the small tributaries of the Sungari are of mountain or semi-mountain character, with rapid flow, carrying large amounts of

suspended particles. Large tributaries, however, such as left-bank Nen Jiang and right-bank Lalin He and Mudanjiang, flow in the flood plain, forming anastomoses, bayous, backwaters, lakes, etc. They are especially numerous downstream of the confluence of the Sungari and Nonni. The total average discharge of the Sungari is about 2,500 m³·s⁻¹. The river freezes from late November until March. It has its highest discharge in spring when the mountain snow melts and disastrous floods may occur.

There are 80 native species in the Sungari District. Taxa of the southern group predominate, as in the Lower Amur District. Nine species are shared and four species probably shared only with the Lower Amur District. Besides, in the Amur drainage, six species (*Chanodichthys dabryi*, *Aphyocypris chinensis*, *Squaliobarbus curriculus*, *Micropercops cinctus*, *Rhinogobius sowerbyi*, *Macropodus ocellatus*) are historically known only from the Sungari though some of them recently penetrated into the Lower Amur proper. The range of *Rhodeus mantschuricus* is not clear; it might also be endemic to the Sungari. The Sungari differs from the Lower Amur by the absence of most migratory salmonids (except for *Oncorhynchus keta*) and of the originally marine or brackish water fishes (termed vicarious in English zoogeographical literature, e.g. Myers, 1939) such as sticklebacks (*Pungitius*) and gobies of the subgenus *Taranetziola* (of *Gymnogobius*).

An area encompassing coastal rivers on both sides of the Amurskiy Liman Strait is commonly considered as a distinct zoogeographic unit, the Coastal Amur District (Taranetz, 1938; Berg, 1949b; Chereshev, 1998). It includes rivers of the Sea of Okhotsk on the continent (from the Uda River in the north), on the Shantarskiye Isles [Shantary Islands] and on the north-western Sakhalin Island, and rivers on both shores of the Amurskiy Liman Strait. Some authors include the district into the Amur drainage in a wide sense (e.g. Novomodny et al., 2004). Compared to the Lower Amur District, the Coastal District is much poorer and inhabited by 24 freshwater species only, shared with the Amur drainage. This fact finds its explanation in the palaeogeography of the area. The Amur and adjacent rivers of the continental coast and the Sakhalin Island belonged to the ancient system of the Palaeo-Amur which existed through the Pleisocene during sea regressions (Lindberg, 1955; Lebedev, 1995; Grosswald & Hughes, 2005).

The native fishes of the Amur drainage

Family Petromyzontidae (northern lampreys)

Lethenteron camtschaticum (Tilesius, 1811)

Petromyzon marinus camtschaticus Tilesius, 1811: 240, pl. 9 figs. 1-2 (originally from "at Petropavlovsk-Kamchatskiy [Kamchatka Peninsula, north-eastern Russia]"; neotype (ZMB 6475) designation by Kottelat (1997) determined type locality as Japan).

Distribution. Anadromous. In Eurasia: rivers of Arctic basin from Pasvik (Norwegian-Russian border) to Kara and Ob'; Novaya Zemlya Islands; rivers of Pacific coast from Anadyr to Japan and Korea. In North America: from Mackenzie River to Kenai Peninsula (Alaska). In Amur: goes upstream and enters Bureya, Sungari, Ussuri (up to Bol'shaya Ussurka River).

Lethenteron reissneri (Dybowski, 1869) (Fig. 7)

Petromyzon reissneri Dybowski, 1869: 958 (Onon and Ingoda rivers [Upper Amur River drainage, Chita Province, Russia]).

Remarks on systematics. Brook lamprey from Hokkaido, Honshu and South Korea represent two distinct undescribed species (Shedko, 2001a; Yamazaki et al., 2006). *Lethenteron reissneri* is treated as a synonym of *L. kessleri* (Anikin, 1905) distributed in rivers of the Arctic basin (Kottelat, 2006; Yamazaki et al., 2006; Kottelat & Freyhof, 2007) but this needs further examination.

Distribution. In Asia: Pacific Ocean basin in Asia from Anadyr and rivers of Kamchatka to rivers of Sea of Japan (Tumen included). In Amur: in smaller tributaries throughout drainage.

Family Acipenseridae (sturgeons)

Acipenser mikadoi Hilgendorf, 1892

Acipenser mikadoi Hilgendorf, 1892: 98 (Tokyo market, Japan).

Remarks on systematics. Considered as a synonym of *A. medirostris*, from the American coast of the Pacific Ocean (e.g. Berg, 1911; Soldatov, 1915;

Nikolsky, 1956; Novomodny et al., 2004; Bogutskaya & Naseka, 2004), or a subspecies of it (e.g. Lindberg & Legeza, 1965; Reshetnikov, 1998), or a distinct species (e.g. Birstein et al., 1993; Birstein et al., 1997; Birstein & DeSalle, 1998; Mecklenburg et al., 2002).

Distribution. Anadromous. In Asia: Asian coast of northern Pacific Ocean from Sea of Okhotsk southward to northern Japan and Korea; rarely met in Amur estuary (Soldatov & Lindberg, 1930).

Acipenser schrenckii Brandt, 1869

Acipenser schrenckii Brandt, 1869: 175 (Amur River drainage).

Distribution. Freshwater and anadromous. Spawning endemic of Amur drainage: migrates for spawning up to middle and lower reaches of Onon (upstream to Aksha) and Ingoda (upstream to Chitinka River) (Karasev, 1987); anadromous populations forage in estuary and in Amur Liman.

Huso dauricus (Georgi, 1775)

Acipenser dauricus Georgi, 1775: 352 (Amur, Argun, Shilka, Onon and Ingoda rivers [Amur River drainage, Russia and China]).

Acipenser orientalis Pallas, 1814: 107 ("enters Amur from Pacific Ocean reaching Shilka and Argun rivers in Dauria" [Amur River drainage, Russia and China]).

Acipenser mantschuricus Basilevsky, 1855: 235 (Amur River [China]).

Distribution. Freshwater and anadromous. Spawning endemic of Amur drainage: migrates far upstream to Argun and Shilka (lower reaches of Onon and Ingoda); adults also occurring in Amur estuary and coastal brackish waters of Sea of Okhotsk and Sea of Japan; non-spawning adults entering some rivers of the coast of the Sea of Okhotsk, such as Urak, Okhota, Kukhtuy, Ul'beya and Inya.



Fig. 7. *Lethenteron reissneri*, male, 160 mm SL; Russia: Ilya River, a tributary of Onon River, upstream from Dul'durga village, 50°43'N 113°35'E.

Family Cyprinidae
(minnows and carps)

Subfamily Acheilognathinae

Acanthorhodeus asmussii (Dybowski, 1872)
(Fig. 8)

Devario asmussii Dybowski, 1872: 212 (Khanka Lake [Amur River drainage, Russia and China]).

Acanthorhodeus asmussii amurensis Holčík, 1962: 160, figs. 3-4 (Kabar Lake at Elabuga in Amur River drainage [Russia]).

Remarks on systematics. The genus *Acanthorhodeus* is synonymized with *Acheilognathus* by most recent authors following Arai & Akai (1988). We retain *Acanthorhodeus* as a distinct genus (e.g. Bogutskaya & Naseka, 2004; Naseka & Bogutskaya, 2004) because of morphological differences between the type-species of *Acanthorhodeus* (*A. macropterus* Bleeker, 1871) and the type-species of *Acheilognathus* (*A. rhombeus* (Temminck & Schlegel, 1846)) (thickened last simple dorsal-fin ray modified into a strong spine flexible only at the very tip vs. non-modified soft ray).

Some authors (e.g. Choi et al., 1990; Kim, 1997; Zhang, 1995; Chen et al., 1998) synonymize *A. asmussii* with *A. macropterus*, which is distributed in central and southern China southward to Zhu Jiang, without supporting evidence; a comparison of type specimens of *A. asmussii* and *A. macropterus* tentatively confirms that they are distinct species (Naseka & Bogutskaya, 2004, figs. 1, 3, 4).

Distribution. Freshwater. Treated here as endemic until further taxonomic study is done. In Amur: from Ol'gino down to Mago and systems of all southern tributaries of Lower Amur. Not

known from Argun and Shilka systems in Russia (e.g. Nikolsky, 1956; Karasev, 1987); also in Mongolia: Kherlen and Khalkh rivers, and Buir Nur Lake (e.g. Dashdorzh & Demin, 1977; Kottelat, 2006); this may represent a distinct species.

Acanthorhodeus chankaensis (Dybowski, 1872)

Devario chankaensis Dybowski, 1872: 212 (Khanka Lake [Amur River drainage, Russia and China]).

Acanthorhodeus asmussi sungariensis Berg, 1931: 218, fig. 6 (Sungari River at Harbin [Amur River drainage, China]).

Distribution. Freshwater. In Asia: Range traditionally considered to extend from Amur southward to Yangtze drainages, excluding Liao He drainage (e.g. Li, 1981) but this may involve several species. In Amur: Ussuri River system and Khanka Lake, and main Amur channel (Middle and Lower Amur) from Blagoveshchensk to Bolon' Lake.

Acanthorhodeus sp.
(Fig. 9)

Acanthorhodeus cf. *asmussii*: Naseka & Bogutskaya, 2004: 281, fig. 2 (Khanka Lake basin).

Acanthorhodeus sp.: Bogutskaya & Naseka, 2004: 42.

Remarks on systematics. Identification uncertain; most probably, a distinct species (Bogutskaya et al., 2001; Naseka & Bogutskaya, 2004). Novomodny (2005b) and Novomodny et al. (2004) do not distinguish it from *A. asmussii* and suppose that they both are conspecific with *A. macropterus*.

Distribution. Freshwater. Endemic or Manchurian. In Amur: presently known only from basin



Fig. 8. *Acanthorhodeus asmussii*, male, 77 mm SL; Russia: Khanka Lake at Post Vostochnyy (Khanka Nature Reserve) north of Spasovka River mouth, 44°39'N 132°34'E.

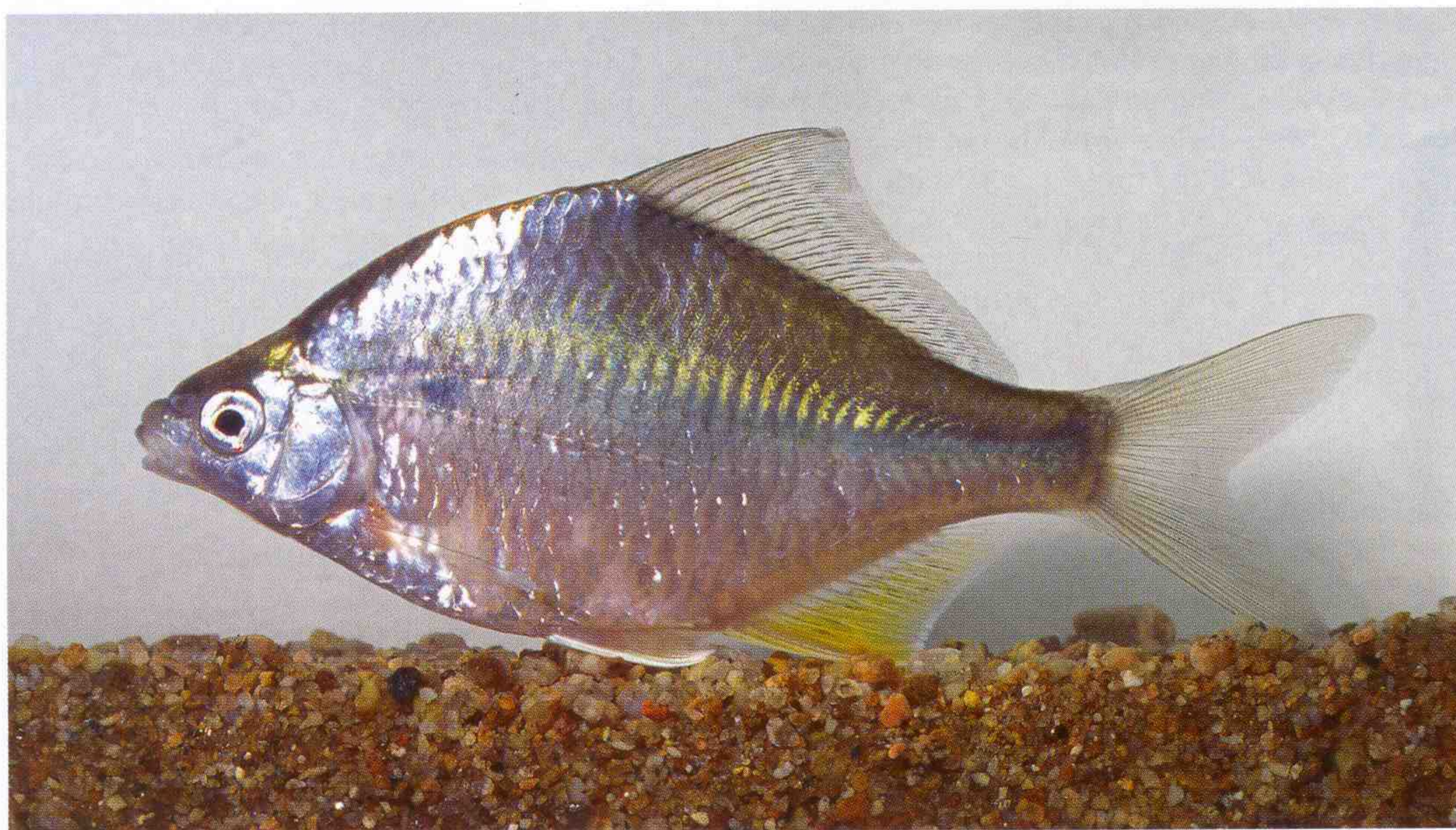


Fig. 9. *Acanthorhodeus* sp., male, 75 mm SL; Russia: Khanka Lake at Post Vostochnyy (Khanka Nature Reserve) north from the Spasovka River mouth, 44°39'N 132°34'E.

of Khanka Lake where it is sympatric with *A. asmussii*; however it may have a wider distribution in Korea and northern China, possibly misidenti-

fied as *A. macropterus*. Figure 26 in Kim (1997) apparently shows this species.

***Rhodeus amurensis* (Vronsky, 1967)**
(Fig. 10)

Pseudoperilampus sp.: Kryzhanovsky et al., 1951: 156

Pseudoperilampus lighti amurensis Vronsky, 1967: 23-24 (Ussuri and Kiya rivers, Khanka and Bolon' lakes, Amur at Daerga and Leninsk [lower Amur drainage, Russia]).

Remarks on systematics. *Pseudoperilampus lighti amurensis* has never been mentioned in Chinese literature. The taxonomy of the small-sized species of the genus *Rhodeus* is still uncertain (Okazaki et al., 2001; Arai & Kato, 2003). They may be divided into two groups: species with 48 chromosomes [*Rhodeus sinensis* Günther, 1868, *R. lighti* (Wu, 1931)] and species with 46 chromosomes [*Rhodeus atremius* (Jordan & Thompson, 1914), *Rhodeus fangi* (Miao, 1934), *Rhodeus notatus* Nichols, 1929, *Rhodeus smithii* (Regan, 1908), *Rhodeus uyeckii* (Mori 1935)]. There is no data on diploid number of chromosomes in *R. amurensis*. Novomodny et al. (2004) suggested that *P. l. amurensis* is a synonym of *R. fangi*. At the same time, Novomodny et al. (2004) synonymized *R. uyeckii* and *R. fangi* and assumed that the species is non-indigenous in the Amur but was introduced in the 1930-1940s. Our opinion is that *R. fangi* (originally described from the lower reaches of the Yangtze at Zhenjiang [Chinkiang]) is a species distinct from the Korean *R. uyeckii* and that *R. amurensis* is not conspecific with *R. uyeckii* (Naseka & Bogutskaya, 2004). The latter species is introduced in the Amur drainage (Novomodny, 2005b, as "Fang's bitterling"). Korean authors (e.g. Kim, 1997; Kim & Park, 2002) treat *R. uyeckii* as a species endemic to the southern part of the Korean Peninsula.

Distribution. Freshwater. Endemic to Amur: Lower Amur from Khabarovsk down to Bolon' Lake, southern tributaries of Lower Amur including Khanka Lake.

***Rhodeus mantschuricus* Mori, 1934**

Rhodeus mantschuricus Mori, 1934b: 57, fig. 1 (Koga near Kitsurin: upper reaches of Sungari River [China])

Remarks on systematics. This species has been treated as a synonym of *Rhodeus sericeus* by most authors (e.g. Berg, 1949a; Wu, 1964; Chen et al., 1998), but Arai et al. (2001) have recently shown that it is a distinct species.

Distribution. Freshwater. Endemic to Amur: Sungari River; probably other southern tributaries of Amur.

***Rhodeus sericeus* (Pallas, 1776)**
(Fig. 11)

Cyprinus sericeus Pallas, 1776: 704 (Dauria [Transbaikalia: Upper Lena, Selenge and Upper Amur in Russia]).

Remarks on systematics. The east Asian *R. sericeus* has been considered conspecific with the European *Rhodeus amarus* despite the fact that their ranges are widely separated. This was doubted by some (e.g. Kottelat, 1997). Molecular studies by Bohlen et al. (2006) recently showed that *R. sericeus* and *R. amarus* belong to two very distinct lineages and are distinct species. Our morphological data show that *R. sericeus* is morphologically heterogeneous, and it seems likely that future studies will result in the recognition of several species. Figure 11 shows the real *R. sericeus* from the type locality (Upper Amur). Populations earlier referred to *R. sericeus* from southern Amur tributaries are now recognised as a distinct species, *R. mantschuricus* (see above). Populations from South Korea are now recognised as *R. pseudosericeus* by Arai, Jeon & Ueda (2001: 276, figs. 1-6).

Distribution. Freshwater. Due to the taxonomic situation, the exact distribution is not yet clear. Traditionally, most authors consider it to include Amur drainage from headwaters down to estuary, river drainages of Peter-the-Great Bay (Sea of Japan) and Sea of Okhotsk up to Uda River, and Sakhalin Island (Tym' and Poronay Rivers).

Subfamily Cultrinae

***Chanodichthys abramoides* (Dybowski, 1872)**

Culter abramoides Dybowski, 1872: 213 (Ussuri River, Khanka Lake [Amur River drainage, Russia and China]).

Erythroculter dabryi shinkainensis Yih & Chu, 1959: 177 (Khanka Lake [China]).

Remarks on systematics. Nomenclatural and taxonomic problems with the usage of the generic name *Chanodichthys* were discussed by Bogutskaya & Naseka (1997, 2004). *Chanodichthys* is the oldest available name for species usually

referred to as *Erythroculter*; see under *Chanodichthys erythropterus* for the identity of the species usually referred to as *Culter erythropterus*.

Chanodichthys abramoides was commonly considered a synonym or a subspecies of *C. dabryi*, originally described from the Yangtze River (Bănărescu, 1967a; Bogutskaya & Naseka, 1997; Reshetnikov, 1998) or a synonym of *C. oxycephalus* (see below) (Berg, 1909, 1916, 1949a; Nikolsky, 1956; Samuylov & Svirsky, 1976). Two distinct taxa (treated sometimes as ecomorphs) occurring in Khanka Lake (Yih & Chu, 1959; Zhang, 1995; Chen et al., 1998; Shapovalov, 2003) were identified as *C. abramoides* and *C. oxycephalus*, based on the examination of a syntype of *Culter abramoides* (ZMB 7933) and the holotype of *Culter oxycephalus* (MNHN 5050) (Bogutskaya & Naseka, 2004).

Distribution. Freshwater. Endemic to Amur: southern part of Lower Amur drainage (Sungari and Ussuri Rivers, Khanka Lake), commonly in lakes and main channel of larger tributaries.

Chanodichthys dabryi (Bleeker, 1871)

Culter dabryi Bleeker, 1871: 66, pl. 12 fig. 2 (Yangtze River, China).

Remarks on systematics. The identity of the nominal species *C. oxycephalus* – *C. abramoides* – *C. dabryi* is not clear; the three nominal species might actually be synonyms.

Distribution. Freshwater. In Asia: usually reported in Chinese waters from Amur southward to Yangtze (e.g. Li, 1981; Zhang, 1995; Chen et al., 1998) but the exact limits of its distribution are not clear. In Amur, reported only from Wudalianchi ("Five Great Lakes", Sungari system) (Zhang, 1995). Not known from the Khanka Lake.

Chanodichthys erythropterus (Basilewsky, 1855)

Culter erythropterus Basilewsky, 1855: 236, pl. 8 fig. 1 (rivers of Gulf of Tschili [Bo Hai, China]).

? *Culter ilishaeformis* Bleeker, 1871: 66, pl. 10 fig. 1 (Yangtze River, China).

Culter sieboldii Dybowski, 1872: 214 (Middle Amur, Ussuri and Sungacha Rivers, Khanka Lake [Amur drainage, China]).

Remarks on systematics. Published data (e.g. Yih & Chu, 1959; Zhang, 1995; Shapovalov, 2003) suggest that several species may be confused under the name *C. erythropterus*.

Distribution. Freshwater. In Asia: from Amur drainage and rivers of Korea southward to Hainan, Taiwan and Red River drainage in south China and northern Vietnam. In Amur: from about Kumara downstream to Orel' Lake. Absent from Shilka and Argun systems on Russian territory of Russia (e.g. Nikolsky, 1956; Karasev, 1987). The population from Buir Nur may represent a distinct taxon.

Chanodichthys mongolicus (Basilewsky, 1855)

Leptocephalus mongolicus Basilewsky, 1855: 234 (Mongolia and Manchuria [North China]; as *mongolensis* in legend for pl. 4 fig. 2).

Culter mongolicus Basilewsky, 1855: 237 (Mongolia [North China]).

Culter rutilus Dybowski, 1872: 214 (Ussuri River, Khanka Lake [Amur River drainage, Russia and China]).

? *Erythroculter mongolicus qionghaiensis* Ding, 1990: 246, fig. (Qionghai Lake, Sichuan, China).

? *Erythroculter mongolicus elongatus* He & Liu, 1980: 483, fig. (Cheng-Hai [Chenghai Lake], Yunnan, China).

Remarks on systematics. *Chanodichthys mongolicus qionghaiensis* and *C. m. elongatus* as well as the fish from Buir Nur basin may represent distinct species.

Distribution. Freshwater. In Asia: from Amur southward to Yangtze drainages. Disjunct distribution in Amur: in Upper Amur, known from Buir Nur basin (Argun system): Orshun, Buir Nur and Khalkh (Dashi-Dorzhi, 1955; Dashdorzh & Demin, 1977). Later reported from Onon (Shilka system) in Mongolia (Kottelat, 2006) which needs confirmation. Absent in Shilka (including Onon) and Argun systems in Russia (e.g. Nikolsky, 1956; Karasev, 1987) and from Middle Amur. Present in Lower Amur from about Amurzet - Ekaterino-Nikol'sk downstream to about Tyr (Amgun' River mouth), including all southern tributaries and Khanka Lake.

Chanodichthys oxycephalus (Bleeker, 1871)

Culter oxycephalus Bleeker, 1871: 66, pl. 5 fig. 3 (Yangtze River [China]).

Remarks on systematics. *Chanodichthys oxycephalus* and *C. dabryi* are considered distinct species (e.g. Wu, 1964; Zhang, 1995; Chen et al., 1998; Bogutskaya & Naseka, 2004). In earlier Russian



Fig. 10. *Rhodeus amurensis*, male, 32 mm SL; Russia: Spasovka River at Gayvoron, Khanka Lake basin, 44°45'N 132°47'E.



Fig. 11. *Rhodeus sericeus*; Russia: Aleur River, a tributary of Shilka River, 52°47'N 117°16'E; **a**, spawning male, 70 mm SL; **b**, spawning female, 65 mm SL.

literature, *C. dabryi* and *C. oxycephalus* were often synonymized.

Distribution. Freshwater. In Asia: from Amur to the Yantze drainages. In Amur: known only from Ussuri, Sungari and Khanka Lake; probably absent from Lower Amur itself.

Culter alburnus Basilewsky, 1855

Culter alburnus Basilewsky, 1855: 236, pl. 8 fig. 3 (river of Gulf of Tschili [Bo Hai, China]).

Culter tientsinensis Abbott, 1901: 489, fig. (Pei-Ho River at Tien-Tsin [Tianjin, China]).

Remarks on systematics. The type species of the genus, *C. alburnus*, possesses a long abdominal keel (from the pectoral to the anal fins), which is the main diagnostic character of the genus in contrast to *Chanodichthys* (see above) with a short abdominal keel. *Cultrichthys* is a subjective junior synonym of *Culter* (Bănărescu, 1967b, 1972b, 1997; Bogutskaya & Naseka, 2004).

The confusion with the uses of the names *Culter alburnus* Basilewsky, 1855 and *Culter erythropterus* Basilewsky, 1855 was noticed long ago (Rendahl, 1928). Yiu & Chu (1959) revised a group of cultrine fishes and recognised two species, the first one known under the common name "ukley" [уклей] in Russian and "boyü" in Chinese, and the second one known under the common name "verkhoglyad" [верхогляд] in Russian and "hun boyü" in Chinese. Having no possibility to examine type material of *C. alburnus* they reached the erroneous conclusion that the name *Culter alburnus* should be applied to "hun boyü". The lectotype of *Culter alburnus* (ZISP 5585), designated by Bogutskaya & Naseka (2004) in fact is a "boyü". The *Culter* population from the basin of Buir Nur is possibly a distinct species.

Distribution. Freshwater. In Asia: from Amur drainage and rivers of Korea southward to Red River drainage in south China and north Vietnam, and Hainan and Taiwan (assuming that *Culter brevicauda* Günther, 1868 is a synonym). Disjunct distribution in Amur drainage. In Argun system in Mongolia, occurs only in Buir Nur basin, in the lake and the lower reaches of its tributaries Orshun and Khalkh (Dashi-Dorzhi, 1955; Dashdorzh & Demin, 1977). Probably does not occur in most of Upper Amur system since it was not observed during a long-term extensive study of Russian stretches of Shilka and Agrun' Rivers

(Karasev, 1987). In the Middle and Lower Amur, it is known from about Albazino downstream to Nizhnetambovskoye.

Hemiculter leucisculus (Basilewsky, 1855)

Culter leucisculus Basilewsky, 1855: 238 (rivers of the Gulf of Tschili [Bo Hai, China]).

Hemiculter schrencki Warpachowski, in Warpachowski & Herzenstein, 1887: 46, fig. 4 (Fu-Tschou [Fuchow], China).

Hemiculter kneri Warpachowski, 1887: 17 (Shanghai, China).

? *Parapelecus eigenmanni* Jordan & Metz, 1913: 21, pl. 3 fig. 1 (Suigen, south of Seoul [South Korea]).

Kendallia goldsboroughi Evermann & Shaw, 1927: 108 (Hangchow [Hangzhou], China).

Distribution. Freshwater; tolerant to slightly brackish water. In Asia: from Amur southward to Red River drainages (southern China and northern Vietnam) and Taiwan. Widely introduced and invasive in Central Asia (Aral Sea basin, Lake Balkhash) (Vasil'eva & Kozlova, 1988; Reshetnikov, 1998). In Amur: Middle and Lower Amur from Sverbeyevo downstream to about Mago, and its southern tributaries and, probably, Zeya River. Gorlacheva et al. (1995) suggest that the species was originally absent from Argun and Shilka but appeared after 1950s by invasion or introduction; however, Taranetz (1937d) believed that the species was native in Argun and Shilka.

Hemiculter lucidus (Dybowski, 1872)

Culter lucidus Dybowski, 1872: 214 (Khanka Lake [Russia and China]).

Remarks on systematics. *Hemiculter leucisculus* and *H. lucidus* have often been confused or misidentified. Their taxonomy was revised by Vasil'eva & Kozlova (1988). The taxonomic status of *Hemiculter bleekeri* Warpachowski, 1887 is not clear; it is treated as a synonym or a subspecies of *H. lucidus* (e.g. Yih & Wu, 1964; Bănărescu, 1968; Zhu, 1995). We tentatively follow Chen et al. (1998) and Wang et al. (2001) in considering *H. bleekeri* a valid species. *Hemiculter varpachowskii*, often synonymized with *H. lucidus*, is discussed below.

Distribution. Freshwater. Probably, endemic to Amur: known from Khanka Lake; limits of distribution outside lake not clear. The fish identified

as *H. lucidus* from Ussuri River system probably represents *H. cf. lucidus* (see below).

Hemiculter cf. lucidus

? *Hemiculter bleekeri* Warpachowski, 1887: 20
(? Yangtze River [China]).

Remarks on systematics. This species differs from *H. lucidus* by some morphological (e.g. Vasil'eva & Kozlova, 1989; Zhu, 1995; Zhang, 1995) and molecular characters (Shedko et al., unpubl.). It is treated as a distinct species identified as *H. bleekeri* (e.g. Yih & Wu, 1964; Li, 1981; Chen et al., 1998) or a subspecies *H. bleekeri bleekeri* (Zhu, 1995; Zhang, 1995; Cheng & Zhou, 1997) with *H. bleekeri lucidus* as a second subspecies (which is not correct; following the Code, the correct names must be *H. lucidus bleekeri* and *H. lucidus lucidus*, respectively). Vasil'eva & Kozlova (1988) followed by Bogutskaya & Naseka (2004) considered *H. cf. lucidus* to be conspecific with *H. lucidus*. At the same time, these authors synonymized *H. lucidus* with *H. bleekeri*. However we did not examine any Yangtze material for the molecular study and still cannot consider the taxonomic relationships of *H. cf. lucidus* and *H. bleekeri* as clear.

Distribution. Freshwater. In Asia: the range of *H. cf. lucidus* appears to include only Amur drainage and rivers of western Korean Peninsula (a photograph in Kim & Park, 2002: 192, shows *H. cf. lucidus* as *H. leucisculus*). In Tumen River, geographically close to Amur drainage, only *H. leucisculus* is reported (Zheng et al., 1980) but this needs confirmation. In Amur: absent from Shilka and Argun systems (including Buir Nur basin); known from Sungari and Lower Amur downstream to about Dayerga.

***Hemiculter varpachovskii* Nikolsky, 1904**

Hemiculter varpachovskii A. Nikolsky, 1904: 359
(Buir Nur [Argun River system, Mongolia and China]).

Remarks on systematics. Treated as a synonym of *H. leucisculus* (e.g. Sokolov, 1983), as a synonym of *H. lucidus* (e.g. Vasil'eva & Kozlova, 1988; Bogutskaya & Naseka, 1997), as a subspecies of the latter (e.g. Chen et al., 1998) or as a valid species (Li, 1981; Kottelat, 2006). Relationships with *H. cf. lucidus* and *H. bleekeri* are not clear.

Distribution. Freshwater. Endemic to Amur: lakes Buir Nur and Hulun Nur with tributaries in Upper Amur system; limits of distribution in Argun River itself in Mongolia, China and, probably, Russia need clarification.

***Megalobrama mantschuricus* Basilewsky, 1855**

Abramis mantschuricus Basilewsky, 1855: 239
("brought to Peking ... from Mongolia and Manchuria" [north China]).

Megalobrama skolkovii Dybowski, 1872: 213 (Middle and Lower Amur, Ussuri and Sungari rivers, Khanka Lake [China and Russia]).

Remarks on systematics. *Megalobrama mantschuricus* was traditionally treated as a synonym of *M. terminalis*. Luo (1990) showed that this is a distinct species (identified as *M. skolkovii*). Vasil'eva & Makeyeva (2003) assumed that the earliest name available for the species is *M. mantschuricus* though syntypes of *Abramis mantschuricus* Basilewsky, 1855 are missing and the original description is vague and lacks a drawing of the fish.

Distribution. Freshwater. In Asia: from Amur River southward to the Yangtze River drainage and rivers further southward draining to the South China Sea, excluding Zhu Jiang and Xi Jiang. In Amur River, distributed in middle and lower reaches, including tributaries from about Blagoveshchensk downstream to about Novosil'novka.

***Parabramis pekinensis* (Basilewsky, 1855)**

Abramis pekinensis Basilewsky, 1855: 239, pl. 6
fig. 2 (rivers of Gulf of Tschili [Bo Hai] China).

Megalobrama skolkovii var. *carinatus* Dybowski, 1872: 213 (Middle and Lower Amur, Ussuri and Sungari rivers, Khanka Lake [China and Russia]).

? *Leuciscus bramula* Valenciennes, in Cuvier & Valenciennes, 1844: 357 (China).

Parabramis liaohonensis Yih & Wu, 1964: 117, figs. 2-51 (Tai-an, Liao Ho River, Liaoning Province, China).

Chanodichthys stenzii Popta, 1907: 246, fig. (Imperial canal at Kiautschou [Chiao-Hsien, Shandong, China]).

Parabramis pekinensis forma *strenosomus* Yiu, She & Yih, 1959: 227 (Heilongjiang [Amur], China).

Distribution. Freshwater. In Asia: continental East Asia from Amur River to South China; introduced in Central Asia and Europe. In Amur: Middle Amur downstream from mouth of Kuma River and Lower Amur with southern tributaries.

Subfamily Cyprininae

Carassius sp.

? *Cyprinus gibelio* Bloch, 1782: 71, pl. 12 (Churmark, Pommern, Schlesien and Preussen [Germany and Poland])

Carassius vulgaris var. *kolenty* Dybowski, 1877: 11 (Amur River [Russia]).

Remarks on systematics. The taxonomic status of the species is still not clear (for discussion, see e.g. Kottelat, 1997, 2006; Vasil'eva & Vasil'ev, 2000; Kottelat & Freyhof, 2007); commonly treated as *C. auratus gibelio* (for discussion of *C. auratus* see, e.g. Kottelat, 2006). Probable syntypes of *C. gibelio* are from Europe; they were identified as *C. carassius* (Kalous et al., 2004), and this creates a number of not yet solved taxonomic and nomenclatural problems.

Distribution. Freshwater. In Eurasia: limits of native range not known since the taxonomy of the species is not yet cleared and because it has been widely introduced all over former USSR, China and elsewhere. However, it seems most probable that it is native in the most parts of Amur River where it is distributed throughout the drainage except for the most montaneous sections.

Cyprinus rubrofuscus La Cepède, 1803

Cyprinus rubro-fuscus La Cepède, 1803: 530, pl. 16 fig. 1 (China).

Cyprinus nigro-auratus La Cepède, 1803: 547, pl. 16 fig. 2 (China).

Cyprinus viridi-violaceus La Cepède, 1803: 547, pl. 16, fig. 3 (China).

Cyprinus anna-carolina La Cepède, 1803: 544, pl. 18 fig. 1 (no locality).

Cyprinus carpio var. *miirgo* Dybowski, 1869: 950 (Onon River [Upper Amur River, Russia]).

Remarks on systematics. This taxon was commonly treated as a subspecies *C. carpio rubrofuscus* (e.g. Chen & Huang, 1977; Zhu, 1995) or a distinct species (Kottelat, 2001a,b, 2006). The use of the name *C. rubrofuscus* is discussed in detail by

Kottelat (2001b, 2006). Its distinctiveness from the European-Central Asian carp is supported by molecular data (Gross & Kohlmann, 2004; Zhou et al., 2004). In the Russian literature, this species commonly appeared under the name *C. c. haematopterus* Temminck & Schlegel, 1846, which is not valid because the name is a junior homonym of *Cyprinus haematopterus* Rafinesque, 1820, a name given to a North American fish.

Distribution. Freshwater; tolerant to slightly brackish water. In Asia: from Amur southward to the Red River drainages, although it is not possible to determine with certainty its original range. In Amur: native from headwaters down to estuary and Amursky Liman Straight.

Subfamily Gobioninae

Abbottina rivularis (Basilewsky, 1855)

Gobio rivularis Basilewsky, 1855: 231 (lakes and rivers of northern China).

Tylognathus sinensis Kner, 1867: 354, pl. 15 fig. 5 (Shanghai, China).

Abbottina psegma Jordan & Fowler, 1903: 835, fig. 5 (Yodo River at Osaka, Japan).

? *Abbottina lalinensis* Huang & Li, in Zhang, 1995: 164, fig. 67 (Sungari, Lalin, Heilongjiang, China).

Remarks on systematics. *Abbottina lalinensis*, described from Sungari system in 1995, was later synonymized with *A. rivularis* (Chen et al., 1998). We have no comparative material from the Sungari, so we cannot comment on the identity of *A. lalinensis*.

Distribution. Freshwater. In Asia: native from Amur southward to Yangtze and rivers of Fujian Province. Widely introduced in East, South-East and Central Asia (Reshetnikov, 1998). In Amur: in southern tributaries; in the main Amur itself from about Blagoveshchensk downstream to Maksim Gor'kiy.

Gnathopogon mantschuricus (Berg, 1914) (Fig. 12-13)

Gobio taeniatus mantschuricus Berg, 1914: 481, fig. 72 (Shansi River, tributary of Hailin River, at Sandavozi railway station, Sungari system [China] and Ussuri River downstream from Lonchakovskiy [Russia]).



Fig. 12. *Gnatopogon mantschuricus*, 60 mm SL; Russia: Zeya River upstream from Blagoveshchensk, 50°34'N 127°40'E.



Fig. 13. *Gnatopogon mantschuricus* (?*soldatovi*), 57 mm SL; Russia: Zeya River upstream from Blagoveshchensk, 50°34'N 127°40'E.

? *Paraleucogobio soldatovi* Berg, 1914: 486, fig. 74 (Ussuri River, Khor River, Amur at Vyatskoye, Ussuri at Kiya River mouth, Rybnoye Lake, Kiya River, Amur 45 wersts upstream from Khabarovsk, Ussuri at Novo-Troitskiy and four more localities on Ussuri River [Amur drainage, Russia]).

Remarks on systematics. We distinguish two sympatric forms of *Gnathopogon* in Amur, which correspond to *Gobio taeniatus mantschuricus* (Fig. 12) and *Paraleucogobio soldatovi* (Fig. 13) as understood by Berg (1914). He later (Berg, 1949a)

synonymized his *G. t. mantschuricus* with *Gobio strigatus* while keeping *P. soldatovi* as a distinct species. *Gobio strigatus* including *G. t. mantschuricus* and *P. soldatovi* were synonymized by Spasovskaya (1953) under the name *Leucogobio strigatus*. *Gnathopogon mantschuricus* is treated as a valid species distributed in Amur by Zhang (1995) and Chen et al. (1998). Karasev (1987) showed morphological differences between samples of *G. strigatus* from Shilka (Upper Amur) and from Lower Amur. Both *G. mantschuricus* and *G. soldatovi* may be distinct species. The latter one is distinguishable by lighter overall coloration in



Fig. 14. *Gobio cynocephalus*, 109 mm SL; Russia: upper reaches of Olenguy River, a tributary of Ingoda River, 4 km upstream from Olenguy village, 51°13'N 113°19'E.

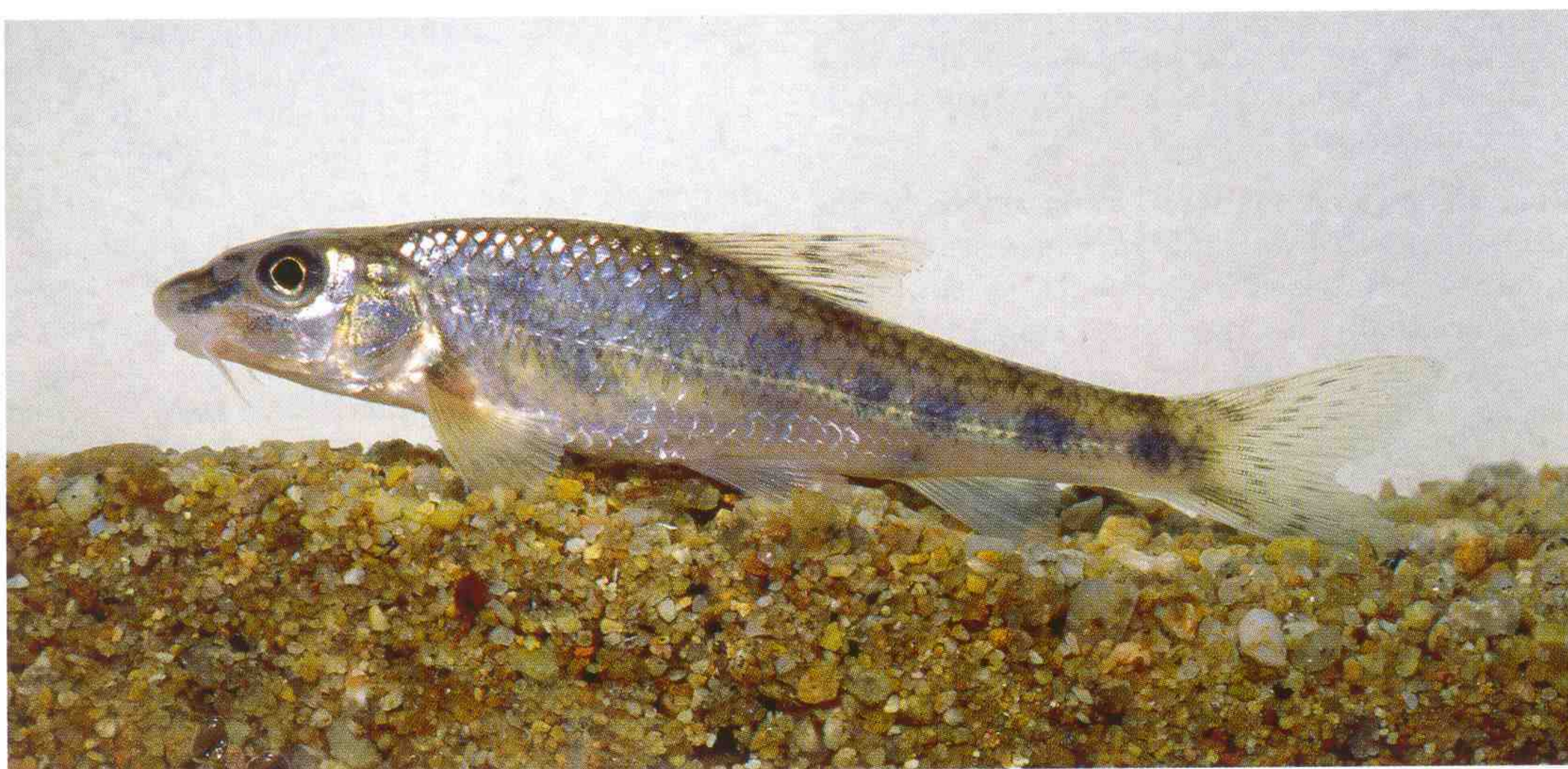


Fig. 15. *Gobio soldatovi*, 69 mm SL; Russia: Spasovka River at Gayvoron, Khanka Lake basin, 44°45'N 132°47'E.

adults and an anteriorly placed dorsal fin. We refrain to formally distinguish them until a taxonomic revision is done. None of them is a synonym of *G. strigatus*.

Distribution. Freshwater. *Gnathopogon mantschuricus* sensu stricto (the form with the bright lateral stripe and a posteriorly placed dorsal fin) occurs in Upper Amur (Buir Nur, lower Argun, Shilka between Nerchinsk and Sretensk; Dashdorzh & Demin, 1977; Karasev, 1987), Middle and Lower Amur and tributaries (recorded from Dzhalinda down to about Sofiysk). The form

which corresponds to *G. soldatovi* is known from Khanka Lake basin (our data), Selemzha system (Taranetz, 1937d) and north-western Korea (Mori, 1936).

***Gobio cynocephalus* Dybowski, 1869**
(Fig. 14)

Gobio fluviatilis var. *cynocephalus* Dybowski, 1869: 951 (Onon and Ingoda rivers [Amur River drainage, Russia]).

Gobio liaoensis Mori, 1927b: 31[2] (Tai-tzu, tributary of Liao Ho, at Chiao-tao [northern China]).

Remarks on systematics. *Gobio cynocephalus* is treated by some authors (e.g. Lu et al., 1977; Zhu, 1995; Kim, 1997) as a subspecies of *Gobio gobio*. *Gobio macrocephalus* Mori, 1930 (reported for Northern Nandai and Tumen rivers; Mori, 1936) was synonymized with *G. gobio* but is now considered a valid species by Kottelat (2006), a conclusion supported by our morphological data.

Distribution. Freshwater. In Asia: Amur, Uda (southern Sea of Okhotsk basin), Upper Yalu and Liao He; not clear if native or introduced in north-western Sakhalin Island (Safronov et al., 2005). In Amur: from headwaters down to estuary.

***Gobio soldatovi* Berg, 1914**
(Fig. 15)

Gobio gobio var. *soldatovi* Berg, 1914: 461, fig. 63 (Lower Amur River at mouth of Chepchiki channel).

? *Gobio gobio tungussicus* Borisov, 1928: 105, pl. 4 fig. 14, 15 (Lena River at Zhigansk [Arctic basin, Russia]).

Remarks on systematics. The taxonomic status of *G. tungussicus* warrants further research. Bogutskaya & Naseka (2004) treated *G. gobio tungussicus* (originally described from Lena River) as a synonym of the morphologically similar *G. soldatovi* based on the examination of the limited ZISP material of these species but it is still unclear if the gudgeon identified as *G. tungussicus* from the Upper Amur is conspecific with the Lena River one. We do not have new materials from the Lena and collected only few specimens of the real *G. soldatovi* from the Lower Amur; this gives no possibility to conduct a wider comparison. *Gobio soldatovi minus* from the Huang He is now considered conspecific with *Gobio lingyuanensis* Mori, 1934 by Chen et al. (1998) under the name *G. lingyuanensis* (this is not correct because *G. minus* is a senior synonym). Both were described from north-eastern China, and both might be synonyms of *G. soldatovi* (see Berg, 1949a).

Distribution. Freshwater. May be endemic to Amur. Occurs in Lower Amur (downstream of Khabarovsk) and its southern tributaries; distribution rather mosaic for the fish prefers lacustrine habitats. Presence in Upper Amur not clear because of ambiguous identity of fish recorded there as *G. soldatovi*. Recently found in north-western Sakhalin Island (Safronov et al., 2005) but may be unintentionally introduced there. In case *G. sol-*

datovi and *G. tungussicus* were a single species, the range would also include Lena drainage (Arctic basin) from its upper tributaries (Vilyuy, Vitim, Zaza) downstream to Zhigansk (see also discussion by Kottelat, 2006).

***Gobio tenuicarpus* (Mori, 1934)**
(Fig. 16)

Gobio gobio tenuicarpus Mori, 1934a: 9, pl. 4 fig. 2a-b (Hsing-lung-shan [Liao-he River basin, Hebei, China]).

Remarks on systematics. The East Asian "white-fin gudgeons" (*R. amplexilabris*, *R. rivuloides*, *R. shansiensis*, *R. johntreadwelli*, *R. tenuicarpus*) were placed in the genus *Romanogobio* based on shared morphological characters (Naseka, 1996). A considerable geographical disjunction exists between the ranges of *Romanogobio* s. str. (Black Sea and Caspian Sea basins) and these East Asian taxa (the *R. tenuicarpus* group). The molecular analysis of Yang et al. (2006) shows that *G. tenuicarpus* is nested within the *Gobio* lineage and distinct from the *Romanogobio* lineage, giving reasons to retain these species in the genus *Gobio* (Kottelat, 2006). However, the *R. tenuicarpus* group deserves the status of a distinct genus, which shares some morphological specializations with *Romanogobio* that may have been acquired independently (e.g. an elongated caudal vertebral region and the presence of epithelial keels on scales).

Distribution. Freshwater. In Asia: Amur and Liao He; probably further southward (Li, 1981; Bănărescu, 1992a). In Amur: from Upper Amur (Buir Nur, Khalkh, Argun, Onon, Ingoda, Shilka) through Middle and Lower Amur (absent from northern tributaries) down to Tyr (the Amgun' River mouth).

***Gobio* sp.**

Gobio sp.: Kottelat, 2006: 34 (Onon River).

Remarks on systematics. Publications summarizing data on the fish identified as *G. soldatovi* (e.g. Karasev, 1987) or *G. soldatovi tungussicus* (e.g. Nikolsky, 1956) from the Upper Amur lack morphological data, which could help to check the identification. On the basis of published data, Kottelat (2006) concluded that the *G. soldatovi tungussicus* reported from the Onon by Sokolov (1983) can be identified as neither *G. tungussicus*

nor *G. soldatovi*. We did not find the species during our collecting trips in the Upper Amur region.

Distribution. Freshwater. Probably, endemic to Amur. According to Taranetz (1937d), Nikolsky (1956) and Karasev (1987), *Gobio* sp. is found in oxbows and larger bays of Onon, Ingoda, Shilka, and Chitinka rivers, and in lakes (both isolated and connected to rivers, for example, Bal'zinskoye Lake (Tura River system) and Shargal'dzhin Lake.

***Gobiobotia pappenheimi* Kreyenberg, 1911**
(Fig. 17)

Gobiobotia pappenheimi Kreyenberg, 1911: 417, fig. 1 (China).

Distribution. Freshwater. In Asia: from Amur southward to middle and lower reaches of Yangtze. In Amur: middle and lower reaches from Konstantinovka downstream to about Sofiysk. In Ussuri system known only from Arsenievka River; in Khanka Lake basin, recorded once in Komissarovka River (Nikolsky, 1956) and later in Ilistaya and Mel'gunovka rivers (Ivankov & Samuilov, unpubl., cited by Naseka & Gershtein, 2006).

***Hemibarbus labeo* (Pallas, 1776)**

Cyprinus labeo Pallas, 1776: 703 (Transbaikalia [Upper Lena, Selenge and Upper Amur River, Russia]).

Gobio barbatus Temminck & Schlegel, 1846: 198, pl. 99 fig. 1 (Nagasaki, Japan).

Acanthogobio oxyrhynchus A. Nikolsky, 1904: 358 (mouth of Santakheza River, Khanka Lake [Lower Amur, Russia]).

Pseudogobio chaoi Evermann & Shaw, 1927: 106 (Nanking [Nanjing, Jiangsu, China]).

Distribution. Freshwater. In Asia: from Amur southward to northern Vietnam and Taiwan, also in north-western Sakhalin Island and Japan. In Amur: from headwaters (Buir Nur, Shilka, Argun) down to estuary, in Zeya, Ussuri and Sungari.

***Hemibarbus maculatus* Bleeker, 1871**

Hemibarbus maculatus Bleeker, 1871: 19, pl. 4 fig. 3 (Yangtze River, China).

Acanthogobio paltschevskii A. Nikolsky, 1904: 356 (mouth of Santakheza River, Khanka Lake [Lower Amur, Russia]).

? *Hemibarbus joiteni* Jordan & Starks, 1903: 241 (Pei-Ho River [Tianjin, China]).

Distribution. Freshwater. In Asia: continental East Asia from Amur southward to Yangtze and rivers between Yangtze and Xi Jiang, also north-western Sakhalin Island. Originally absent from Primorye [Maritime Territories] in Russia. Introduced in Central Asia and southern Primorye. In Amur: middle and lower reaches down to estuary; uppermost recorded locality is Kumara River mouth.

***Ladislavia taczanowskii* Dybowski, 1869**
(Fig. 18)

Ladislavia taczanowskii Dybowski, 1869: 954, pl. 17 fig. 7 (Onon and Ingoda rivers [Amur River drainage, Russia]).

Distribution. Freshwater. In Asia: Amur, Yalu, northern Korean Peninsula. In Amur: upper reaches (Onon, Ingoda, Shilka, Argun); Middle Amur down to Blagoveshchensk and in Zeya and Bureya systems; Lower Amur with Ussuri and Sungari systems.

Microphysogobio (Rostrogobio) amurensis
(Taranetz, 1937)
(Fig. 19)

Rostrogobio amurensis Taranetz, 1937a: 114 (Lower and Middle Amur; Khanka Lake [Russia]).

Remarks on systematics. Some authors (e.g. Pan et al., 1991; Chen et al. 1998; Yang et al., 2006) divide *Microphysogobio* into four genera, which we treat as subgenera, *Microphysogobio* (18-20 species), *Rostrogobio* Taranetz, 1937a: 114 (3 species), *Huigobio* Fang, 1938: 239 (3 species), *Platysmacheilus* Lu, Luo & Chen, 1977: 533 (3 species). In the Amur drainage, there are only two species and they belong to the subgenus *Rostrogobio*.

Rostrogobio amurensis was usually treated as a synonym (e.g. Bogutskaya & Naseka, 2004) or a subspecies of *Microphysogobio tungtingensis*, which then included up to 5 subspecies (e.g. Bănărescu & Nalbant, 1973). *Microphysogobio amurensis* is treated as a valid species of *Rostrogobio* by Chen et al. (1998). *Microphysogobio anudarini* from the Upper Amur is considered as a valid species by Kottelat (2006).

Distribution. Freshwater. Endemic to Amur: the Middle and Lower Amur downstream to about Tyr, also Sungari and Ussuri system and Khanka Lake.



Fig. 16. *Gobio tenuicarpus*, 109 mm SL; Russia: Arsenievka River, a tributary of Ussuri River, at Lazarevka, 44°19'N 133°25'E.



Fig. 17. *Gobiobotia pappenheimi*, 65 mm SL; Russia: Arsenievka River, a tributary of Ussuri River, at Lazarevka, 44°19'N 133°25'E.

Microphysogobio (Rostrogobio) anudarini
Holcik & Pivnicka, 1969

Microphysogobio tungtingensis anudarini Holčík & Pivnička, 1969: 8, figs 1-3 (Buir Nur, Argun system, Mongolia).

Remarks on systematics. Taxonomic status of *M. anudarini* was discussed by Kottelat (2006).

Distribution. Freshwater. Endemic to Amur: described from Buir Nur; probably in Hulun Nur (Kottelat, 2006). Recorded (under the name *R. amurensis*) from Shilka and Argun (Nikolsky,

1956; Karasev, 1987); collected in Onon, Ingoda and Shilka (pers. obs.) itself.

Pseudorasbora parva
(Temminck & Schlegel, 1846)

Leuciscus parvus Temminck & Schlegel, 1846: 215, pl. 102 fig. 3, 3a, 3b (Nagasaki, Japan).

Micraspius mianowskii Dybowski, 1869: 954 (lakes in Onon River system [Upper Amur, Russia]).

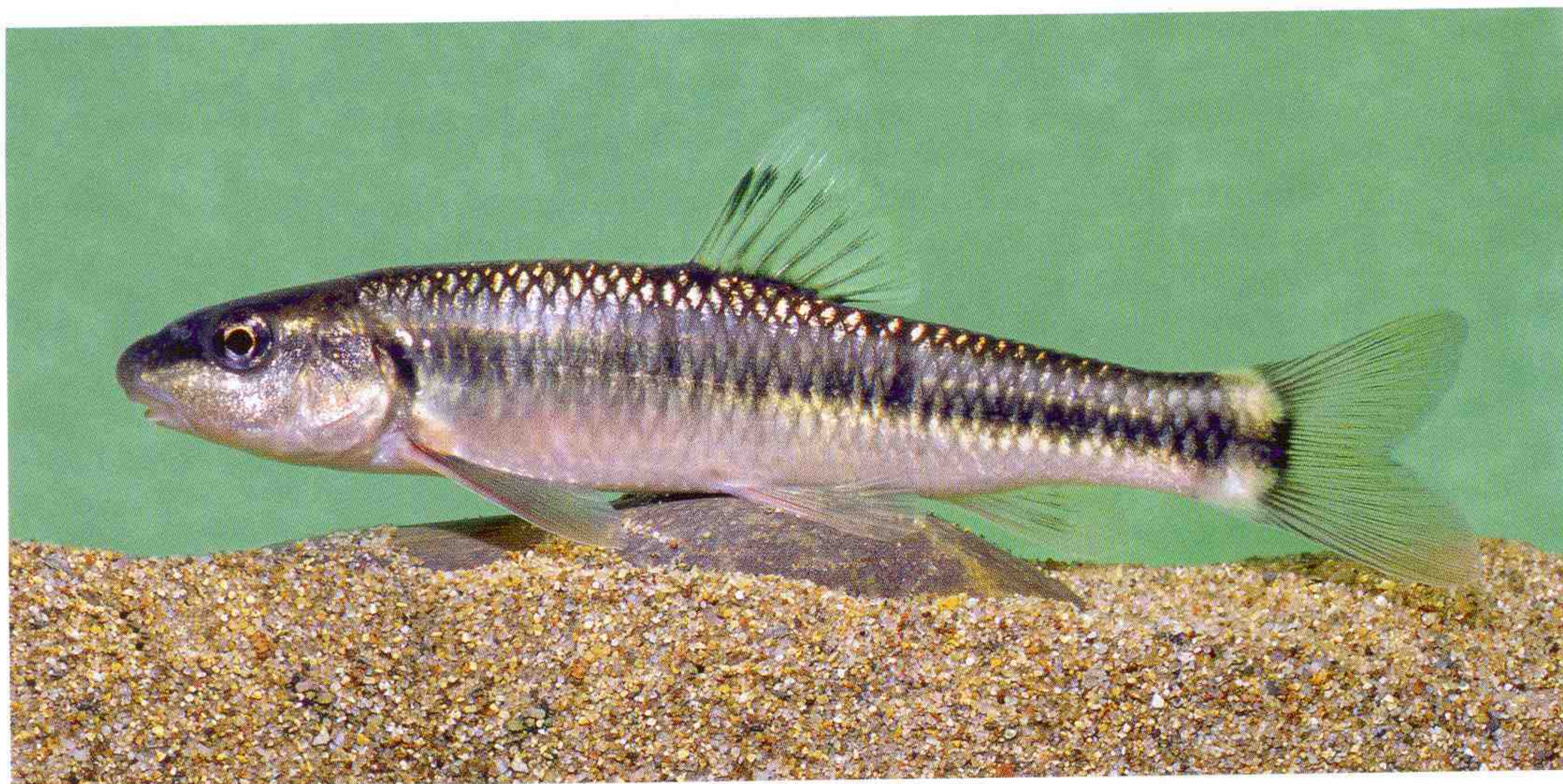


Fig. 18. *Ladislavia taczanowskii*, 81 mm SL; Russia: Amazar River, a tributary to Middle Amur, upstream from Amazar village, 53°51'N 120°51'E.



Fig. 19. *Microphysogobio amurensis*, 91 mm SL; Russia: Khanka Lake at Post Vostochnyy (Khanka Nature Reserve) in the north from the Spasovka River mouth, 44°39'N 132°34'E.

Distribution. Freshwater; tolerant to slightly brackish water. In Asia: native from Amur to northern Vietnam, also Japan, Hainan, Taiwan. Introduced and invasive in Europe and Asia. In Amur: from upper reaches (Buir Nur, Argun, Onon, Ingoda, Shilka) downstream to Lower Amur until about Novo-Georgiyevsk

Sarcocheilichthys (Chilogobio) czerskii
(Berg, 1914)

Chilogobio czerskii Berg, 1914: 490, fig. 75 (Sintukha [Komissarovka] River, Khanka Lake basin, Amur River drainage, Russia).

Remarks on systematics. *Sarcocheilichthys czerskii* and *S. soldatovi* were assigned to a distinct genus *Chilogobio* by Berg (1914), distinguished from *Sarcocheilichthys* by the absence of the horny sheath on the lower lip (vs. presence). A divergence between *Chilogobio* and *Sarcocheilichthys*

is supported by molecular data (Zhang et al., 2008), which gives support to the recognition of *Chilogobio* at least at subgeneric level. *Sarcocheilichthys soldatovi* was considered a synonym of *S. czerskii* and assigned to the genus *Sarcocheilichthys* starting from the publication by Spanovskaya (1953) though Berg (1914, 1949a) showed some morphological differences between the two species in Khanka Lake. According to our data (A. Naseka, unpubl.), *C. czerskii* and *C. soldatovi* are distinguished not only by the characters mentioned by Berg – the relative size of the head (head length larger than body depth vs. about equal) and the position of the mouth (mouth subterminal vs. almost inferior) – but also by the coloration of spawning males (back and flanks goldish with wide black vertical stripes, no crimson or blue color vs. back and flanks almost entirely black with bluish stains, throat and anterior part of belly crimson).

Distribution. Freshwater. *Sarcocheilichthys czerskii* and *S. soldatovi* are sympatric in part of their range, but, because they are rare and only known by relatively few specimens, their respective distribution is not yet clear. *Sarcocheilichthys czerskii* is reliably known only from Khanka Lake. Records of *Chilogobio czerskii* by Karasev (1987) in Onon and Shilka probably refer to *C. soldatovi*.

Sarcocheilichthys (Chilogobio) soldatovi
(Berg, 1914)
(Fig. 20)

Chilogobio soldatovi Berg, 1914: 492, fig. 76 (downstream from Rybnoye Lake; 8 wersts downstream from Vyatskoye; downstream from Ossipovka; mouth of Kiya Rivers (Ussuri); 5-7 wersts downstream from Vyatskoye (Rybnoye Lake); Ussuri upstream from Korsakovskiy; 100 wersts upstream from Nikolayevsk-na-Amure; mouth of Iman River; Ussuri 6 wersts downstream from mouth of Bikin; Ussuri 4-5 wersts downstream from Kerdrovyy; Kargi at Zelenyy Bor [all localities Lower Amur drainage, Russia]).

Remarks on systematics. See *S. czerskii* above for comments on the status of *Chilogobio* and taxonomic relations with *S. czerskii*.

Distribution. Freshwater. In Asia: Amur, Yalu and rivers of north-western Korean Peninsula

(Kim & Park, 2002). In Amur: from upper reaches (including Buir Nur, see Kottelat, 2006) down to Ussuri and Khanka Lake.

Sarcocheilichthys (Sarcocheilichthys) lacustris
(Dybowski, 1872)
(Fig. 21)

Barbodon lacustris Dybowski, 1872: 216 (lakes in lower Amur River drainage, Russia).

Remarks on systematics. Treated as a subspecies of *S. sinensis* (e.g. Berg, 1914, 1949a; Lindberg & Taranetz, 1929; Spanovskaya, 1953; Nikolsky, 1956; Karasev, 1987), synonymized with *S. sinensis* (Mori, 1927a; Rendahl, 1928; Bănărescu & Nalbant, 1973; Bănărescu, 1992a; Naseka, 1996; Reshetnikov, 2002; Novomodny et al., 2004; Bogutskaya & Naseka, 2004) or considered a valid species *S. lacustris* (e.g. Lu et al., 1977; Zhu, 1995; Chen et al., 1998). *Sarcocheilichthys lacustris* differs from *S. sinensis* by having a thickened base of the last unbranched dorsal-fin ray (vs. not thickened), smaller scales (circumpeduncular scales 20-22 vs. 14-16), often two rows of pharyngeal teeth (vs. one row). There are some morphometric differences between *S. lacustris* from Shilka and those from Lower Amur (Karasev, 1987).

Distribution. Freshwater. Endemic to Amur: from Blagoveshchensk downstream to Tyr, in southern tributaries and Khanka Lake basin. No historic records on distribution in Upper Amur before it was found in Shilka between Nerchinsk and Sretensk (Karasev, 1987). Not clear whether this is due to a recent invasion or introduction (Gorlacheva et al., 1995) or an oversight by earlier authors.

Saurogobio dabryi Bleeker, 1871

Saurogobio dabryi Bleeker, 1871: 27, pl. 5 fig. 1 (? Yangtze River, China).

Gobiosoma amurensis Dybowski, 1872: 211 (Amur River drainage).

Pseudogobio drakei Abbott, 1901: 486 (Pei-ho River [Hebei and Tianjin], China).

Longurio athymius Jordan & Starks, 1905: 197, fig. 3 (Chemulpo [Inchon, North Korea]).

Distribution. Freshwater. In Asia: from Amur, Yalu and Liao He southward to Xi Jiang and Hainan. In Amur: Buir Nur (expected in Hulun Nur; see Kottelat, 2006), absent from other parts of Upper Amur; in Middle Amur from about

Blagoveshchensk downstream to very lower reaches of Amur including Ussuri, Sungari, and Khanka, Orel' and Chlya Lakes.

***Squalidus chankaensis* Dybowski, 1872**

Squalidus chankaensis Dybowski, 1872: 215 (Khanka Lake [Amur River drainage, Russia]).

Gobio ussuriensis morpha *brevicirris* Berg, 1914: 476, fig. 70 (Ussuri River at Bira river mouth [Amur River drainage, Russia]; infrasubspecific, not available).

Remarks on systematics. Up to 12 subspecies have been recognised in *S. chankaensis* (e.g. Bănărescu & Nalbant, 1973). Bănărescu (1992a) later restricted *S. chankaensis* to the Amur drainage, and all other subspecies were either treated as valid species or synonymized with other species, e.g. *S. gracilis* and *S. atromaculatus*. See also *S. mantschuricus* below.

Distribution. Freshwater. Endemic to Amur: recorded from Buir Nur, Orshun and Khalkh rivers (e.g. Dash-Dorzhi, 1955; Spanovskaya, 1958), Onon, Shilka and Argun (Karasev, 1987) and in Middle Amur from Dzhalinda down to about Sofiysk. These authors considered the "short-barbel form" (true *S. chankaensis*) and the "long-barbel form" (now *S. mantschuricus*) as conspecific (both identified as *S. chankaensis*) but their mention of short barbels and pigmented dorsal scales (the characteristic features of *S. chankaensis*) confirm that they dealt with *S. chankaensis*.

***Squalidus mantschuricus* Mori, 1927**

? *Gobio argentatus* Sauvage & Dabry de Thiersant, 1874: 9 (Yangtze, China).

Gobio ussuriensis morpha *longicirris* Berg, 1914: 476, fig. 71 (Ussuri River [Amur River drainage, Russia]; infrasubspecific, name not available).

Leucogobio mantschuricus Mori, 1927b: 30 (Hun, tributary of Liao He at Fushun, Manchuria [northern China]).

Remarks on systematics. In the Amur, Berg (1914, 1949a) distinguished two species now in the genus *Squalidus*: *Gobio ussuriensis* Berg, 1914 and *Gobio chankaensis* Dybowski, 1872. Berg (1914) described two morphs within *G. ussuriensis*: *G. ussuriensis* morpha *longirostris* (with the barbel reaching the middle of the eye; the barbel length

equal to the pupil diameter) and *G. ussuriensis* morpha *brevicirris* (with the barbel reaching the anterior margin of the eye; the barbel length less than the pupil diameter). The morpha *brevicirris* was considered by Berg (1949a: 657) as "typical". Since Spanovskaya (1953) and Nikolsky (1956), *G. ussuriensis* was considered as a synonym of *G. chankaensis* in many publications, and the length of the barbels was treated as a character variable within the species. However, some authors still considered that two valid species of *Squalidus* are present in Amur drainage (Zhang, 1995; Chen et al., 1998). Shedko & Shedko (2003) revised them and found clear morphological differences. The key character was the barbel length. The short-barbel *Squalidus* was identified by Shedko & Shedko (2003) as *S. chankaensis* because this latter species was characterized by Berg (1914) as having a short barbel. Berg had examined a syntype of *S. chankaensis*, which was sent to him from the Warsaw University; this specimen is now lost and we could not find any other Dybowski's specimen that could be considered a syntype of *S. chankaensis*. The long-barbel *Squalidus* was identified by Shedko & Shedko (2003) as *S. argentatus* following most recent Chinese publications.

The short-barbel species actually represent what was called *Gobio ussuriensis* morpha *brevirostris* by Berg (1914) though the name *brevirostris* is not available from this combination (Art. 10.2 and 45.6.2 of the Code). However the name *ussuriensis* is available. As it was said above, *S. ussuriensis* sensu Berg (1914, 1949a) actually refers to two species, the short-barbel one and the long-barbel one. Syntypes of *S. ussuriensis* were deposited in ZISP under the number 15995. This jar, which is now lost, contained specimens which were nominated "types" by Berg (1914: 475, 477); though Berg also listed many other specimens (54 ZISP numbers in total), the separate mention of the "types" makes ZISP 15995 syntypes and excludes all other specimens from the type series (Art. 72.4.6. of the Code). Berg's clear indication that the "types" were short-barbel give a reason to consider *S. ussuriensis* as a junior synonym of *S. chankaensis*.

Naseka (1996) considered *L. mantschuricus* as a probable valid subspecies of *S. argentatus* based on examination of specimens from the type localities, the Liao He and the Yangtze, respectively. He found that the typical *S. argentatus* differs from *S. mantschuricus* by having smaller

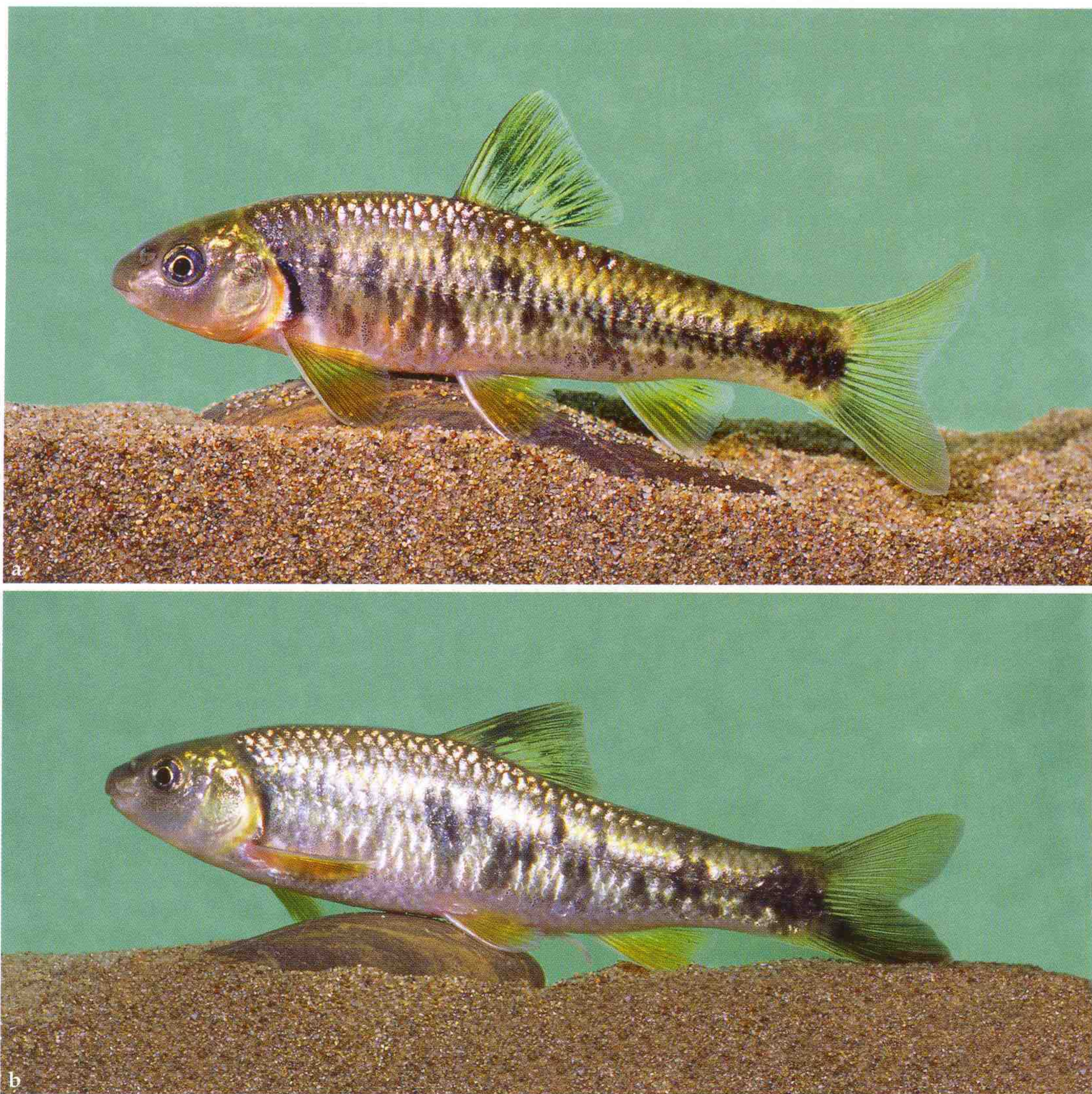


Fig. 20. *Sarcocheilichthys soldatovi*; Russia: Shilka River upstream from Shivki village, 51°57'N 116°46'E; **a**, spawning male, 80 mm SL; **b**, spawning female, 85 mm SL.

scales (38-42 vs. 33-37) and more total vertebrae (38 vs. 36). The Amur specimens were similar to *S. mantschuricus*. Bănărescu (1992a) treated *S. mantschuricus* as a valid species and limited the range of *S. argentatus* to the Yangtze, rivers of Zhejiang Province and Xi Jiang.

Distribution. Freshwater. In Asia: Amur and Liao He; probably in some other adjacent rivers (Mori, 1936).

Subfamily Leuciscinae

Elopichthys bambusa (Richardson, 1845)

Leuciscus bambusa Richardson, 1845: 141, pl. 63 fig. 2 (Canton [Guangzhou], China).

Nasus dauricus Basilewsky, 1855: 234 (Mongolia, Manchuria [northern China]).

Scombrocypris styani Günther, 1889: 226 (Yangtze River).

Distribution. Freshwater (potamodromous); tolerant to slightly brackish water. In Asia: from

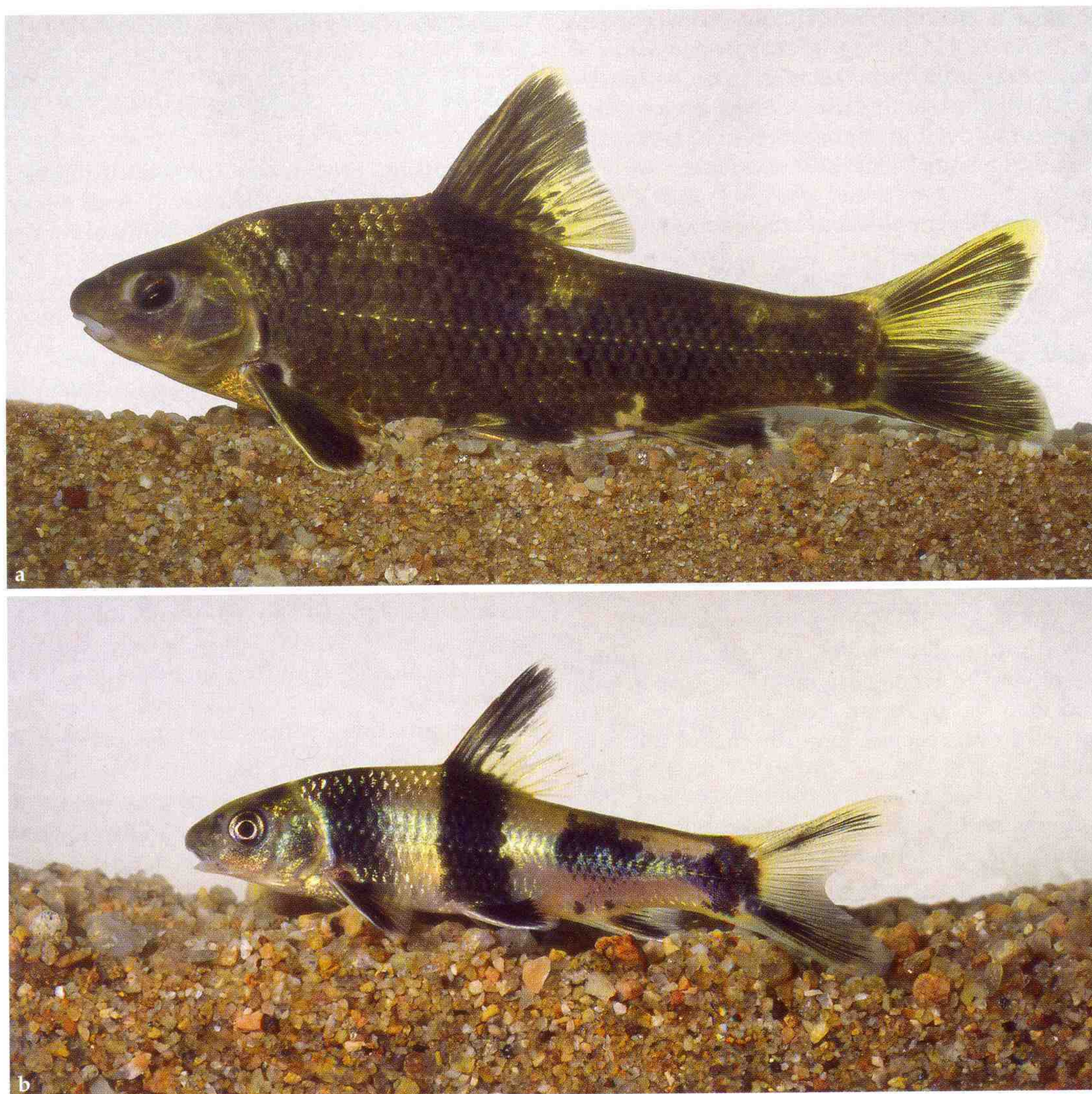


Fig. 21. *Sarcocheilichthys lacustris*; Russia: Arsenievka River, a tributary of Ussuri River, at Lazarevka, 44°19'N 133°25'E; **a**, adult male, 158 mm SL; **b**, juvenile, 55 mm SL.

Amur southward to Yangtze and Xi Jiang. In Amur: Amur itself from about Kumara down to Dudi, also in Ussuri, Sungari, Khanka Lake and lakes of Lower Amur.

Hypophthalmichthys molitrix
(Valenciennes, 1844)

Leuciscus molitrix Valenciennes, in Cuvier & Valenciennes, 1844: 360 (? China).

Leuciscus hypophthalmus Richardson, 1845: 139, pl. 63 fig. 1 (Canton [Guangzhou, China])

Cephalus mantschuricus Basilevsky, 1855: 235, pl. 7 fig. 3 (Peking [Beijing], Mongolia, Manchuria [northern China]).

Hypophthalmichthys dybowskii Herzenstein, in Warpachowski & Herzenstein, 1887: 38 (Amur River; Amur between Emoro and Chilusa [Fuzhou, China]).

Distribution. Freshwater (potamodromous); tolerant to slightly brackish water. In Eurasia: native in continental rivers from Amur southward to Yangtze and Xi Jiang; absent from Korean

Peninsula. In Amur: from Kumara downstream to about Tyr including lakes, lower reaches of Zeya, Sungari, Ussuri, Khanka Lake. Widely introduced in Asia and Europe. At present, it is difficult to distinguish between indigenous and non-indigenous (stocked) individuals.

***Leuciscus waleckii* (Dybowski, 1869)**

Idus waleckii Dybowski, 1869: 953, pl. 16 fig. 5 (Onon and Ingoda rivers [Upper Amur, Russia]).

Leuciscus farnumi Fowler, 1899: 179 (Tore River, tributary of Sungari River, China).

Remarks on systematics. *Leuciscus tumensis* (from north-eastern Korea and southern Primorye [Northern Nandai, Tumen, Razdol'naya rivers]), which has usually been treated as a subspecies of *L. waleckii* is a distinct species because of morphological differences (N. Bogutskaya and N. Kolpakov, unpubl.).

Distribution. Freshwater. In Asia: from Amur southward to Huang He including Upper Yalu and Liao He. In Amur: from headwaters down to very lower reaches, in northern and southern tributaries.

***Phoxinus* sp.**
(Fig. 22)

Remarks on systematics. American species placed in *Phoxinus* (e.g. Howes, 1985; Gilbert, 1998) form a distinct lineage and the name *Chrosomus* Rafinesque, 1820 is available for this genus. Other species often placed in *Phoxinus* are discussed below under *Rhynchocypris*. A number of nominal species commonly treated as synonyms of *P. phoxinus* have been described from Asia and the identity of each has to be investigated (Kottelat, 2006, 2007). *Phoxinus* sp. from Amur is an undescribed species distinct from those in the rivers of the Arctic basin (Haenfling & Bogutskaya, unpubl.). It is also distinct from *P. tumensis* Luo, 1996 distributed in the rivers of southern Primorye southward to the Josen River in North Korea.

Distribution. Freshwater. In Amur: whole drainage, commonly in smaller tributaries. Records of *P. phoxinus* by Mori (1936) from upper Yalu probably refer to present species. The identity of the *Phoxinus* species from rivers of the Pacific basin north of Amur is not known.

***Pseudaspius leptcephalus* (Pallas, 1776)**

Cyprinus leptcephalus Pallas, 1776: 703 (Transbaikalia [Upper Lena, Selenge and Upper Amur River, Russia]).

Distribution. Freshwater (potamodromous); tolerant to slightly brackish water. In Asia: whole Amur drainage (from headwaters down to Amurskiy Liman); north-western Sakhalin.

***Rhynchocypris czekanowskii* Dybowski, 1869**
(Fig. 23)

Phoxinus czekanowskii Dybowski, 1869: 953 (Onon and Ingoda rivers [Upper Amur, Russia]).

Phoxinus czekanowskii czerskii Berg, 1912: 225, pl. 1 fig. 6, 6a (Odarka River, Khanka Lake basin [Lower Amur, Russia]).

Remarks on systematics. Most Asian nominal species that had been placed in the genus *Phoxinus* in fact belong to another genus, called *Moroco* or *Rhynchocypris* (e.g. Mori & Uchida, 1934; Masuda et al., 1984; Yang & Min, 1986; Kim, 1997) of which *Rhynchocypris* Günther, 1889 is the senior synonym. This is supported by molecular data (Ito et al., 2002; Sakai et al., 2002, 2006).

Distribution. Freshwater. In Asia: Arctic Ocean drainages from Kara to Kolyma and Indigirka; Amur, Tym' River (Sakhalin Island), Tugur River and Bol'shoy Shantar Island (Sea of Okhotsk, Pacific basin). In the Amur: from headwaters to estuary.

***Rhynchocypris lagowskii* Dybowski, 1869**
(Fig. 24)

Phoxinus lagowskii Dybowski, 1869: 952, pl. 15 fig. 4) (Transbaikalia [Upper Lena, Selenge and Upper Amur, Russia]).

Rhynchocypris variegata Günther, 1889: 225 (Yangtze, China).

Phoxinus lagowskii chorensis Rendahl, 1928: 58 (Chor [Khor] River [Ussuri system, Amur drainage, Russia]).

Remarks on systematics. *Phoxinus lagowskii oxycephalus* is treated here as a valid species (see below). *Moroco oxyrhynchus* Mori, 1930 (originally described from the Tumen-Ula) was treated as a synonym of *P. lagowskii* (e.g. Berg, 1949a) but is considered now as a valid species (Ito et al., 2002; Sakai et al., 2002, 2006; Shedko & Shedko, 2003).

Distribution. Freshwater. In Asia: Upper Lena River and Selenge River system (Yenisei River drainage) (Arctic Ocean basin); rivers of Pacific Ocean basin from Amur southward to Yangtze, northern Honshu (Japan). In Amur: from headwaters to estuary.

Rhynchocypris oxycephala
(Sauvage & Dabry de Thiersant, 1874)

Pseudophoxinus oxycephalus Sauvage & Dabry de Thiersant, 1874: 11 (Pekin, Si-wan, and south Shen-si, China).

Phoxinus czekanowskii suifunensis Berg, 1932: 361 (Suifun and Kangauz rivers at Vladivostok; ? Tumen-ula).

Remarks on systematics. Earlier treated as a subspecies of *P. lagowskii* but now considered a valid species (Choi et al., 1990; Nakabo, 2002; Shedko, 2001a; Ito et al., 2002; Shedko & Shedko, 2003; Sakai et al., 2002, 2006).

Distribution. Freshwater. In Asia: rivers of Pacific basin from Amur southward to Yangtze drainages; in Korea in Yellow Sea basin; southern Japan (Honshu, Kyushu, Shikoku). In Amur: middle reaches of Amur and Bureya River system downstream to lower reaches, Ussuri River but absent from Khanka Lake basin.

Rhynchocypris cf. *percnurus*

? *Cyprinus percnurus* [perenurus] Pallas, 1814: 299 (lakes along Lena River [Arctic basin, Russia]).

Leuciscus dauricus Valenciennes, in Cuvier & Valenciennes, 1844: 149 (Transbaikalia [Upper Lena, Selenge and Upper Amur, Russia]).

Phoxinus jelskii Dybowski, 1869: 952 (lakes in Darasun, But-Durutaj, Ila and Makhojtova valleys [River Onon system, Upper Amur, Russia]).

Phoxinus percnurus mantschuricus Berg, 1907b: 201 (Da-chu-an, a tributary of Sungari River, Amur River drainage, China).

Remarks on systematics. A number of nominal species from Siberia (Arctic basin) have been treated as synonyms of *R. percnurus* (see, e.g. Berg, 1949a). Nominal species based on material from the Amur drainage have also been listed as synonyms of *P. percnurus* but they may represent one or more distinct species. The Amur populations have been treated as a subspecies *Phoxinus percnurus mantschuricus* (e.g. Berg, 1949a; Shedko,

2001a) or as a distinct species (Safronov & Nikitin, 2005). This is supported by morphological differences. The identity of the populations from the Upper Amur has not yet been investigated; it is not clear whether it is conspecific with *R. mantschuricus* from the lower Amur; it might be distinct and, if so, one of the names *L. dauricus* and *P. jelskii* would be available for it. The subspecies *R. percnurus sachalinensis* of Berg, 1907 is partly sympatric with *R. mantschuricus* and is now considered to be a distinct species (*R. sachalinensis*) based on a comparative morphological study (Safronov & Nikitin, 2005).

Distribution. Freshwater. In Asia: Amur, rivers of Peter-the-Great Bay and eastern North Korea; north-western Sakhalin Island from Baikal Bay southward to Viakhtu Bay. In Amur: entire drainage, including Zeya, Sungari, Ussuri and Amgun' rivers.

Tribolodon hakonensis (Günther, 1877)

Leuciscus hakuensis Günther, 1877: 442 (Hakou [= ? Hakone] Lake, Japan; name corrected to *hakonensis* in Opinion 63).

Distribution. Anadromous and freshwater resident. In Asia: Pacific coast and islands; from Sakhalin and rivers of Amurskiy Liman southward to about 31°N. An occasional anadromous visitor in Amur.

Subfamily Rasborinae

Aphyocypris chinensis Günther, 1868

Aphyocypris chinensis Günther, 1868: 201 (Chikiang [Zhejiang, China]).

Distribution. Freshwater. In Asia: from Amur and Yalu He southward to Sichuan. In Amur: known only from Sungari and Lower Amur at Bolshoy Ussuriysky Island near Khabarovsk (Novomodny et al., 2004).

Opsariichthys bidens Günther, 1873

Opsariichthys bidens Günther, 1873: 249 (Shanghai, China).

Opsariichthys uncirostris amurensis Berg, 1932: 384, fig. 295 (Amur).

Remarks on systematics. Treated as a distinct species (Chu & Chen, 1989; Zheng, 1989; Ding,



Fig. 22. *Phoxinus* sp., male (with a leech), 52 mm SL; Russia: upper reaches of Olenguy River, a tributary of Ingoda River, 4 km upstream from Olenguy village, 51°13'N 113°19'E.



Fig. 23. *Rhynchocypris czekanowskii*, 72 mm SL; Russia: Amazar River, a tributary to Middle Amur, upstream from Amazar village, 53°51'N 120°51'E.

1994; Zhu, 1995; Chen et al., 1998; Kottelat, 2001a, 2001b; Wang et al., 2001) though some authors (e.g. Gorlacheva et al., 1999; Kim & Park, 2002) still treat it as a synonym or a subspecies of *O. uncirostris* (Temmick & Schlegel, 1846) endemic to Japan.

Distribution. Freshwater. In Asia: from Amur southward to Xi Jiang and Hainan. Introduced in Amu Darya (Aral Sea basin). In Amur: historically known from about Blagoveshchensk down to Novo-Georgiyevsk with southern tributaries.

Recently introduced and started to spread in Upper Amur; found in Shilka (pers. obs., 2005) and in Onon in 1996 (Gorlacheva et al., 1999; Gorlacheva & Afonin, 2007).

Subfamily Squaliobarbinae

Ctenopharyngodon idella (Valenciennes, 1844)

Leuciscus idella Valenciennes, in Cuvier & Valenciennes, 1844: 362 (China).

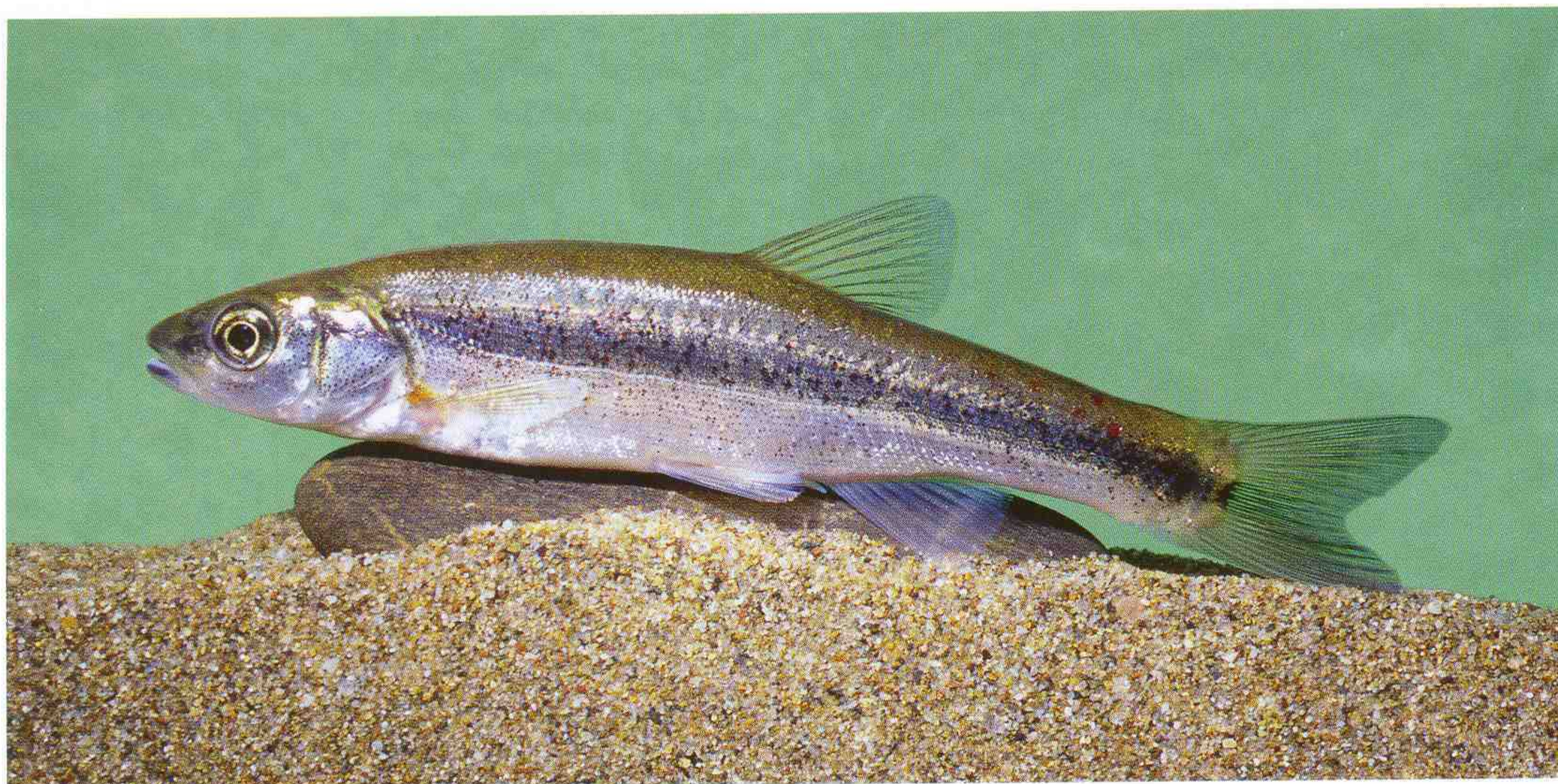


Fig. 24. *Rhynchocypris lagowskii*, 85 mm SL; Russia: Amazar River, a tributary to Middle Amur, upstream from Amazar village, 53°51'N 120°51'E.



Fig. 25. *Cobitis choii*, male 65 mm SL; Russia: Arsenievka River, a tributary of Ussuri River, at Lazarevka, 44°19'N 133°25'E.

Leuciscus tschiliensis Basilewsky, 1855: 233 (rivers of Gulf of Tchili [China]).

Pristiodon siemionovii Dybowski, 1877: 26 (Amur, Ussuri, Sungacha, Sungari rivers, Khanka Lake).

Distribution. Freshwater (potamodromous); tolerant to slightly brackish water. In Asia: native in East Asia from Amur southward to Xi Jang (south China). Widely introduced and stocked worldwide. In Amur: middle and lower reaches from about Blagoveschensk down to estuary. In

southern areas of Amur drainage it is difficult to distinguish between indigenous and non-indigenous (stocked) individuals.

***Mylopharyngodon piceus* (Richardson, 1846)**

Leuciscus piceus Richardson, 1846: 298 (Canton [Goangzhou], China).

Distribution. Freshwater (potamodromous); tolerant to slightly brackish water. In Asia: native in East Asia from Amur southward to Xi Jang

(south China) and Taiwan. Widely introduced and stocked all over the world. In Amur: lower parts, mostly from mouth of Sungari southward to Udył' Lake. Indigenous populations in Amur drainage may be threatened or even extinct (Novomodny et al., 2004); it is difficult to distinguish between indigenous and non-indigenous (stocked) individuals.

***Squaliobarbus curriculus* (Richardson, 1846)**

Leuciscus curriculus Richardson, 1846: 299 (Canton [Goangzhou], China).

Distribution. Freshwater. In Asia: native in East Asia from Amur southward to Xi Jiang (south China) and North Vietnam. In Amur: only in Sungari system.

Subfamily Xenocypridinae

***Plagiognathops microlepis* (Bleeker, 1871)**

Xenocypris microlepis Bleeker, 1871: 53, pl. 9 (Yangtze River).

Plagiognathus jelskii Dybowski, 1872: 216 (Khanka Lake; Ussuri [Amur drainage, Russia and China]).

Distribution. Freshwater. In Asia: from Amur southward to Xi Jiang. In Amur: Lower Amur mainstream and southern tributaries.

***Xenocypris macrolepis* Bleeker, 1871**

Leuciscus argenteus Basilewsky, 1855: 232 (Pekin [Beijing], China; invalid, a junior primary homonym of *Leuciscus argenteus* Fitzinger, 1832 and *Leuciscus argenteus* Storer, 1839).

Xenocypris argentea Günther, 1868: 205 (China; invalid, a junior secondary homonym of *Leuciscus argenteus* Basilewsky, 1855 when both placed in *Xenocypris*).

Xenocypris macrolepis Bleeker, 1871: 53, pl. 5 fig. 2 (Yangtze).

Xenocypris guentheri Sauvage & Dabry de Thiersant, 1874: 13 (replacement name for *Leuciscus argenteus* Basilewsky, 1855).

Xenocypris sungariensis Berg, 1907a: 418 (Sungari River at Harbin and Hailin River, a tributary of Mutan-kiang [Amur drainage, China]).

Distribution. Freshwater. In Asia: from Amur southward to Xi Jiang. In Amur: Lower Amur

mainstream from about Voskresenovka downstream to about Tyr, southern tributaries; also recorded in Al'kedon, a tributary of Selemdzha in Zeya system (Taranez, 1937b). After 1950s, the species was registered in Upper Amur (Gorlacheva et al., 1995).

Family Botiidae

(botiine loaches)

Remarks on systematics. Botiidae has long been treated as a subfamily of the family Cobitidae. It is now considered a distinct family (Nalbant & Bianco, 1998; Nalbant, 2002; Kottelat, 2004; Šlechťová et al., 2006).

***Parabotia mantschurica* (Berg, 1907)**

Leptobotia mantschurica Berg, 1907a: 420 (Mudanjiang River, Sungari River system [Amur drainage, China]).

Remarks on systematics. *Leptobotia mantschurica* is often synonymized with *Parabotia fasciata* Dabry de Thiersant, 1872 (see Kottelat, 2004). We consider them as distinct, as shown by morphological differences.

Distribution. Freshwater. Endemic to Amur drainage or near-endemic (probably, also in upper Liao He). Southern limits not clear. In Amur drainage: Amur River from Blagoveshchensk downstream to estuary, and southern tributaries.

Family Cobitidae

(spiny loaches)

***Cobitis choii* Kim & Son, 1984**

(Fig. 25)

Cobitis choii Kim & Son, 1984: 50, fig. 1 (Mihocheon, a tributary of Kum [Geum] River at Yeocheon-ri, Chungcheongbug-do, South Korea).

Cobitis lebedevi Vasil'eva & Vasil'ev, 1985: 464, fig. 1A, 2A, 3 (channel of Old Amur at Elabuga [Lower Amur, Russia]).

Remarks on systematics. Kottelat & Lim (1992), Nalbant (1993), Reshetnikov (1998, 2002) and some others treated *Cobitis lebedevi* as a synonym of

Iksookimia choii described from South Korea. Kim et al. (1999), Kim & Park (2002) and Kottelat (2006) consider *C. choii* and *C. lebedevi* as distinct species in the genus *Iksookimia*. However, molecular data support close phylogenetic affinities of *C. choii* with *Cobitis* rather than with *Iksookimia* (Šlechtová et al., 2008).

Distribution. Freshwater. In Asia: Amur and southern Korean Peninsula. In Amur: from Buir Nur and Kherlen down to lower reaches of Amur at Nikolayevsk-na-Amure.

***Cobitis lutheri* Rendahl, 1935**

(Fig. 26)

Cobitis taenia lutheri Rendahl, 1935: 330, fig. 1-4 (Santakheza [Spasovka] and Odarka rivers in Khanka Lake basin [Amur drainage, Russia]).

Distribution. Freshwater. From Amur southward to rivers of Yellow Sea basin, Sakhalin Island. In Amur: Middle and Lower Amur from about 53°N downstream to estuary with tributaries Zeya, Bureya, Sungari and Ussuri.

***Cobitis melanoleuca* Nichols, 1925**

(Fig. 27)

Cobitis taenia melanoleuca Nichols, 1925: 3 (Chinssu, Shansi [Shanxi], China)

Cobitis granoei olivai Nalbant, Holčík & Pivnička, 1970: 121, figs. 2-6 (Orkhun River system, tributary of Selenge [Baikal Lake basin], Mongolia).

Remarks on systematics. *Cobitis melanoleuca* has a very extensive range and may involve several species. However we abstain to recognize *C. granoei olivai* a distinct species as Prokofiev (2007) did because *C. melanoleuca* needs to be revised within the whole range using both karyological and morphological data (Kottelat, 2006; Vasil'ev & Vasil'eva, 2008). The loach identified as *C. sinensis* and treated as a possible invasive species in Amur (Novomodny et al., 2004) may be a local form of *C. melanoleuca*.

Distribution. Freshwater. In Eurasia: Eastern Europe (Don, Volga, Kuban'), rivers of Arctic basin and Nura River, Amur, Sakhalin Island, northern China and Korea. In Amur: entire drainage from headwaters downstream to estuary.

***Misgurnus nikolskyi* Vasil'eva, 2001**

(Fig. 28)

? *Misgurnus buphoensis* Kim & Park, 1995: 54, fig. 1 (Bupori [Tumen-ula drainage], Sonbong Country, North Hamgyong Province, North Korea).

Misgurnus nikolskyi Vasil'eva, 2001: 589, fig. 3 (Lefu River at Novokorovinskaya [Khanka Lake basin, Amur drainage, Russia]).

Remarks on systematics. *Misgurnus nikolskyi* is morphologically similar to *M. buphoensis*, and, therefore, was treated as a synonym of the latter by Shedko & Shedko (2003). There are, however, karyological differences (Vasil'ev & Vasil'eva, 2008).

Distribution. Freshwater. In Asia: rivers of south Sea of Okhotsk and Sea of Japan from Tugur southward to rivers of Peter-the-Great Bay and Sakhalin Island (except for southern part of island). In Amur: Sungari and Lower Amur downstream to Ussuri, Khanka Lake.

***Misgurnus mohoity* (Dybowski, 1869)**

(Fig. 29)

Cobitis fossilis var. *mohoity* Dybowski, 1869: 957 (Dul'durda River and lakes of Onon and Ingoda river system [Amur drainage, Russia]).

Cobitis ajdan Sinitsyn, 1900: 49 (Onon River [Amur drainage, Russia]) (nomen nudum).

Ussuria leptcephala A. Nikolsky, 1904: 362 (Ussuri at Khabarovsk; Kerulen River in eastern Mongolia).

? *Misgurnus cestoides* Kessler, 1876: 34, tabl. 3 fig. 5 (Dalai Nor Lake [Inner Mongolia, China]).

Remarks on systematics. We tentatively follow Chinese authors (e.g. Chen, 1981; Zhu, 1995; Zheng et al., 1989; Wang et al., 2001) in considering *M. bipartitus* (Sauvage & Dabry de Thiersant, 1874) from China as a distinct species.

Distribution. Freshwater. Endemic or near-endemic: Amur drainage and, probably, upper Liao He. In Amur: from Onon and Ingoda and Buir Nur down to lower reaches including southern tributaries, but absent from Khanka Lake basin.



Fig. 26. *Cobitis lutheri*, female 68 mm SL; Russia: Manchzhurka River, Khanka Lake basin; 44°48'N 131°59'E.



Fig. 27. *Cobitis melanoleuca*, female 75 mm SL; Russia: Pyatigorka River, Ussuri River system, 44°33'N 133°20'E.



Fig. 28. *Misgurnus nikolskyi*, 178 mm SL; Russia: upper Spasovka River at Zelenovka, Khanka Lake basin, 44°31'N 133°01'E.



Fig. 29. *Misgurnus mohoity*, male 140 mm SL; Russia: Ilya River, a tributary of Onon River, upstream from Dul'durga village, 50°43'N 113°35'E.



Fig. 30. *Barbatula toni*, 82 mm SL; Russia: upper reaches of Olenguy River, a tributary of Ingoda River, 4 km upstream from Olenguy village, 51°13'N 113°19'E.



Fig. 31. *Barbatula* sp., 86 mm SL; Russia: Tygda River, a tributary of Middle Amur, at Tygda, 53°05'N 126°22'E.

Family Nemacheilidae
(stone loaches)

Remarks on systematics. *Nemacheilidae* had earlier been treated as a subfamily of Cobitidae, later of Balitoridae, and now as a distinct family (Nalbant & Bianco, 1998; Nalbant, 2002; Kottelat, 2004; Tang et al., 2006; Šlechtová et al., 2008).

***Barbatula toni* (Dybowski, 1869)**
(Fig. 30)

? *Nemacheilus nudus* Bleeker, 1864: 12 (Mongolia [northern China]).

Cobitis toni Dybowski, 1869: 957, pl. 18 fig. 10 (Onon and Ingoda rivers [upper Amur, Russia]).

Remarks on systematics. See Kottelat (1990, 2006) and Bogutskaya & Naseka (2004) on nomenclatural status of the name *Barbatula*, which has priority over *Orthrias*. On taxonomy and nomenclature of *Barbatula* from Mongolia, North China and adjacent areas, see Kottelat (2006).

Barbatula toni is commonly considered as being rather morphologically diverse and having an extensive range but it may involve a number of distinct species. It is treated as a subspecies *B. barbatula toni* by Prokofiev (2003). Some authors synonymized *B. toni* and *B. nuda* (e.g. Kim, 1997; Kim & Park, 2002). However, as the exact type locality of *N. nudus* is not known (a detailed discussion of this matter is given by Kottelat, 2006), we can not determine whether *B. nuda* is conspecific with either *C. toni* or *Barbatula* sp. from the Tygda River (below) or with one of the un-

named *Barbatula* species mentioned by Kottelat (2006). We did not examine the holotype of *B. nuda* (MNHN 1450).

Distribution. Freshwater. In Asia: *B. toni* is usually considered distributed from Ob' to Kolyma in Arctic basin and southward to Huang He in Pacific basin. In Amur: from very upper reaches downstream to estuary. However, range may be much more limited. A specimen in Figure 30 is from type locality of *C. toni*; we collected similar individuals (deep-bodied ones, with vertical dark bands on body and a considerably spotted caudal fin with spots not forming regular bars) only in Shilka system.

Barbatula sp.
(Fig. 31)

Remarks on systematics. See above under *B. toni*.

Distribution. Freshwater. In Amur: specimens of this species (shallow-bodied, with spots on body forming no vertical bands and elongated spots on dorsal and caudal fins forming 2-3 regular transverse bars) widely distributed in drainage; morphologically similar specimens were also collected in Khanka Lake basin.

Lefua costata (Kessler, 1876)

Diplophysa costata Kessler, 1876: 29, pl. 3 fig. 3 (Dalai-nor [Dalai Nur] Lake, Inner Mongolia, China).

Remarks on systematics. *Lefua* was treated as a genus close to *Oreonectes* or a synonym of the latter (Herzenstein, 1889; Bănărescu & Nalbant, 1968, 1995). In most recent publication they are treated as distinct genera (e.g. Zhu, 1989; Kottelat, 1990; Mihara et al., 2005). *Lefua costata* is originally described from Dalai Nur Lake (43°18'N 116°39'E) in central Inner Mongolia, an endorheic basin far from the Amur drainage. A photo in Kottelat (2006: 100) represents a *L. costata* from the Nen Jiang (the Sungari system) in Antu, Jilin Province, China (M. Kottelat, pers. comm.).

Distribution. Freshwater. Baasanjav & Tsendayush (2001; cited by Kottelat, 2006) give the range of *L. costata* in Mongolia as streams Azargiin, Tamcagiin Bulag, Shine Usnii in Buir Nur basin. In Amur drainage in Russia, in Sungari system (Shedko et al., 2008). Distribution outside of Amur

not clear since the species was usually considered a synonym of *L. pleskei* (see below).

Lefua pleskei (Herzenstein, 1887)

Octonema pleskei Herzenstein, in Warpachowski & Herzenstein, 1887: 48, fig. 5 (Lefu [Il'istaya] River at Nikolayevka, Khanka Lake basin [Amur drainage, Russia]).

Remarks on systematics. *Lefua pleskei* was synonymized with *L. costata*, but recently revalidated (Naseka & Bogutskaya, 2004). Molecular data support the distinctness of *L. pleskei* (Shedko et al., 2008).

Distribution. Freshwater. Southern tributaries of Lower Amur; rivers of Sea of Japan in Primorye in Russia. As the species was confused with *L. costata* until recently, its exact distribution is not yet clear but it occurs southward to Huang He since a fish depicted in Nichols (1943: pl. 8 fig. 2) from Chin-Ssu, middle Huang-He river [Shansi, China] is identifiable as *L. pleskei* by its external appearance.

Family Bagridae
(bagrid catfishes)

Tachysurus brashnikowi (Berg, 1907)

Macrones (Leiocassis) brashnikowi Berg, 1907a: 421 (Chlya Lake [Lower Amur]; Amurskiy Liman).

Remarks on systematics. The genus *Pelteobagrus* was considered a synonym of *Pseudobagrus* by some (Lee & Kim, 1990; Ng & Freyhof, 2007). Molecular data also supported synonymization of *Pelteobagrus* and *Pseudobagrus* (Ku et al., 2007). Formally, after the neotype designated for *Tachysurus sinensis* (Ng & Kottelat, 2007, 2008) based on a specimen formerly identified as *Pelteobagrus fulvidraco* (see below), the names *Pelteobagrus* Bleeker, 1864 and, if synonymized, *Pseudobagrus* Bleeker, 1858, become subjective junior synonyms of the name *Tachysurus* La Cèpède, 1803.

Tachysurus brashnikowi (in the genus *Pelteobagrus*) was synonymized with *Pseudobagrus nitidus* Sauvage & Dabry de Thiersant, 1874 by some authors (e.g. Zhang, 1995; Kim, 1997; Chu et al., 1999; Novomodny, 2005a; Novomodny et al., 2004). We suppose that the northern and

southern populations of the material identified by these authors represent distinct species (for discussion of this matter see Naseka & Bogutskaya, 2004).

Distribution. Freshwater. In Asia: Amur and rivers of western Korean Peninsula as shown by Mori (1936). In Amur: Middle and Lower Amur with southern tributaries; in Amur mainstream from about Blagoveshchensk downstream to estuary.

Tachysurus herzensteini (Berg, 1907)

Macrones herzensteini Berg, 1907a: 421 (Onon River).

Remarks on systematics. This species is known by few specimens: holotype (ZISP 7092, Onon River) and two specimens described by Nikolsky (1956: 418), Egorova (1952: 489) and Chernova (1952: 353): one from Sintukha [Komissarovka] River in the Khanka basin and the other one from Shilka.

Distribution. Freshwater. Endemic to Amur drainage: Shilka and Amur with northern tributaries.

Tachysurus mica (Gromov, 1970)
(Fig. 32)

Mystus mica Gromov, 1970: 400, fig. (Lake Ommi, middle Amur system, Russia).

Remarks on systematics. The species was identified as *Leiocassis argentivittatus* by Zhang (1995), Chu et al. (1999) and Novomodny (2005a). We consider *P. mica* and *L. argentivittatus* as distinct species (Naseka & Bogutskaya, 2004) superficially similar because of their small size.

Distribution. Freshwater. Endemic to Amur drainage: originally described from middle Amur at Leninskoye and in lower Amur in Ommi Lake (Gromov, 1970); also known at Khabarovsk (Novomodny, 2005a), in Khanka Lake basin (Samuilov & Svirsky, 1976; Naseka & Gershtein, 2006). Novomodny et al. (2004), identifying the species as *Leiocassis argentivittatus*, assume that it is not native in Amur drainage but introduced from southern China in 1930-1940s. This seems rather questionable because the fish is small-sized and residential; in 1970-1976 it was recorded from

three very remote localities in the Amur drainage in Russia: Leninskoye (Middle Amur), Ommi Lake (Lower Amur, main channel) and Mel'gunovka River (Ussuri River system, Khanka Lake basin) (Samuilov & Svirsky, 1976). Zhang (1995) reports "*L. argentivittatus*" from the Sungari.

Tachysurus sinensis La Cepède, 1803
(Fig. 33)

Tachysurus sinensis La Cepède, 1803: 305 (based on a drawing; China).

Silurus calvarius Basilewsky, 1855: 241, pl. 9 fig. 1 (rivers of Gulf of Tschili [Bo Hai, China]).

Pseudobagrus wittenburgii Popta, 1911: 335, fig. (Amur River at Blagoveshchensk).

Remarks on systematics. The generic name *Tachysurus* La Cepède, 1803 is a senior synonym of *Pseudobagrus*. The designation of the neotype for *T. sinensis*, which is a specimen previously identified as *P. fulvidraco* from Huairou Reservoir (Yongding River drainage), Beijing, China, made the name *Tachysurus sinensis* the senior synonym of *Silurus calvarius* Basilewsky, 1855 and a valid name for the northern Chinese bagrid catfish (Ng & Kottelat, 2007).

Distribution. Freshwater. In Asia: Amur, rivers of western Korean Peninsula and China southward to at least Huang He. In Amur: from lower reaches of Onon (absent from Mongolian part of river) down to estuary and Amurskiy Liman (at Naleo Cape), in Zeya, Sungari, Ussuri and Khanka Lake.

Tachysurus ussuriensis (Dybowski, 1872)
(Fig. 34)

Bagrus ussuriensis Dybowski, 1872: 210 (Ussuri; Sungacha and Khanka Lake in Sungari system, Amur drainage, Russia).

Leiocassis hwanghoensis Mori, 1933: 167 (Huang He River, China).

Distribution. Freshwater. In Asia: from Amur southward to Zhu Jiang. In Amur: absent in Shilka and Argun systems in Mongolia but recorded in 1927 in Onon at Aksha in Russia (e.g. Dashdorzh & Demin, 1977); Middle Amur with Zeya; Lower Amur with southern tributaries downstream to Sukhanovka and, probably, further downstream.



Fig. 32. *Tachysurus mica*, 44 mm SL; Russia: Khanka Lake at Kamen' Rybolov, 44°44'N 132°03'E.



Fig. 33. *Tachysurus sinensis*, 102 mm SL; Russia: Khanka Lake at Kamen' Rybolov, 44°44'N 132°03'E.

Family Siluridae
(sheatfishes)

***Silurus asotus* Linnaeus, 1758**

Silurus asotus Linnaeus, 1758: 304 (Asia).

Silurus bedfordi Regan, 1908: 61, pl. 2 fig. 3 (Kim-hoa and Chong-ju, South Korea).

Silurus cinereus Dabry de Thiersant, 1872: 189, pl. 47 fig. 1 (Yangtze River, China).

Distribution. Freshwater. In Asia: continental East Asia from Amur southward to Zhu Jiang, Xi Jiang, northern Vietnam; central and southern Japan. In Amur: Onon and Argun (Kherlen,

Khalkh, Buir Nur) in Mongolia, Shilka and Argun in Russia and China; Middle and Lower Amur downstream to Amurskiy Liman.

***Silurus soldatovi* Nikolsky & Soin, 1948**

Silurus soldatovi Nikolsky & Soin, 1948: 1359, fig. 1 (B, G, E) (Amur at Elabuga 90 km downstream from Khabarovsk).

Distribution. Freshwater. In Asia: Amur and Liao He drainages. In Amur: from about Blagoveshchensk downriver to Sungari, Ussuri, Khanka Lake and Amurskiy Liman.



Fig. 34. *Tachysurus ussuriensis*, 220 mm SL; Russia: Tunguska River, a tributary to Amur, at Khabarovsk, 48°35'N 134°46'E.

Family Esocidae
(pikes)

***Esox reichertii* Dybowski, 1869**

Esox reichertii Dybowski, 1869: 956 (large lakes in Onon and Ingoda systems [Upper Amur, Russia]).

Distribution. Freshwater. In Asia: whole Amur drainage (except for upper montane sections), Tugur and Uda rivers of south Sea of Okhotsk basin, Sakhalin Island.

Family Osmeridae
(smelts)

***Hypomesus nipponensis* McAllister, 1963**

Hypomesus transpacificus nipponensis McAllister, 1963: 36, fig. 11 (upper) (Onuma lake, southern Hokkaido).

Distribution. Freshwater and anadromous. In Asia: lakes, lower reaches of rivers, bays of Hokkaido and Honshu (Japan), whole Primorye (from Serebryanka River in the north) and Sakhalin Island. In Amur: only found in estuary.

***Hypomesus olidus* (Pallas, 1814)**

Salmo olidus Pallas, 1814: 391 (rivers and lakes of Kamchatka [Pacific Ocean basin, eastern Russia]).

Hypomesus olidus bergi Taranetz, 1936: 85 (lake along the Tym River, Sakhalin Island, Russia).

Hypomesus olidus drjagini Taranetz, 1936: 84 (Kolyma River, Arctic Ocean basin, Russia).

Coregonus sardinella kamtschaticum Kurenkov & Ostroumov, 1965: 560 (Kamchatka Peninsula, Russia).

Hypomesus sakhalinus Hamada, 1957: 137, Figs. 1-3 (Taraika Lake, Sakhalin Island, Russia).

Distribution. Freshwater and anadromous. In Eurasia: rivers, estuaries and coastal waters of European and Siberian shores of Arctic Ocean, from Kara drainage to Chukotka Peninsula and to Korea and Hokkaido (Japan). In America: from Copper to Kobuk (Alaska) and Mackenzie (Canada) drainages. In Amur: resident populations in lakes of tributaries from Zeya River to elsewhere downstream, but not reported for Sungari (Zhang, 1995); anadromous populations in lower reaches.

***Osmerus dentex* Steindachner & Kner, 1870**

Osmerus dentex Steindachner & Kner, 1870: 429 (Decastris [De Kastri] Bay, Tatar Strait).

Remarks on systematics. Usually treated as a subspecies of *O. mordax*. Morphological and genetic data support its recognition as a distinct species (Taylor & Dodson, 1994; Shedko, 2001b).

Distribution. Anadromous. In Eurasia: estuaries and coastal waters of European and Siberian shores of Arctic Ocean, from White Sea to Chu-

kotka (eastern Siberia), Korea and Hokkaido (Japan). In America: from Vancouver Island to Coronation Bay. In Amur: enters Amur mainstream for spawning and migrates upstream to Bogorodskoye.

***Salangichthys microdon* (Bleeker, 1860)**

Salanx microdon Bleeker, 1860: 100 (Tokyo, Japan).

Remarks on systematics. *Salangichthys* were previously placed in a separate family, Salangidae. Now in the tribe Salangini of the subfamily Osmerinae (Osmeridae) (Johnson & Patterson, 1996; Nelson, 2006).

Distribution. Marine, coastal. In Asia: Sea of Japan and Pacific coast of Japan. In Amurskiy Liman: at Lyangr Island and Puir Cape, in Chili Bight (Soldatov & Lindberg, 1930).

Family Coregonidae
(whitefishes)

***Coregonus chadary* Dybowski, 1869**

Coregonus chadary Dybowski, 1869: 954, pl. 17 fig. 8 (Onon River [Upper Amur, Russia]).

Distribution. Freshwater; tolerant to slightly brackish water. Near endemic: abundant in Amur drainage from Onon system in Mongolia and Russia and Argun in China and Russia downstream to lower Amur at about Bogorodskoye (absent from Sungari). Outside Amur: in Tugur and Uda rivers of southern Sea of Okhotsk coast.

***Coregonus ussuriensis* Berg, 1906**

Coregonus ussuriensis Berg, 1906: 396 (Ussuri River, Khanka lake [Lower Amur, Russia and China]).

Coregonus ussuriensis var. *schmidtii* Berg, 1909: 53 (Sungari River at Harbin, China).

Distribution. Freshwater; tolerant to slightly brackish water. Spawning endemic: reproducing populations only in Middle (from about Blagoveshchensk) and Lower Amur, Zeya, Bureya, Sungari, Ussuri, Amgun', lakes of Lower Amur including Evoron Lake, also Amurskiy Liman. Outside Amur: recorded along western (southward to Aleksandrovsk) and eastern (southward to Tym') coasts of Sakhalin Island (Taranetz, 1937c), but the species does not spawn here.

Family Thymallidae
(graylings)

***Thymallus baicalolenensis* Matveyev, Samusenok, Pronin & Tel'pukhovsky, 2005**

Thymallus arcticus baicalolenensis Matveyev, Samusenok, Pronin & Tel'pukhovsky, in Matveyev, Samusenok, Tel'pukhovsky, Pronin, Vokin, Prosekin & Anoshko, 2005: 69 (Barguzin River, Baikal lake basin, Yenisei River drainage).

Distribution. Freshwater. In Asia: Amur, Baikal Lake basin and Lena River drainage (upper part). In Amur: headwaters of Bureya and, probably, of Zeya.

***Thymallus burejensis* Antonov, 2004**

Thymallus burejensis Antonov, 2004: 443, fig. 2 (Levaya Bureya River, tributary of Bureya, Middle Amur).

Distribution. Freshwater. Endemic to Amur: only in Middle Amur: Bureya River system.

***Thymallus flavomaculatus* Knizhin, Antonov & Weiss, 2006**

Thymallus grubii flavomaculatus Knizhin, Antonov & Weiss, 2006: 582, figs. 2, 3 (Anyuy River [Lower Amur, Russia]).

Distribution. Freshwater. In Asia: Amur, rivers of Sea of Japan (from Koppi down to Maksimovka) and of Sea of Okhotsk westward to Mute River. In Amur: upper reaches of tributaries of lower Amur (Amgun' and Ussuri).

***Thymallus grubii* Dybowski, 1869**
(Fig. 35)

Thymallus grubii Dybowski, 1869: 955, pl. 18 fig. 9 (Onon and Ingoda rivers [Upper Amur, Russia]).

Distribution. Freshwater. Endemic to Amur: Upper and Middle Amur from headwaters of Onon and Ingoda downstream to Bureya mouth; also Bureya system itself.

Thymallus tugarinae

Knizhin, Antonov, Safronov & Weiss, 2007

(Fig. 36)

Thymallus tugarinae Knizhin, Antonov, Safronov & Weiss, 2007: 141, figs. 2, 3 (Anyuy River [Lower Amur, Russia]).

Distribution. Freshwater. In Asia: Amur, Kievka River (Sea of Japan), Uda, Tugur and Mukhtel' Rivers (Sea of Okhotsk) and rivers of north-western Sakhalin Island. In Amur: middle and lower reaches of main Amur channel from Bolshoy Never River downstream to estuary and all tributaries such as Zeya, Bureya, Amgun', Ussuri and Khanka Lake basin, also, probably, Sungari.

Family Salmonidae

(salmons, trouts)

Brachymystax lenok (Pallas, 1773)

(Fig. 37)

Salmo lenok Pallas, 1773: 716 (Yenisei River [Arctic basin, Russia]).

Salmo coregonoides Pallas, 1814: 362 (an unnecessary substitute name for *Salmo lenok* Pallas, 1773, see Bogutskaya & Naseka, 2004).

Brachymystax lenok savinovi Mitrofanov, 1959: 275 (Lake Marka-Kul, Irtysh River system, Ob' River drainage, Kazakhstan).

Distribution. Freshwater. In Asia: Upper Irtysh, Marka-Kul Lake, Upper Ob' River (where probably recently extirpated; see Shedko & Shedko, 2003); whole Yenisei with tributaries (including Baikal Lake, Selenge River and Khuvsgul Lake basins); whole Lena drainage; Yana; Indigirka; Kolyma; Amur; Uda and Tugur rivers; Upper Yalu River (historical records). In Amur: whole drainage from Onon and Kherlen downstream to very lower tributaries.

Brachymystax tumensis Mori, 1930

(Fig. 38)

Brachymystax tumensis Mori, 1930: 42, pl. 3 fig. 1 (Tumen-ula River).

Brachymystax lenok tsilingensis Li, 1966: 92 (Yangtze and Huang He, Shensi [Shaanxi], China).

Brachymystax lenok czerskii Kirillov, in Kirillov et al., 1979: 165 (Undulyung River in Lena River drainage, Yakutia, Russia).

Remarks on systematics. The taxonomic status of "pointed-snout lenok" and "blunt-snout lenok" has been debated for a long time. The "blunt-snout lenok" was commonly considered to be conspecific with the "pointed-snout lenok", i.e. *B. lenok* (references are given by Shedko & Shedko, 2003, Bogutskaya & Naseka, 2004 and Kottelat, 2006). They occur in sympatry in part of their ranges. The correct name of the blunt-snout lenok is, most probably, *B. tumensis* (Shedko, 2001a; Shedko & Shedko, 2003) though the matter is not yet totally settled because it has not been possible to examine material from the type locality (the syntypes of *B. tumensis* are lost). It can not be excluded that there are more than one species of blunt-snout lenok (for a detailed discussion, see Kottelat, 2006). In case the Tumen blunt-snout lenok is a species distinct from the Amur blunt-snout lenok, the valid name for the latter will be *B. czerskii*. In Figures 37 and 38 the distinguishing features in the shape of the snout and the configuration and coloration of the lower jaw can be seen. However the key characters for identification are the shape of the bones of the ethmoid cranial region (Shedko & Shedko, 2003).

Distribution. Freshwater. In Asia: Ob' River; Lena River (Vitim, Undyulyung, Olekma systems); Amur; Uda and Tugur Rivers, rivers of Bolshoi Shantar Island, rivers of Amurskiy Liman Bay and north-western Sakhalin Island; rivers of Primorye (coastal Sea of Japan) and North Korea; Yalu River and other rivers of Korean Peninsula of Yellow Sea basin; some tributaries of Luan He, Wei He, Huang He and Yangtze rivers in North-East and central China.

Hucho taimen (Pallas, 1773)

Salmo taimen Pallas, 1773: 716 (Tura and other rivers of Siberia, flowing to Arctic Ocean).

Distribution. Freshwater. In Eurasia: upper tributaries of Pechora, Siberian rivers from Ob' to Yana (Arctic Ocean basin); Amur and drainages of Sea of Okhotsk to Uda in the west included, and north-western Sakhalin Island (Pacific Ocean basin); Kama (with tributaries Vyatka, Belaya, Vishera, Chusovaya) in Volga drainage (Caspian Sea basin). In Amur: from Onon and Kherlen downstream to rivers of Amurskiy Liman, all northern and southern tributaries included.



Fig. 35. *Thymallus grubii*, 165 mm SL; Russia: Zheltuga River, a tributary of Shilka River, 53°24'N 119°16'E.



Fig. 36. *Thymallus tugarinae*, 141 mm SL; Russia: Pyatigorka River, Ussuri River system, 44°33'N 133°20'E.

***Oncorhynchus gorbuscha* (Walbaum, 1792)**

Salmo gorbuscha Walbaum, 1792: 69 (rivers in Kamchatka).

Distribution. Anadromous. Native to northern Pacific and Arctic basins in Russia, Japan, North China in Eurasia, also North America. Original spawning localities from central California to near Mackenzie River in Arctic Canada and, on Asian side, from North Korea up to Yana and Lena drainages. Introduced in White and Barents seas. In Amur: enters lower Amur in June-July and spawns in August-September; main populations in Ul and Amgun' Rivers, and in rivers flowing

into Amurskiy Liman. Recorded in Amur mainstream up to Bogorodskoye.

***Oncorhynchus keta* (Walbaum, 1792)**

Salmo keta Walbaum, 1792: 72 (rivers in Kamchatka).

Distribution. Anadromous. Northern Pacific ocean from Bering Strait southward to south of Korean Peninsula and Honshu in Asia, and to Sacramento River in North America; Arctic basin from Lena in the west to Mackenzie River in the east; Kuriles. In Amur: enters mostly tributaries of Lower Amur (Ussuri, Amgun, Anyuy, Gur),



Fig. 37. *Brachymystax lenok*, 380 mm SL; Russia: Zheltuga River, a tributary of Shilka River, 53°24'N 119°16'E.



Fig. 38. *Brachymystax tumensis*, 450 mm SL; Russia: Kharalga River, a tributary of Onon River, 49°58'N 112°38'E.

also of Middle Amur upriver to Zeya (absent from Upper Amur); summer chum stocks enter in July-August and spawn in August-September, while fall chum stocks enter in September and spawn from October through January.

Oncorhynchus kisutch (Walbaum, 1792)

Salmo hisutch Walbaum, 1792: 70 (as *kisuth* in Index on page 714; as *kisatch* in Emendanda on page 720; rivers and lakes [Kamchatka]).

Remarks on systematics. The name is traditionally misspelled as *O. kisutch* in literature; original spelling *kisatch* is again in use by, e.g. Kottelat & Freyhof, 2007. However we suppose that the incorrect subsequent spelling *kisutch*, which is in prevailing usage and is attributed to the publication of the original spelling, is to be preserved according to Art. 33.3.1 of the Code.

Distribution. Anadromous. In Eurasia and America: enters rivers of Asian Pacific coast from rivers of Chukotka Peninsula and Anadyr' southward to south Hokkaido and eastern coast of North Korea, and of American coast from Alaska to Monterey Bay. There are records from Amur estuary; Novomodny et al. (2004) suggest that the species enters Amgun' River where it probably spawns but this has never been confirmed.

Oncorhynchus masou (Brevoort, 1856)

Salmo masou Brevoort, 1856: pl. 9 fig. 2 (Hakodate, Japan).

Distribution. Anadromous and freshwater resident but only anadromous in Amur. In Asia: Asian Pacific basin from Amur southward to both coasts of Korean Peninsula, Hokkaido, Honshu, Ryukyu and Taiwan. In Amur: enters Amur and spawns in some tributaries; longest migration, 600 km upstream, in Gur River (Novomodny et al., 2004).

***Oncorhynchus tshawytscha* (Walbaum, 1792)**

Salmo tshawytscha Walbaum, 1792: 71, 713 (Kamchatka).

Remarks on systematics. The name is often misspelled as *O. tschawytscha* in literature; original spelling is again in use by, e.g. Kottelat & Freyhof, 2007. See under *O. kisutch* above on preservation of an incorrect subsequent spelling, which is in prevailing usage.

Distribution. Anadromous. In Asia and North America: northern Pacific basin from Chukotka to Japan (northern Hokkaido) along Asian coast and from Barrow Cape southward to California along American coast. In Amur: occasional visitor, once caught 150 km upstream from mouth in 2001 (Novomodny et al., 2004).

***Parasalmo mykiss* (Walbaum, 1792)**

Salmo mykiss Walbaum, 1792: 59 (Kamchatka).

? *Salmo gairdnerii* Richardson, 1836: 221 (Columbia River, USA).

? *Salmo iridea* Gibbons, 1855: [2] col. 6 (Leandro stream, Alameda, California).

Remarks on systematics. *Parasalmo* is widely treated as a synonym of *Oncorhynchus* since Smith & Stearley (1989). See Kottelat & Freyhof (2007) for comments on the taxonomy of *Parasalmo gairdnerii*/*Oncorhynchus mykiss*. *Parasalmo mykiss* and *P. penshinensis* from the Kamchatka Peninsula are still kept in a distinct genus *Parasalmo* together with the American *P. clarkii* and *P. gairdnerii* in Russian literature (e.g. Chereshev et al., 2001, 2002; Smetanin, 2002). *Parasalmo* includes the so-called Pacific trouts, which are distinguished from Pacific salmon (*Oncorhynchus*) by having a mostly residential (freshwater) mode of life and repeated spawning vs. mostly anadromous mode of life and single spawning. Recently, these ideas got a new support by molecular data (Crespi & Fulton, 2004) demonstrating a monophyletic group including *P. clarkii* and *P. mykiss* and constituting the sister-group to five *Oncorhynchus* species.

Distribution. The native mikizha *P. mykiss* spawns in rivers of south Kamchatka Peninsula and in one river on Bol'shoy Shantar Island in southern Sea of Okhotsk. Only some individuals enter coastal areas while most of any given population inhabit only rivers. In Amur: occasional visitor (Novomodny et al., 2004).

***Salvelinus curilus* (Pallas, 1814)**

Salmo curilus Pallas, 1814: 351 (rivers of Kuriles).

Salmo fariopsis Kner, in Steindachner & Kner, 1870: 437, pl. 1 fig. 3 (Decastris [De Kastr] Bay, Sea of Japan).

Salvelinus malma krascheninnikovi Taranetz, 1933: 83 (south Sea of Okhotsk and Sea of Japan).

Remarks on systematics. Commonly treated as a synonym or a subspecies of *Salvelinus malma*. Specific status confirmed by genetic data (Shedko et al., 2007).

Distribution. Migratory and resident forms distributed from Kuriles and Sakhalin to Korea and Japan. In Amur: resident populations in upper reaches of smaller tributaries of Lower Amur system up to upper reaches of Ussuri River tributaries. A population known in Ilistaya River, Khanka Lake basin (Barabanshchikov, 2003).

***Salvelinus leucomaenis* (Pallas, 1814)**

Salmo leucomaenis Pallas, 1814: 356 (Russia).

Distribution. Anadromous. Asian Pacific coast from Penzhina River and rivers of East Koryakia to Hokkaido and Honshu. In Amur: an occasional visitor, rarely migrating upstream and commonly for not more than 100 km from mouth (Novomodny et al., 2004).

Family Gadidae
(cods)***Lota lota* (Linnaeus, 1758)**
(Fig. 39)

Gadus lota Linnaeus, 1758: 255 (lakes of Europe).

Distribution. Freshwater. In Europe: from Loire drainage (France) eastward to White, Barents and Arctic Sea basins; upper Volga drainage; south-eastern Caspian basin; rivers draining to Black Sea; Rhône drainage (France); in Italy, native only in Po drainage; eastern England (now extinct) (Kottelat & Freyhof, 2007). In Asia and America: in Siberia eastward to Chukotka and in Alaska; Sakhalin Island. In Amur: from headwaters (Onon and Kherlen in Mongolia) down to tributaries of lower Amur.

Family Mugilidae

Chelon haematocheilus (Temminck & Schlegel, 1845)

Mugil haematocheilus Temminck & Schlegel, 1845: 135, pl. 72 fig. 2 (Nagasaki, Japan).

Mugil so-iuy Basilevsky, 1855: 226, pl. 4 fig. 3 (rivers of Gulf of Tschili and Gulf of Tschili [Bo Hai; China]).

Mugil lauvergnii Eydoux & Souleyet, 1850(1841): 174, pl. 4 fig. 3 (Macao).

Remarks on systematics. *Liza* is commonly treated as a valid genus (Harrison & Howes, 1991; Thomson, 1997; Harrison, 2003a,b). Japanese authors synonymize it with *Chelon* (e.g. Senou et al., 1996; Nakabo, 2002). Genetic data also support synonymization of *Chelon* and *Liza* (Rossi et al., 2004).

Distribution. Coastal marine, brackish and freshwater. In Asia: Japan (Hokkaido to Kyushu) and continental coast from Amur southward to Xiamen through Korean Peninsula. In Amur: occasional marine visitor.

Mugil cephalus Linnaeus, 1758

Mugil cephalus Linnaeus, 1758: 316 (Atlantic Ocean and its rivers).

Distribution. Globally: temperate to tropical marine waters worldwide, except for West African coast. In Amur: enters Amur for wintering; known from a fishery at Subbotino and at Bol'shoy Chkhil' Cape (30 km downstream from Nikolayevsk-na-Amure).

Family Gasterosteidae (sticklebacks)

Gasterosteus sp.

Remarks on systematics. Morphologically and genetically different from sympatric *Gasterosteus aculeatus* (Higuchi & Goto, 1996; Shedko, 2001a), which some authors consider as restricted to Europe.

Distribution. Anadromous. In Asia: Sea of Japan coast in Russia; Sakhalin Island; southern Kuriles, Japan (Hokkaido and Honshu), eastern coast of Korean Peninsula. In Amur: estuary from about 15 km downstream of Nikolayevsk-na-Amure to the very mouth.

Pungitius bussei (Warpachowski, 1887) (Fig. 40)

Gasterosteus bussei Warpachowski, in Warpachowski & Herzenstein, 1887: 13, pl. fig. 1 (Lefu [Ilistaya] River, Khanka Lake basin [Amur drainage, Russia]).

Remarks on systematics. This species has long been treated as a synonym of *P. sinensis* (Guichenot, 1869) (e.g. Berg, 1949b; Okada, 1961; Bogutskaya & Naseka, 1997; Keivany & Nelson, 2000). After having examined the syntypes of *P. sinensis* (MNHN 5228) we (SVSh, NGB) consider *P. bussei* as a distinct species. However a comparison of materials from the Bo Hai basin and from the Amur is needed.

Distribution. Freshwater. Endemic to Amur drainage. Reliably known only from Amur: Khanka Lake basin (sympatric with *P. kaibarae* in Ilistaya River), Ussuri River and Amur from Ussuri mouth downstream to Bogorodskoye; expected in Sungari.

Pungitius kaibarae (Tanaka, 1915)

Pigosteus kaibarae Tanaka, 1915: 565 (Kichisho-in, southwest of Kyoto, Japan).

Remarks on systematics. Treated as *P. sinensis kaibarae* or as a synonym of *P. pungitius sinensis* by most authors (e.g. Okada, 1961; Keivany & Nelson, 2000). Recently treated as a valid species (e.g. Kim & Park, 2002; Nakabo, 2002; Shedko et al., 2005).

Distribution. Freshwater and brackish water. In Asia: rivers draining to Sea of Japan from Zerkal'naya (44°09'N 135°38'E) southward to Tumen River and rivers of entire eastern coast of Korean Peninsula; also Japan (Honshu). In Amur: Khanka Lake basin (sympatric with *P. bussei* in Ilistaya River).

Pungitius sp.

Remarks on systematics. A distinct species morphologically close to *P. polyakovi* because they share the absence or incomplete development of the anteroventral branch of the ectocoracoid.

Distribution. Freshwater. In Asia: rivers of Sea of Okhotsk and Sea of Japan from Tugur River southward to northern part of Primorye and in northern Sakhalin Island southward to Tym' River. In Amur: from Bogorodskoye downstream to estuary; also rivers of Amurskiy Liman.



Fig. 39. *Lota lota*, 240 mm SL; Russia: Ilya River, a tributary of Onon River, upstream from Dul'durga village, 50°43'N 113°35'E.



Fig. 40. *Pungitius bussei*, 37 mm SL; Russia: Ilistaya River at Nikolayevka, Khanka Lake basin, 43°51'N 132°29'E.

***Pungitius pungitius* (Linnaeus, 1758)**

Gasterosteus pungitius Linnaeus, 1758: 296 (Europe).

Remarks on systematics. A polymorphic species which may involve a number of distinct species both in Europe and in Asia (Kottelat 1997; Kottelat & Freyhof, 2007).

Distribution. Anadromous. In Eurasia: coastal areas and inland in northern Europe, from Netherlands to northern Russia, including southern Norway and Baltic Sea basin, and Siberia; Pacific basin: from Chukotka and Kamchatka southward to rivers of Sea of Japan in Russia; Sakhalin; Honshu northward from Iwate and Fukui Prefectures, Hokkaido; probably, absent from Korean Peninsula. In Amur: migrates into lower Amur and rivers of Amurskiy Liman.

***Pungitius sinensis* (Guichenot, 1869)**

Gasterosteus sinensis Guichenot, 1869: 204, pl. 12 fig. 4 (China, ? Yangtze River).

Gasterosteus wosnesenskii Kessler, 1876: 9 (western coast of Kamchatka, Russia, partim: only specimens with complete lateral row of scutes; also spelled *wossnesenskii* and *wossnessenskii*; emended to *wosnessenskii* in the same publication [Kessler, 1876: iv]).

Gasterosteus japonicus Steindachner, 1880: 27, pl. 3 fig. 2 (Strelok Bay near Vladivostok, Sea of Japan).

Pygosteus steindachneri Jordan & Snyder, 1901: 747 (replacement name for *Gasterosteus japonicus* Steindachner, 1880, a primary junior homonym of *Gasterosteus japonicus* Houttuyn, 1782).

Remarks on systematics. *Pungitius stenurus* (Kessler 1876), which is treated as a synonym of *P. pungitius sinensis* by some (Berg, 1949b; Keiva-

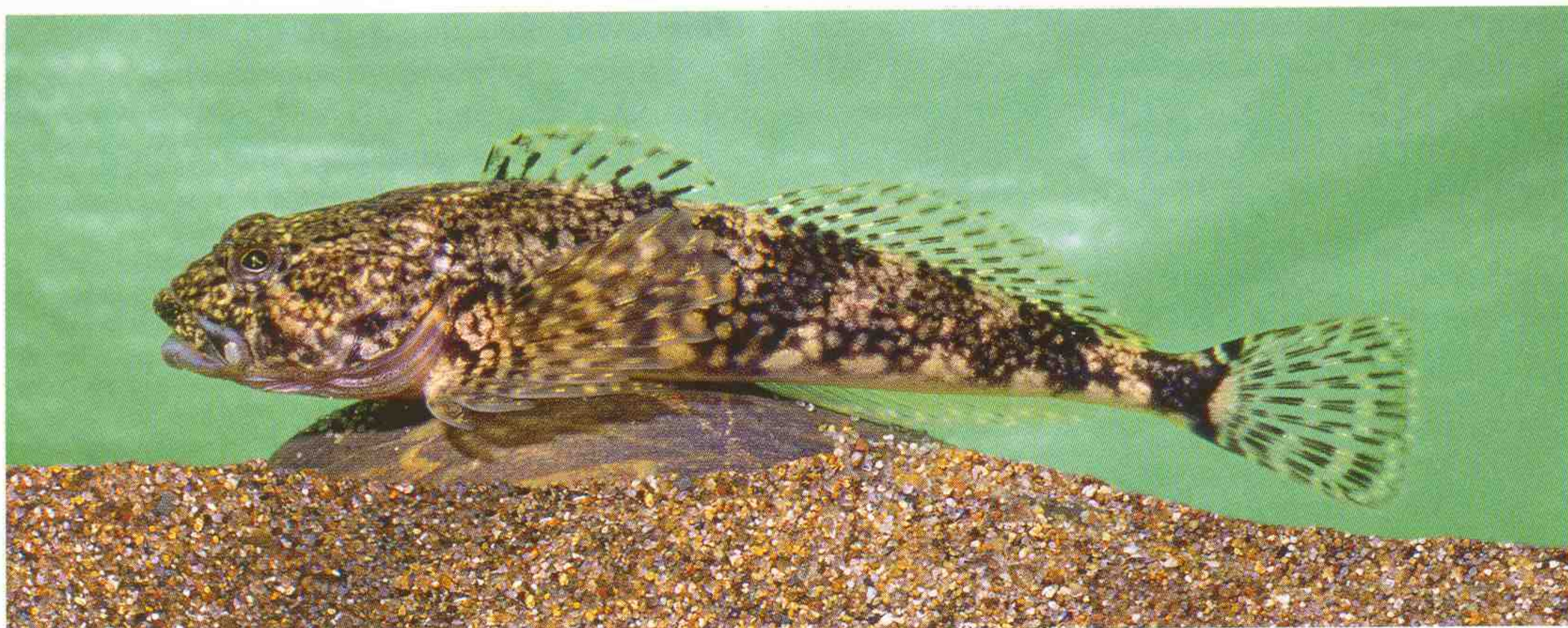


Fig. 41. *Cottus szanaga*, 72 mm SL; Russia: Amazar River, a tributary to Middle Amur, upstream from Amazar village, 53°51'N 120°51'E.



Fig. 42. *Mesocottus haitej*, 78 mm SL; Russia: Olenguy River, a tributary of Ingoda River, 4 km upstream from Olenguy village, 51°13'N 113°19'E.



Fig. 43. *Rhinogobius lindbergi*, 38 mm SL; Russia: Komissarovka River at Il'inka, Khanka Lake basin, 44°54'N 131°57'E.

ny & Nelson, 2000) may be a distinct species. SVSh examined syntypes (ZISP 2471, 5 specimens) and found that the specimens differ from *P. sinensis* by a more elongated body (vs. stout), a silvery overall coloration (vs. presence of vertical dark bars) and small lateral scutes in the complete lateral row (vs. large scutes). Actually, we follow the opinion of Kessler (1876) who clearly distinguished his *P. wosnesenjenskyi* and *P. stenurus*.

Distribution. Freshwater and anadromous. In Asia: northern China (rivers of Bo Hai basin), Japan (Hokkaido, Honsu), rivers of Sea of Japan in Russia, Korean Peninsula, Sakhalin Island, Shantarskiye Island (Sea of Okhotsk), rivers of the Sea of Okhotsk basin, western and eastern coasts of Kamchatka, Kuriles. In Amur: from about Bogorodskoye downstream to estuary; not reported from Sungari (Zhang, 1995).

Family Cottidae (bullheads)

Cottus szanaga Dybowski, 1869 (Fig. 41)

Cottus szanaga Dybowski, 1869: 949, pl. 14 fig. 1 (Onon River with tributaries [Upper Amur, Russia]).

Remarks on systematics. It has long been synonymized with *C. poecilopus* although clearly distinct (Holčík & Pivnička, 1969; Shedko & Shedko, 2003).

Distribution. Freshwater. In Asia: Amur; rivers of northern coast of Sea of Japan in Russia (in the north from Velikaya Kema River); Tugur (Sea of Okhotsk); north Sakhalin Island. In Amur: in Onon system in Mongolia and Russia, Shilka and Argun in Russia and further downstream in main Amur channel to Dzhalinda; absent from main channel downriver from about Dzhalinda but present in piedmont and montane sections of tributaries including rivers flowing into Amurskiy Liman; absent from Khanka Lake basin.

Megalocottus taeniopterus Kner, 1868

Cottus taeniopterus Kner, 1868: 28 (Decastris [De Katri] Bay and Amurskiy Liman [Tatar Strait, northern Japan Sea, Russia]).

Remarks on systematics. Commonly treated as a subspecies of *Megalocottus platycephalus*, which is a strictly marine species. *Megalocottus taeniopterus* differs from *M. platycephalus* by the relative length of the lower jaw, the extent of development of postorbital and occipital tubers, the coloration of pectoral fins, the shape of free ends of ventral fin rays, and their relative length and coloration in females (Gudkov, 2006).

Distribution. Coastal marine and brackish waters. In Asia: Amurskiy Liman (Tatar Strait), Sakhalin Island, entire continental coast of Sea of Japan southward to Peter-the-Great Bay. Absent from Hokkaido. In Amur: only found in very lower part of estuary and rarely going upstream to about Nikolayevsk-na-Amure.

Mesocottus haitej (Dybowski, 1869) (Fig. 42)

Cottus haitej Dybowski, 1869: 949, pl. 14 fig. 2 (Onon and Ingoda rivers with tributaries [Upper Amur, Russia]).

Distribution. Freshwater. In Asia: Amur and rivers of north-west Sakhalin Island; recorded from Tugur River (Sea of Okhotsk) but not confirmed. In Amur: Onon system in Mongolia and Russia, Shilka and Argun in Russia and further downstream to estuary, northern and southern tributaries, but absent from Khanka Lake basin.

Family Sinipercidae (sinipercids)

Remarks on systematics. The family placement of the related *Coreoperca* and *Siniperca* is uncertain; they have been placed in Centropomidae, Percichthyidae, or, as is more appropriate (Roberts, 1993), in their own family Sinipercidae (see discussion in Nelson, 2006).

Siniperca chuatsi (Basilevsky, 1855)

Perca chua-tsi Basilevsky, 1855: 218, pl. 1 fig. 1) (Tientsin [Tianjin], China).

Distribution. Freshwater. In Asia: from Amur and northwestern Sakhalin southward to Xi Jiang. In Amur: Middle and Lower Amur (historical records from about Kumara down to Tyr) and its southern tributaries.

Family Odontobutidae
(freshwater sleepers)

***Micropercops cinctus* (Dabry de Thiersant, 1872)**

Philypnus cinctus Dabry de Thiersant, 1872: 179, pl. 37 fig. 3 (mountain streams in Kiang-si [Jiangsu], China).

Eleotris swinhonis Günther, 1873: 242 (Shanghai, China).

Distribution. Freshwater. In Asia: from Amur southward to Xi Jiang. In Amur: historically known only from Sungari system; recorded in Amur at Khabarovsk in 1990s (Novomodny, 2005a). Also reported from Upper Amur (Tagirova, 2000) but this needs confirmation.

***Perccottus glenii* Dybowski, 1877**

Perccottus glenii Dybowski, 1877: 28 (Ussuri River [Lower Amur, Russia]).

Eleotris pleskei Warpachowski, in Warpachowski & Herzenstein, 1887: 19, fig. 2 (Lefu [Il'istaya] River, Khanka Lake basin [Lower Amur, Russia]).

Eleotris dybowskii Herzenstein & Warpachowski, in Warpachowski & Herzenstein, 1887: 21 (Khingan, Amur drainage).

Distribution. Freshwater. In Asia: from Tugur (Sea of Okhotsk) and Amur southward to Yangtze and Fujian (Li, 1981). In Amur: historically known from middle and lower Amur (from Tygda River down to the estuary) with tributaries Zeya, Sungari, Ussuri and the Khanka Lake basin. Recently reported from Shilka (Upper Amur) where it is introduced.

Family Gobiidae
(gobies)

***Gymnogobius (Chloea)* sp.**

Remarks on systematics. A new species (Shedko & Novomodny, in preparation) close to *Gymnogobius taranetzi* (Pinchuk, 1978).

Distribution. Freshwater. Endemic to Amur drainage or near endemic: Sungari River and Amur at Khabarovsk. Also, probably, Liao He.

***Gymnogobius (Taranetziola) opperiens*
Stevenson, 2002**

Gymnogobius opperiens Stevenson, 2002: 299, figs. 4N, 8C (Yuapu River, Yamagoe, Toshima, Hokkaido, Japan).

Remarks on systematics. Shedko & Chereshev (2005) divided the genus *Gymnogobius* into three subgenera, *Gymnogobius* (four species), *Chloea* (five species) and *Taranetziola* (four species). They may represent distinct genera though *Gymnogobius* still appears to constitute a monophyletic assemblage (Shedko & Chereshev, 2005).

Distribution. Freshwater. In Asia: Kunashir (Kuriles), Hokkaido (except for eastern coast), northern Honshu, Sakhalin, coast of Sea of Japan from Amur southward to Pusan (Korea). In Amur: from Bogorodskoye downstream to Chlya Lake.

***Rhinogobius lindbergi* Berg, 1933**
(Fig. 43)

Rhinogobius similis lindbergi Berg, 1933: 654, figs. 610-612 (Amur River at Vyatskoye; Ussuri River at Kolyubakinskiy).

Remarks on systematics. Treated as a subspecies or a synonym of *Rhinogobius similis* (e.g. Berg, 1949b; Lindberg & Krasnyukova, 1975; Bogutskaya & Naseka, 1997) or a synonym of *Rhinogobius cliffordpopei* (e.g. Zhang, 1995; Zhu, 1995). Sakai et al. (2000) treated it as a valid species based on a detailed morphological study.

Distribution. Freshwater. In Amur: southern tributaries of lower Amur including Khanka Lake and Amur downstream to estuary. Limits outside Amur not clear. Probably occur in Yalu River and rivers of Korean Peninsula, too.

***Rhinogobius sowerbyi* Ginsburg, 1917**

Rhinogobius sowerbyi Ginsburg, 1917: 100 (Yalu River, China).

? *Rhinogobius bergi* Lindberg, 1936: 402, figs. 7-10 (Maihe River, Peter-the-Great Bay basin, Sea of Japan, Russia).

Remarks on systematics. The taxonomy of *R. brunneus* is not resolved. A number of types distinguished primarily by body colouration, but also often occupying different habitat types within the same stream are collectively referred to as the *R. brunneus* species complex. In Japan, the *R. brunneus* complex it thought to comprise

at least ten species (Kato, 1996). A key to the eight species in the *R. brunneus* complex from Taiwan is given in Chen & Shao (1996). *Rhinogobius sowerbyi* is treated as a synonym of *R. brunneus* (e.g. Zhang, 1995; Kim, 1997; Reshetnikov, 1998) or as a valid species (as *Ctenogobius sowerbyi*) in Chinese literature (e.g. Li, 1981; Zhu, 1995); the latter conclusion is supported by a recent morphological revision (Vasil'eva, 2007).

Distribution. Freshwater. In Asia: rivers of Sea of Japan and Yellow Sea basins in China and Japan. In Amur: reported only from Jingpo Hu Lake (Upper Mudanjiang) and Wudalianchi ("Five Great Lakes", Upper Nen Jiang) in Sungari River system (Zhang, 1995).

Family Osphronemidae (gouramies)

Macropodus ocellatus Cantor, 1842

Macropodus ocellatus Cantor, 1842: 484 (Chusan Island [Zhoushan Qundao, Zhejiang, China]).

Remarks on systematics. Misidentified as *M. chinensis* (e.g. Storchilo, 1993; Novomodny et al., 2004); for taxonomy of *M. ocellatus* see Freyhof & Herder (2002).

Distribution. Freshwater. In Asia: from Amur and Japan southward to Zhu Jiang and Xi Jiang. In Amur: historically known only from Sungari; recently found at Khabarovsk (Storchilo, 1993). Novomodny et al. (2004) suggest that it is not native in Amur.

Family Channidae (snakeheads)

Channa argus (Cantor, 1842)

Ophicephalus argus Cantor, 1842: 484 (Chusan Island [Zhoushan Qundao, Zhejiang, China]).

Ophicephalus pekinensis Basilevsky, 1855: 225, pl. 9 fig. 3 (Tientsin [Tianjin], China).

Ophicephalus argus warpachowskii Berg, 1909: 200, fig. 3 (? Khanka Lake).

? *Ophicephalus argus kimurai* Shih, 1936: 81, fig. 5 (Tientsin [Tianjin] and Sichuan, China).

Distribution. Freshwater. In Asia: from Amur southward to Xi Jiang and Hainan Island. In

Amur: lowland sections of Middle and Lower Amur with southern tributaries.

Family Pleuronectidae

Platichthys stellatus (Pallas, 1787)

Pleuronectes stellatus Pallas, 1787: 347, pl. 9 fig. 1 (Kamchatka; Aleutian Islands, Kuriles).

Distribution. Freshwater. In Asia: Northern Pacific Ocean. Enters Amur upstream to Nikolaevsk-na-Amure.

Acknowledgements

We are pleased to thank the following persons for their help at different stages of this work: German Novomodny (Khabarovsk branch of TINRO), Viktor Nazarov, Evgeniy Barabanschikov and Nikolay Chernykh (TINRO-Centre), Yury Sushitsky and Vladimir Herstein (Nature Reserve "Khankaisky"), Marina Shedko (Institute of Biology and Soil), Dmitry Pitruk and Andreu Balanov (Institute of Marine Biology) for their valuable help in organizing field trips, collecting additional materials, and very fruitful discussions. Tatyana Igoshina was of great help while working with maps and literature. Special thanks go to Maurice Kottelat for constructive comments on initial versions of the manuscript and valuable discussions on nomenclatural and taxonomic matters. Examination of type specimens in different museums was possible thanks to P. Campbell (BMNH), P. Bartsch (ZMB), E. Miksch (NMW), G. Duhamel (MNHN). We appreciate the help from M. Hauteceure (MNHN) for radiographs. The project is supported by RFBR grant 06-04-96004-r_vostok_a and by Presidium of the Far Eastern Branch of Russian Academy of Sciences (project "Amur Complex Expedition, 2004-2008"); BNG was also supported by a RFBR grant 07-04-01245.

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Appendix. Gazetteer

Variants of spelling or transcription of names of hydrographic features and populated places in the Amur drainage and neighbouring areas (names mentioned in species accounts).

In the case of rivers, coordinates refer to their mouths. The main variant in English and Russian (latinized) is that taken from the NGA GNA data base (<http://geonames.nga.mil/ggmagaz/geonames4.asp>). The main variants of Mongolian names are harmonized with Kottelat (2006). Variants given in square brackets are taken from available old and recent maps and literature.

- Agrun [Argun', Ergun He], a river, 53°15'N 121°21'E
- Aksha [Акша], a populated place, 50°16'N 113°17'E
- Albazino [Албазино], a populated place, 53°23'N 124°04'E
- Amgun [Amgun', Амгунь], a river, 52°56'N 139°41'E
- Amur [Heilongjiang, Heilong Jiang, Heilungkiang], a river, 53°N 141°E
- Amurzet [Амурзет], a populated place, 47°44'N 130°57'E
- Anyui [Onyuy, Dondon, Анюй], a river, 49°16'N 136°28'E
- Arsenievka [Daubikhe, Арсеньевка], a river, 44°57'N 133°34'E
- Avvakumovka [Аввакумовка], a river, 43°45'N 135°09'E
- Bal'zinskoye [Бальинское], a lake, 51°51'N 113°35'E
- Blagoveshchensk [Благовещенск], a populated place, 50°13'N 127°34'E
- Bogorodskoye [Bogorodsk, Богородское], a populated place, 52°23'N 140°25'E
- Bolon' [Болонь], a lake, 49°50'N 136°20'E
- Bol'shaya Ussurka [Иман, Большая Уссурка], a river, 45°56'N 133°40'E
- Buir Nur [Buir-nor, Buyr Nuur], a lake, 47°50'N 117°40'E
- Bureya [Бурей], a river, 49°24'N 129°31'E
- Chitinka [Читинка], a river, 52°08'N 113°27'E
- Chlya [Чля], a lake, 53°26'N 140°02'E
- Da'an [Daan], a populated place, 45°30'N 124°16'E
- Dalai Nur [Dalai-nor], a lake, 43 18'N 116 39'E (this lake is endorheic and lies in Inner Mongolia Autonomous Region [Nei Mongol], China; Nikolai Przhevalsky [Przewalski] visited the lake in 1871 and collected fishes which were later described by Kessler (1876); there are several lakes with the same name Dalai; one of them, now called Hulun Nur, is in the upper Amur drainage)
- Dayerga [Даерга], a populated place, 49°17'N 136°21'E
- Dudi [Дуди], a populated place, 52°05'N 140°12'E
- Dzhalinda [Джалинда], a populated place, 53°28'N 123°53'E

- Elabuga [Елабуга], a populated place, 48°48'N 135°52'E
 Gor [Гор], a river, 50°05'N 136°54'E
 Harbin [Ha-erh-pin, Kharbin], a populated place, 45°45'N 126°35'E
 Hulun Nur [Hu Lun, Dalai Nur, Dalai-nor, Qulun], a lake, 49°N 117°30'E (not to be confused with Dalai Nur in Inner Mongolia, see above)
 Ilistaya [Lefu, Илистая], a river, 44°33'N 132°29'E
 Ingoda [Ингода], a river, 51°42'N 115°49'E
 Inya [Иня], a river, 59°23'N 144°54'E
 Irtysh [upper reaches in China: Ertix He or Black Irtysh; Иртыш], a river, 58°11'N 68°16'E
 Kiyevka [Киевка], a river, 42°53'N 133°40'E
 Khabarovsk [Хабаровск], a populated place, 48°23'N 134°57'E
 Khalkh [Khalkhyn Gol, Khalkin Gol, Khalkiin Gol, Khalkhin-gol, Halhaiin Gol], a river, 47°55'N 117°48'E
 Khanka [Xingkai Hu, Hsing-k'ai Hu, Hanka, Ханка], a lake, 45°N 132°25'E
 Kherlen [Kerulen, Kherlen Gol, Herlen-gol, Herlen He], a river, 48°43'N 117°03'E
 Khuvs gul [Hovsgol Nur, Хубсугул, Косогол], a lake, 51°N 100°30'E
 Komissarovka [Sintokha, Sintuhe, Комиссаровка], a river, 44°52'N 132°07'E
 Konstantinovka [Константиновка], a populated place, 49°36'N 128°E
 Koppi [Коппи], a river and a populated place, 48°33'N 137°56'E
 Kumara [Кумара], a river and a populated place, 51°34'N 126°43'E
 Leninskoye [Ленинское], a populated place, 47°57'N 132°40'E
 Mago [Маго], a populated place, 53°13'N 140°09'E
 Maksim Gor'kiy [Максим Горький], a populated place, 51°23'N 138°55'E
 Maksimovka [Kkhutsin, Максимовка], a river and populated place, 46°05'N 137°56'E
 Marka-Kul [Markakol], a lake, 48°45'N 85°45'E
 Mel'gunovka [Мо, Мельгуновка], a river, 44°37'N 132°14'E
 Mukhtel' [Мухтель], a lake and a river, 54°08'N 139°06'E
 Mudanjiang [Mudan Jiang, Mutan-kiang, Mudan bira], a river, 44°37'N 132°14'E
 Nerchinsk [Нерчинск], a populated place, 52°N 116°31'E
 Nikolayevsk-na-Amure [Nikolaevsk-on-Amur, Nikolaevskoye, Николаевск-на-Амуре], a populated place, 53°06'N 140°43'E
 Nizhnetambovskoye [Нижнетамбовское], a populated place, 50°55'N 138°09'E
 Novo-Georgiyevsk [Novogeorgiyevskoye; Ново-Георгиевск], a populated place, 52°30'N 140°19'E
 Novoil'inovka [Новоильиновка], a populated place, 51°11'N 138°37'E
 Odarka [Оларка], 44°41'N 132°48'E
 Ol'gino [Ольгино], a populated place, 52°53'N 125°45'E
 Ommi [Омми], a lake, 50°05'N 136°46'E
 Onon [Onon Gol, Onon Kawa, Onon Gawa, Онон], a river, 51°42'N 115°49'E
 Orel' [Орель], a lake, 53°26'N 139°44'E
 Orshun [Orshon, Orshun Gol, Oshuun Gol], a river, 48°57'N 117°44'E
 Poronay [Поронай], a river, 49°13'N 143°06'E
 Razdol'naya [Suifen He, Suifun, Раздольная], a river, 43°19'N 131°45'E
 Selemdzha [Selemzha, Селемджа], a river, 51°43'N 128°53'E
 Selenge [Selenga, Селенга], a river, 52°20'N 106°20'E
 Serebryanka [Серебрянка], a river, 45°02'N 136°39'E
 Shargal'dzhin [Шаргольджин], a lake and a populated place, 50°13'N 127°34'E
 Shilka [Шилка], a river, 53°15'N 121°21'E
 Sofiysk [Sofiiskoe, Sofiyskoye, Софийск], a populated place, 51°35'N 139°50'E
 Spasovka [Santakheza, Спасовка], a river, 44°45'N 132°39'E
 Sretensk [Сретенск], a populated place, 52°14'N 117°41'E
 Sukhanovka [Сухановка], a populated place, 51°20'N 139°07'E
 Sungacha [Bol'shoi Sungach, Song'acha He], a river, 45°33'N 133°22'E
 Sungari [Songhua, Sungari-ula, Sunggari, Zungari, Сунгари], a river, 47°41'N 132°31'E
 Sverbeyevoye [Свербеево], a populated place, 53°33'N 123°16'E
 Tugur [Тугур], a river, 53°45'N 136°47'E
 Tumen [Tumannaya, Tumen-ula; Tumen Ula, Tuman-gang, Tumen Jiang, Tumenkiang, Туманная], a river, 42°17'N 130°40'E
 Tura [Тура], a river, 64°16'N 100°11'E
 Tygda [Тыгда], a river and a populated place, 53°28'N 123°53'E
 Tym' [Тымы], a river, 51°51'N 143°11'E
 Tyr [Тыр], a populated place, 52°56'N 139°42'E
 Uda [Уда], a river, 54°52'N 135°18'E
 Udyi' [Удыль], a lake, 52°04'N 139°45'E
 Ul'beya [Ульбея], a river, 59°30'N 144°26'E
 Ussuri [Wusuli Jiang, Уссури], a river, 48°27'N 135°03'E
 Voskresenovka [Воскресеновка], a populated place, 48°N 132°54'E
 Wudalianchi, lakes and a populated place, 48°45'N 126°09'E
 Yalu [Yalu He, Amnok], a river, 40°N 124°22'E
 Yenisei [Yenisey, Bol'shoi Yenisey, Енисей], a river, 70°06'N 82°52'E
 Zeya [Зея], a river, 51°45'N 128°52'E
 Zhigansk [Жиганск], a populated place, 66°47'N 123°20'E

Received 5 September 2008

Revised 15 November 2008

Accepted 17 November 2008