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Main alterations in ichthyofauna of the largest rivers of the northern coast of the Black Sea in the last 50 years: A review

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A b s t r a c t . This review compares the current state of ichthyofauna in the largest rivers of the northern coast of the Black Sea (Don, Kuban, Dnieper and Dniester rivers) with data published by B e r g (1948–1949). Changes in species composition are characterized by the disappearance or decline in anadromous and semi-anadromous fishes. The total number of native species that are extinct, protected, in declined or become rare has reached from 19 % in the Kuban to 36 % in the Dnieper River basins. Appreciable changes have occurred in the ratios between rheophilous and limnophilous fishes (the latter becoming predominant in many parts of the rivers). Euryhaline and even marine species have invaded most of river basins. And the number of introduced or established alien species varies from 9.7 % in the Dnieper to 16.8 % in the Kuban River basins. These changes, which have yielded quite altered ichthyofauna, must be taken into consideration in conservation endeavours

Key words: native, introduced, non-native, extinction, protected fishes, alien

Introduction

B e r g (1949a) summarised his own and literature data on ichthyofauna of the main rivers of Russia and neighbouring countries in his famous monograph, which was published before significant growth of human pressure on natural waters began. The Dniester, Dnieper, Don and Kuban are the largest rivers on the northern coast of the Black Sea (Fig. 1). According to B e r g (1949a), their basins belong to the Black-Sea region within the Ponto-Caspian-Aral zoogeographic province, which is characterised by three endemic species: *Acipenser nudiventris, Chalcalburnus chalcoides*, and *Pungitius platygaster* (Table 1). Berg included all of these rivers as part of the Danube-Kuban district of the Black Sea region when examining differences in their ichthyofauna. Thus, the Dniester ichthyofauna is the most similar to that of the Danube River: according to B e r g (1949a) they have three common endemic species – *Zingel zingel, Umbra krameri*, and *Gobio kesslerii*. In contrast, the Dnieper ichthyofauna is characterized by the absence of endemic species, Coregonids and Thymallids (B e r g 1949a). The Don River basin is characterized by one endemic species only, *Leuciscus danilewskii*, and by the absence of *Barbus* spp. The Kuban ichthyofauna is the most different and includes several southern forms, which are characteristic of the Terek River basin or West Transcaucasia and endemic freshwater *Leuciscus aphipsi* (B e r g 1949a). Later, the second endemic Kuban species *Romanogobio pentatrichus* was described.

B e r g (1949a) reported the ichthyofauna of the Dniester River to have 72 species, the Dnieper River 73 species, the Don River 62 species and the Kuban River 57 species. But these rivers have been subjected to significant human alterations in the 50 years since Berg's publication. Their hydrological and temperature regimes have changed considerably as a result of water retention structures, in particular dams. Annual discharge rates have

decreased and became more variable, spring discharge fluctuations deformed and the area of flood plains decreased. For instance, the flood plains of the Dnieper River have decreased by five times (B u g a i 1977). Appreciable changes to the temperature regime of different parts of the river channels and to the salinity in lagoons have also occurred. These and other human influences, such as pollution, water abstraction for irrigation, poaching and over exploitation, fish stocking, etc., have modified species composition as well as population densities and distribution. In light of the changes to these river systems and their ichthyofauna, as well as some new taxonomic data, a review of the available information is warranted, particularly with regard to the important role of these rivers in sustaining of anadromous and semi-anadromous fishes.

Methodology

Published data as well as existing and new unpublished data derived from the collections of the Zoological Museum of the Moscow State University (MMSU) and recent expedition have been compiled. B e r g ' s publications (1948, 1949a,b) provided the base-line data on the species composition of native fauna present prior to the middle of 20-th century, with certain exchanges caused by new taxonomic achievements and discoveries of some rare species. Some species were, however, not taken into consideration: 1) According to E l v i r a (1987), there are two species of genus *Chondrostoma* in the Don River basin: *C. variabilis* and *C. nasus*. But this conclusion cannot be confirmed or rejected now because in most regional publications Berg's taxonomy of Cyprinid fishes (B e r g 1949b) is accepted with subspecies status of *C. variabilis* (*C. nasus variabilis*), and thus only one species, *C. nasus,* is recorded; 2) *Gobius constructor* was recorded for the Don River basin based on two specimens caught in the Kalitva River (tributary of the Donets River) in 1957 (T r o i t s k i i & T s u n i k o v a 1988). All publications about this species in the Don River basin have been published before the new taxonomy of freshwater Caucasian gobies was prepared (see V a s i l ' e v a 1998). Thus, the taxonomic status of these fishes remains uncertain; 3) Catostomid fishes *Ictiobus bubalus, I. cyprinellus*, and *I. niger* are cultivated in some fish farm of the Lower Don River basin (T r o i t s k i i & T s u n i k o v a 1988), but there are no data about their presence in natural waters; 4) In 1963–1964, 50000 young specimens of *Barbus brachycephalus* were introduced to Akhtanizovsky lagoon (Kuban River basin), but the results of this introduction are unknown; 5) *Orthrias merga* was included in the Kuban River fauna by B e r g (1949b), but there are no recent data to confirm its occurrence there; 6) B e r g (1949b) recorded *Sabanejewia caucasica* for the Upper Kuban, but subsequent investigations could not confirm its occurrence there. Moreover, the distribution patterns of spined loaches from the genus *Sabanejewia* suppose the area of *S. caucasica* to be restricted to several rivers of the Caspian Sea basin only (Kuma, Terek, Sulak, Shura-ozen') (V a s i l ' e v a 1995); 7) Only one specimen of *Lota lota* was found in the Kuban River basin (T r o i t s k i i 1948), namely in the Protoka (the right branch of the lower part of river channel, which falls into the sea at Achuev village). Possibly it came there from the Don River by Taganrogsky Bay (P l o t n i k o v 2000); 8) *Scomber scombrus* Linnaeus, 1758 is not included in the list of the Dnieper River ichthyofauna because there are no records of this species in Dnieprovsky-Bugsky lagoon since 1860 (S v e t o v i d o v 1964); 9) *Oncorhynchus mykiss* was at first introduced to Belarus water bodies after World War Two. A trout farm was constructed in the Gaina River basin (tributary of the Berezina River), Minsk District (Z h u k o v 1965), with *O. mykiss* also growing on at the "Putsha Voditsa" fish farm near Kiev (P a v l o v 1980). But there is no information about its occurrence in water bodies

of the Dnieper River basin; 10) During 1957–1964, larvae of *Coregonus lavaretus* (Linnaeus, 1758) were introduced to Dubossarskoye Reservoir (T o m n a t i k 1965), but this species is not recorded for the Dniester River basin in later publications (P a v l o v 1980, B o d a r e u 1993, D o l g i i 1993a,b); 11) According to K o t l í k et al. (2002), "*Barbus cyclolepis waleckii* Rolik, 1970" recorded for the Dniester River basin in Poland represents a natural hybrid of *Barbus barbus* and *B. carpathicus*.

Some species have previously been included by mistake in fauna lists and these are also excluded from analysis: 1) *Neogobius rhodioni* Vasiľeva et Vasiľev, 1994 was previously included into the Kuban River fauna (V a s i ľ e v a 1998) based on a few specimens from the MMSU collection that were not sufficient for specific determination (V a s i ľ e v a & V a s i ľ e v 1994). Our recent unpublished karyological data demonstrate freshwater gobies inhabiting some tributaries of the Kuban River (Psekups, Afips) to be *Neogobius constructor;* 2) *Barbus ciscaucasicus* Kessler, 1877 was recorded to have entered the Don River basin (Chograiskoye Reservoir) through the Kuma-Manych channel (B o g u t s k a y a 1998a). But Chograiskoye Reservoir does not belong to the Don River basin and is part of the Vostochnyi Manych River, which previously drained into the Sostinskie Lakes but now drains into Chograiskoye Reservoir.

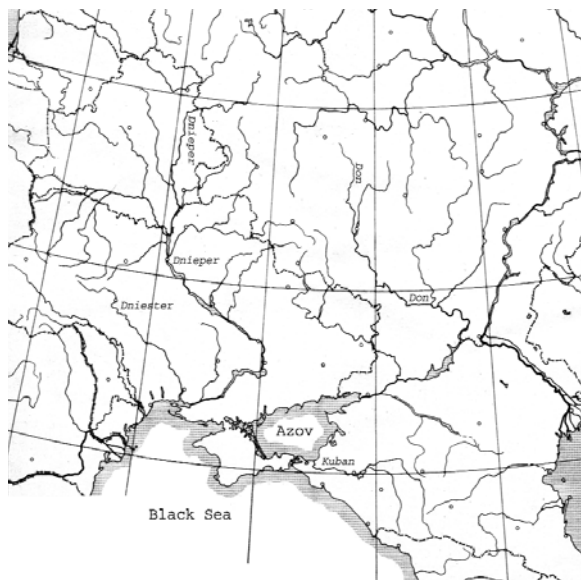

Fig. 1. Principle rivers of the northern coast of the Black Sea.

Discussion

K u b a n R i v e r b a s i n

The current list of the Kuban River ichthyofauna includes 95 species from 27 families (Table 1) of which 16 species are exotic. *Polyodon spathula* was acclimatized in the Goryacheklyuchevskoi fish farm, young specimens were introduced to Krasnodarskoye Reservoir, and it now occurs in this reservoir and possibly in the Lower Kuban. *Hypophthalmichthys nobilis, H. molitrix*, *Ctenopharyngodon idella* and *Mylopharyngodon piceus* were introduced to open waters of the North-western Caucasus in 1960. *H. nobilis*

now occurs, with evidence of natural breeding, in Varnavinskoye and some other reservoirs, in lagoons and distilled parts of the Sea of Azov. Natural breeding of *C. idella* and *H. molitrix* has been recorded in the Kuban River since 1962. Recently, *C. idella* is abundant in lagoons and reservoirs, and *H. molitrix* is the object of commercial fisheries (500 t per year) in all rivers, reservoirs, lagoons and distilled parts of the sea. There is no information on the natural breeding of *M. piceus*. *Pseudorasbora parva* was found in several floodplain lakes and in the rice fields (Troitskii & Tsunikova 1988, Plotnikov 2000).

Catostomid fishes *Ictiobus bubalus, I. cyprinellus* and *I. niger*, as well as *Ictalurus punctatus*, are cultivated in some fish farms and sometimes occur in natural waters, mainly in Krasnodarskoye Reservoir, but without natural breeding (Emtyl' 1997). *Gambusia holbrooki* and *Oryzias latipes* were introduced to several water bodies of the North-western Caucasus to control malarial mosquitoes. Recently, these species occur in some waters of the Krasnodar District: Old Kuban, Karasunskie Lakes and the channel of electric power station (Plotnikov 2000). As the result of an acclimatization programme, *Morone saxatilis* is occasionally recorded in lagoons since 1965. In 1970, several hundreds of its young specimens were introduced to Shapsugskoye Reservoir. *Oreochromis mossambicus* is cultivated in several fish farms and recently occurs in the in-take channel of the Krasnodar electric power station (Plotnikov 2000). *Liza haematocheila*[1] was introduced to the Black Sea and the Sea of Azov in 1970, and it now occurs in most of the lagoons and has entered the Kuban River (Troitskii & Tsunikova 1988, Plotnikov 2000). *Rutilus frisii* occurs in the Black Sea and Sea of Azov basins as a nominative subspecies, which has not been found in the Kuban River basin (Berg 1949a, Troitskii & Tsunikova 1988). The Caspian subspecies *R. frisii kutum* Kamensky, 1901 has been introduced to the Kuban lagoons as of 1957, and is now recorded for the lowest parts of the Kuban River and for the Sea of Azov (Plotnikov 2000). Finally, two new species have recently been found in the Kuban River basin: *Sander volgensis* in water bodies of the Lower Kuban (Moskul 1994, Emtyl' 1997) and *Rhodeus sericeus* (my data), but both of these are native species.

Of the previously reported 77 native species, 8 are widely distributed throughout the basin: *Abramis brama, A. bjoerkna, Alburnus alburnus, Cyprinus carpio*, *Pelecus cultratus, Rutilus rutilus, Scardinius erythrophthalmus,* and *Perca fluviatilis*. Some of them, namely *A. alburnus, A. bjoerkna* and *S. erythrophthalmus*, are absent in mountain lakes and small streams with rapid flow and cold water only, and *C. carpio* and *P. fluviatilis* are also absent in several lagoons. Whereas *A. brama* and *R. rutilus* occur in all rivers, channels, lakes, and reservoirs, as well as in the delta and lagoons. Some less widely distributed species are *Abramis sapa, Aspius aspius, Carassius auratus, Sabanejewia aurata, Gymnocephalus cernuus*[2] and *Sander lucioperca*. Semi-anadromous *A. aspius* inhabits lagoons, reservoirs and brackish sea waters and occurs in some tributaries. *C. auratus* occurs in the channel, its tributaries and water bodies of the flood plains, but is absent in lagoons. *G. cernuus* inhabits stagnant waters or waters with slow current and soft grounds. *S. lucioperca* occurs in the channel below the city of Krasnodar and in lower and middle stretches of its main tributaries. It is abundant in many reservoirs (Troitskii & Tsunikova 1988, Shebzukhova 1992, Moskul 1998, Plotnikov 2000).

The distribution of some other species is mainly limited by certain parts of the basin. Thus, *Anguilla anguilla* rarely occurs in the lower part of the Kuban River only. Anadromous *Alosa tanaica*, *A. maeotica* and *A. immaculata* come to freshwater lagoons and the lower part of the Kuban River (up to Krasnodarskoye Reservoir) for breeding only.

[1] This name is proved to be a correct name for the Pilnegas mullet by Parin (2003).

[2] Preliminary osteological results suppose *Acerina* and *Gymnocephalus* to be separate genera, with the former genus to be represented by two species: *A. cernua* and *A. baloni* (Neyelov & Urganova 1998)

Alburnoides bipunctatus and *Gobio gobio* inhabit the upper parts of the main channel and its left bank tributaries. Before dam construction, *G. gobio* also occurred in the delta, but only rarely. *Leuciscus aphipsi* is recorded in the left bank tributaries of the Kuban River only, but *L. borysthenicus* in the lowest parts of rivers and in the lakes. *L. cephalus* occurs in tributaries, but *L. idus* in brackish waters, in lagoons as well as in the river channel. *Barbus tauricus* occurs mainly in the middle and upper parts of the channel and in the main tributaries. In the Lower Kuban, it is very rare and consists mainly of young specimens. *Carassius carassius* occurs in lagoons and some reservoirs. *Leucaspius delineatus* inhabits the Middle and Lower Kuban and its tributaries as well as lakes, reservoirs and lagoons. *Phoxinus phoxinus* inhabits streams with rapid flow and sandy or stony bottom, but does not occur east of the Psekups River. *Romanogobio pentatrichus* was found in the channel and in the Laba River only (Troitskii 1965, Troitskii & Tsunikova 1988, Naseka 1998, Plotnikov 2000).

Twenty-nine marine or euryhaline species occur in the Lower Kuban only. Euryhaline *Clupeonella cultriventris* occurs in lagoons and the Lower Kuban; its breeding was recorded in Krasnodarskoye Reservoir in which the marine species *Sprattus sprattus* also occurs, but only rarely. Marine *Engraulis encrasicolus* and *Belone belone*, as well as euryhaline *Gasterosteus aculeatus*, have been recorded for the lagoons only. *Atherina boyeri* occurs in lagoons and in the mouth of the Protoka. *Pungitius platygaster* occurs in lagoons, reservoirs and lower parts of rivers and was recorded for the Laba River. *Syngnathus typhle* is rare in lagoons, whereas *S. abaster* (syn. *S. nigrolineatus* Eichwald, 1831) occurs in the channel up to its middle course and is abundant in the Fedorovskoye, Shapsugskoye and Krasnodarskoye reservoirs. *Nerophis ophidion* was recorded for Krasnodarskoye Reservoir and occurs in lagoons and lower parts of rivers. *Percarina demidoffi* is very rare in the delta and in most of the lagoons, but abundant in Akhtanizovsky lagoon. Young specimens of *Liza aurata*, *L. saliens* and *Mugil cephalus*, as well as adults of the latter species, inhabit most of the lagoons, and two latter species also are found at the mouth of the Kuban River. Most gobies occur in lagoons, and only some of them are abundant: *Benthophilus magistri, B. stellatus, Knipowitschia caucasica,* and *K. longecaudata*. At the same time, *Neogobius fluviatilis* is a common species, inhabitig the channel, left bank tributaries, reservoirs and lagoons. *Umbrina cirrosa* and *Platichthys flesus* are found in lagoons and in the mouth of the Kuban and Protoka rivers (Troitskii & Tsunikova 1988, Plotnikov 2000).

Five native species have recently been added to the Russian Red Book of protected taxa: 1) *Eudontomyzon mariae* recently belongs to the rare species with sharply decreasing numbers. In 1947, it was abundant in the channel, its several tributaries (Psekups, Afips) and smaller rivers to the west of the Afips as well as the Belaya, Pshish, Il', Abin and Agodum rivers. Breeding has been observed in the Kuban River between the cities of Armavir and Kropotkin as well as in the River Psekups (Troitskii & Tsunikova 1988, Plotnikov 2000); 2) Anadromous *Acipenser nudiventris* is very rare in the Black and Azov seas, with sharply decreasing numbers and possibly no longer occurring in the Kuban River basin (Plotnikov 2000); 3) Anadromous *Huso huso*, before the construction of Fedorovskoye and Krasnodarskoye reservoirs migrated up to the village of Ladozhskaya to spawn (more than 200 km) and possibly further upstream. Recently, only a few specimens occur in the Kuban River (Plotnikov 2000); 4) *Chalcalburnus chalcoides* in the Kuban River is semi-anadromous. Previously, it was abundant in gulfs and estuaries of the Sea of Azov, with salinity 10–12 ‰ but had a restricted distribution in rivers, where it spawned in places with moderate flow and stone or sandy bottom. Prior to dam construction, the Kuban

River was the main breeding river for this fish (Berg 1949b), with reproduction in the channel as far upstream as the villages of Ust'-Labinskaya and Tbilisskaya (about 240 km), the Protoka branch and the main left bank tributaries (Afips, Psekups, Pshish, Belaya, Laba). Following dam construction, *C. chalcoides* lost its spawn areas in the Kuban River basin and its numbers declined sharply throughout the area due to pollution and over exploitation. Small local freshwater populations exist in Krasnodarskoye and Shapsugskoye reservoirs (Troitskii & Tsunikova 1988, Plotnikov 2000); 5) Anadromous *Salmo labrax* previously migrated up the Kuban River and some of its tributaries: Laba, Khodz', Urup for breeding. But recently, there are no records on anadromous salmon from this area. Its freshwater form occurs in the Upper Kuban and its tributaries from the Teberda to the Belaya (Troitskii & Tsunikova 1988, Plotnikov 2000).

Also, freshwater *Acipenser ruthenus* has disappeared in some parts of the basin and becomes rare species (Troitskii 1965). Three other native anadromous or semi-anadromous species, *A. gueldenstaedtii, A. stellatus, Vimba vimba,* are in decline since dam construction (Troitskii 1965, Sokolov 1998, Bogutskaya 1998b). Some other anadromous and semi-anadromous species, *Alosa tanaica*, *A. immaculata* (syn. *A. kessleri* /Grimm, 1887/) and *A. maeotica*, now occur in the Lower Kuban basin only (Troitskii & Tsunikova 1988, Plotnikov 2000) and are becoming rare (Table 1). Thus, in total there are 15 more or less vulnerable native freshwater and anadromous or semi-anadromous species (19.0 %).

Don River basin

The current list of the Don ichthyofauna includes 78 species from 20 families (Table 1), with rare species from the former list (Berg 1949a) now considered extinct: *Salmo labrax*. This anadromous species from the Black Sea and Sea of Azov belongs to the list of endangered fishes of Ukraine (Red Book of Ukraine 1994) and to protected fishes of Russia. Recent data suggest it has completely disappeared from the Don River basin (Troitskii & Tsunikova 1988) and is now recorded for the Obitochnyi Bay (the northern part of the Sea of Azov) only (Kulik & Diripasko 1999). Of recently acquired fauna, 10 species (12.8 %) are exotic. *Hypophthalmichthys nobilis, H. molitrix, Mylopharyngodon piceus,* and *Ctenopharyngodon idella* were introduced for commercial aims. *H. nobilis* occurs in the delta and in the reservoirs of the Lower Don basin. *M. piceus* is found in lower parts of the Voronezh and Khoper River basins, whereas *C. idella* and *H. molitrix* occur in the Lower and Upper Don (Khoper), most often in reservoirs, but without natural reproduction (Poznyak 1987, Troitskii & Tsunikova 1988, Davydenko 1995). *Morone saxatilis* also introduced for commercial reasons has been recorded in the Lower Don and *Platichthys flesus* in Proletarskoye Reservoir (Manych River basin) from 1979, the latter introduction of limited success with only a few specimens reported in the late 1980s (Poznyak 1987, Troitskii & Tsunikova 1988). *Ictalurus punctatus,* introduced as a farm fish, now also occurs in natural waters (Troitskii & Tsunikova 1988). *Pseudorasbora parva* has been found in the Lower Don (Nadtoka & Abramenko 1998), *Perccottus glenii* in the Khoper River from 1994 (Davydenko 1995), and recently *Neogobius gorlap* has been found in Tsimlyanskoye Reservoir (our data based on materials, collected by V. Boldyrev).

Of 68 extant native species, there are 10 species widely distributed throughout the basin: *Abramis brama, A. bjoerkna, Alburnus alburnus, Leucaspius delineatus, Leuciscus idus, Rutilus rutilus, Scardinius erythrophthalmus, Tinca tinca, Gymnocephalus cernuus, Perca fluviatilis*.

Some of them (*A. brama, A. bjoerkna, A. alburnus, R. rutilus*) occur in all rivers, channels, lakes, and reservoirs, and also in the delta and brackish waters; whereas *L. delineatus, T. tinca* and *S. erythrophthalmus* mainly occur in lakes, tributaries and reservoirs; and *L. idus* is most abundant in flowing waters. Some less distributed species are *Abramis ballerus, A. sapa, Aspius aspius, Carassius auratus, C. carassius, Sander lucioperca*, and *Neogobius fluviatilis*. The first three species and *S. lucioperca* occur more often in rivers, large lakes and reservoirs, whereas *C. auratus* and *C. carassius* are more common in the Lower Don, in its lakes and reservoirs (Fedorov 1960, 1970, Poznyak 1987, Troitskii & Tsunikova 1988, Babushkin 1990, Klyavin 1992, Davydenko 1995).

The distribution of some other native species is mainly limited to certain parts of the basin. Thus, *Cyprinus carpio* is common and abundant in the Lower Don basin and rare in the Upper Don, whereas *Phoxinus phoxinus* is distributed in the Upper Don basin only (Davydenko 1995). Recent data indicated that *Cobitis taenia* occurs in the Upper Don basin: several specimens of this species were collected by B. Levin in the Khoper River (Penza District) together with *Cobitis rossomeridionalis*, the most numerous and common loach in the Don River basin (Vasiľeva & Vasiľev 1998).

Thirteen marine or euryhaline species occur in the Lower Don. *Neogobius gymnotrachelus* and *N. melanostomus* are very rare there and are recorded for Tsimlyanskoye Reservoir, whereas *Benthophilus magistri* is quite common. *Atherina boyeri* is distributed up to city of Rostov, and *Gasterosteus aculeatus* is recorded for the Lower Don and the Sal River. *Percarina demidoffi, Caspiosoma caspium,* and *Mesogobius batrachocephalus* occur rarely in the Don mouth only. *Benthophilus stellatus* occurs up to the city of Voronezh, and *Neogobius syrman* is rare up to Aksai. *Knipowitschia longecaudata* occurs in the delta, in the main river channel up to Kokchetavskaya and in Tsimlyanskoye Reservoir and reservoirs of the Manych River drainage. *Clupeonella cultriventris* inhabits the delta, Tsimlyanskoye Reservoir, some reservoirs of the Manych River drainage, and is randomly distributed in the Upper Don. *Syngnathus abaster* is found in reservoirs of the Manych River drainage and in the Donets River basin (Fedorov 1970, Troitskii & Tsunikova 1988, Poznyak 1987, Dentshik 1997, Vasiľeva 1998).

There are 10 protected species of the Red books of the Ukraine and Russia that occur in the Don River basin: 1) Metamorphosed specimens of *Eudontomyzon mariae* are very rare, and in the breeding season they occur in some small streams of the Upper Don (Babushkin 1990). Ammocoetes more or less often occur in some parts of the basin: in the Donets, Voronezh and Khoper rivers and some lakes and small streams of their basins (Fedorov 1960, Red book of Ukraine 1994, Davydenko 1995, Levin 2001); 2) Anadromous *Acipenser nudiventris* is becoming endangered and is protected in the Ukraine and Russia; 3) *Acipenser ruthenus* is becoming very rare in the Don River basin (Khoper) and has completely disappeared from some its tributaries (Donets) (Red book of Ukraine 1994, Davydenko 1995); 4) Anadromous *Huso huso* lost all breeding sites in the Upper Don after construction of the Tsimlyanskoye Reservoir, its numbers have decreased sharply, and the population is maintained by artificial reproduction only. Excessive fishing has caused further decline in its numbers. Now, this species is very rare and practically extinct in most of the basin; 5) *Alburnoides bipunctatus* is rare in the Upper Don despite previous records in the Khoper and Donets Rivers (Berg 1949a, Fedorov 1960) where it has become very rare (Khoper, Davydenko 1995) and possibly extinct (Donets, Movchan & Smirnov 1983); 6) *Chalcalburnus chalcoides* was previously abundant in gulfs and estuaries of the Sea of Azov (salinity 10–12 ‰), but had restricted

distribution in rivers where it spawns (moderate flow and stone or sandy bottoms). This species was not abundant in the Don River basin in the past (Berg 1949a) and recently its numbers have decreased sharply due to dam and reservoir construction, pollution and over fishing. Now it is very rare in the Upper Don (Davydenko 1995). A small local population inhabits Tsimlyanskoye Reservoir (Troitskii & Tsunikova 1988); 7) *Leuciscus danilewskii* is a quite common freshwater species in the Upper Don, but it is practically extinct in most of the Donets River drainage as a result of habitat changes caused by river regulation. And thus it is included in the Ukraine list of vulnerable species (Red book of Ukraine 1994); 8) The anadromous form of *Rutilus frisii* lost all its breeding sites in upper parts of rivers and practically disappeared (Bogutskaya 1998a) after Tsimlyanskoye Reservoir construction. Recently, only freshwater populations have been recorded for the Donets River drainage (Dentshik 1994); 9) *Cottus gobio* was recorded for the Voronezh River in 1929 and 1942 only (Fedorov 1960) and for the small rivers of the Ryazan District (Babushkin 1990). This species occurs in small rivers and streams with clean, cold water and stony bottom. Its numbers have been quite variable in different years. This species was included in the Russian list of protected animals (Red Book of RSFSR 1983) and recently it is included in the Red book of Russia, but not all of investigators agree with this opinion; 10) *Sander volgensis* rarely occurs in lower parts of rivers. As a result of dams, pollution and over fishing, its numbers have declined sharply. In recent years, this species was not recorded for the Upper Don and now the only notable population occurs in Tsimlyanskoye Reservoir (Troitskii & Tsunikova 1988).

Besides protected taxa, three other rare species recently occur in some parts of the Don basin. They are *Alosa maeotica, Cobitis taenia* and *Leuciscus leuciscus*. The latter species is recorded for the Upper Don basin (Voronezh River and small rivers in the Ryazan District) where it is very rare (Fedorov 1960, Babushkin 1990). Five native anadromous or semi-anadromous species (*Acipenser gueldenstaedtii*, *A. stellatus, Alosa tanaica, A. immaculata, Vimba vimba*) belong to species with declining numbers (Reshetnikov 1998) since dam construction. Till the middle of 20-th century, *Chondrostoma variabilis* was quite common species, more often occurred in lower parts of rivers. Owing to human influences the numbers of this species have recently declined (Bogutskaya 1998b), with *Leuciscus cephalus* rare in some parts of the Khoper basin (Davydenko 1995). *Pelecus cultratus* is quite abundant in lower parts of rivers and in reservoirs, but its numbers have declined sharply in some parts of the basin as a result of human influences. Thus, it has disappeared from the Donets River drainage (Dentshik 1994). Numbers of *Silurus glanis* have also declined sharply (Troitskii & Tsunikova 1988). Thus, 23 species (33.8 % of native fauna) are now vulnerable or subject to human impacts. But at the same time, two native species (2.9 % of native fauna) recently become more or less prospering: *Abramis ballerus* in Tsimlyanskoye Reservoir and in upper parts of the basin (Fedorov 1970, Troitskii & Tsunikova 1988) and *Clupeonella cultriventris*. Following channel and reservoir construction, the latter species now occurs not only in the delta but also in some other parts of the basin. In Tsimlyanskoye Reservoir and some of those in the Manych River basin it is abundant (Poznyak 1987, Troitskii & Tsunikova 1988).

Dnieper River basin

The Dnieper list of ichthyofauna currently includes 93 species from 27 families (Table 1). Three species from the previous list (Berg 1949a) are now considered extinct or nearing

extinction: 1) *Acipenser nudiventris* randomly occurs in the Black Sea, but has not been recorded recently for the Dnieper River and neighbouring parts of the sea; 2) B e r g (1948, 1949a) recorded *Alosa maeotica* for the Dnieprovsky-Bugsky lagoon, but recently it does not occur there (P a v l o v 1980); 3) Marine *Platichthys flesus*, mentioned for the Dnieper fauna by B e r g (1949a), recently is absent there, as well as in Dnieprovsky-Bugsky lagoon (S m i r n o v 1986), possibly as a result of increasing salinity in the lagoon.

Nine species from the recent fauna are exotic. *Ctenopharyngodon idella* has been recorded in the Pripyat' River basin (at the Skripitsa River mouth). It entered there from the "Krasnaya Zor'ka" fish farm (U g l y a n e t s & K o r o l e t s 1991). By accidental introduction, *Pseudorasbora parva* has entered the Dnieper River basin and has been recorded for the Lower Dnieper (M o v c h a n & S m i r n o v 1981). *Hypophthalmichthys nobilis* and *H. molitrix* were introduced to Kakhovskoye Reservoir in 1967 and 1963, respectively (M o v c h a n & S m i r n o v 1983). *Mylopharyngodon piceus* also was introduced or entered the Dnieper River basin via fish farms (B o g u t s k a y a 1998b). *Ictalurus nebulosus* was introduced to water bodies of Belarus from 1948 and recently it occurs in lakes from the Pripyat' River basin, Brest District (Z h u k o v 1965).

Gambusia holbrooki was introduced to the Dniepropetrovsk District of the Ukraine in 1934 and has established in Soljenoye, Sketovoye, Zadorozhnoye Lakes as well as some lakes and a small pond in Dniepropetrovsk. It first appeared in the Kiev District in 1936, but occurs there only in summer and completely disappears after cold winters (M o v c h a n 1988). *Coregonus albula* has established in Dniepropetrovskoye Reservoir in 1951–52. This species, as well as some other whitefishes (*C. lavaretus* /Linnaeus, 1758/, *C. nasus* /Pallas, 1776/ and *C. peled* /Gmelin, 1789/) have been reared at the "Putsha Voditsa" fish farm. Information on other coregonids in the Dnieper River basin is lacking (P a v l o v 1980).

Lepomis gibbosus was introduced to European waters about 100 years ago and has been recorded in Dnieprovsky-Bugsky lagoon, in the lower part of the Dnieper channel and floodplain water bodies of the Lower Dnieper. It has also been found in the Middle Dnieper and some of its tributaries in which it can enter from the "Putsha Voditsa" fish farm (T s h e r b u k h a 1982).

There are 10 native species widely distributed throughout the basin: *Rutilus rutilus, Abramis brama, A. bjoerkna, Perca fluviatilis, Leuciscus leuciscus, L. idus, Scardinius erythrophthalmus, Leucaspius delineatus, Gobio gobio, Esox lucius*. Some less widely distributed and less abundant species are *Orthrias barbatulus, Sander lucioperca, Aspius aspius, Tinca tinca, Gymnocephalus cernuus*. The latter three species have recently become rare in some parts of the basin (Z h u k o v 1965, B e l y a e v et al. 1965, P a v l o v 1980, M o v c h a n & S m i r n o v 1981, 1983, T s h e r b u k h a 1982, 1989, L a v r o v 1983, S h e v t s o v a et al. 1986, M o v c h a n 1988, U g l y a n e t s & K o r o l e t s 1991).

The distribution of some other species is limited to certain parts of the basin. Thus, *Alosa tanaica* inhabits all parts of Dnieprovsky-Bugsky lagoon, but does not extend up into the channel. *A. immaculata* is quite abundant in the lagoon and the lower part of the channel but is absent in the middle and upper stretches (B u g a i 1965, P a v l o v 1980), whereas the freshwater form of *Salmo labrax* occurs in the Upper Dnieper. It inhabits some tributaries of the Berezina River only: Gaina River with its tributaries, Volma River and upper parts of Svicloch and Vyach rivers (Z h u k o v 1965). *Eupallasella perenurus* inhabits some lakes and small, stagnate or poorly-drained floodplain water bodies in the Upper and Middle Dnieper, whereas *Phoxinus phoxinus* occurs in springs and upper parts of

rivers and is recorded for the Pripyat', Desna, Teterev and Uzh river basins (Zhukov 1965, Movchan & Smirnov 1981, Lavrov 1983, Uglyanets & Korolets 1991). *Carassius carassius* is common and the most abundant in lakes, ponds, lower parts of rivers, in Dnieprovsky-Bugsky lagoon and in Kakhovskoye Reservoir (Zhukov 1965, Movchan & Smirnov 1983). *Lota lota* occurs mainly in tributaries and several lakes as well as reservoirs of the Upper and Middle Dnieper, but it is absent in lower part of the basin (Zhukov 1965, Shevtsova et al. 1986, Movchan 1988). *Sabanejewia aurata* was found in the Middle Dnieper only (Trubezh River, Movchan 1988). *Gymnocephalus baloni* has been recorded for Kremenchugskoye and Kanevskoye reservoirs, as well as for the Desna and Pripyat' Rivers (Tsherbukha 1989, Uglyanets & Korolets 1991).

Eight marine and euryhaline species occur in Dnieprovsky-Bugsky lagoon only: *Sprattus sprattus, Merlangius merlangus, Syngnathus typhle, Umbrina cirrosa, Solea nasuta, Psetta maeotica, Knipowitschia caucasica* and young specimens of *Pomatomus saltator*. *Liza saliens, L. aurata*, and *Mugil cephalus* occur in the lagoon, and few specimens have been recorded for the lower part of the channel. *Nerophis ophidion* enters the mouth of the Dnieper River and *Syngnathus abaster* occurs in the Lower Dnieper and in Kakhovskoye Reservoir. Previously, the latter species extended to the city of Kiev as well as the Ros' and Saksagan' rivers. *Percarina demidoffi* was previously distributed throughout the Dnieprovsky-Bugsky lagoon, but recently it is limited to the upper and middle parts and sometimes occurs in the lower part of the channel as far as Kherson. *Neogobius syrman* and *N. cephalargoides* also occur in the lagoon in which increasing salinity defines the species distribution up into the Dnieper River mouth. *Knipowitschia longecaudata* inhabits the lagoon and the river channel up to Berislav (Tsherbukha 1982, Smirnov 1986, Movchan 1988).

There are 10 protected species in the Dnieper River basin: 1) *Eudontomyzon mariae* inhabits the upper part of the channel and its tributaries only: Pripyat', Teterev, Sozh, Iput', Svisloch, Plissa, Serebryanka, Vilʹshanka, Desna and Psjel, mainly in Belarus territory (Zhukov 1965, Pavlov 1980, Shevtsova et al. 1986); 2) *Acipenser ruthenus* was previously abundant in the Dnieper River basin, mainly in Belarus. Some specimens were recorded as far as Smolensk, and some occurred even at Dorogobuzh (about 1400 km). In recent years, *A. ruthenus* has become very rare in most of the basin. It occurs in the Middle Dnieper and in upper part near Smolensk and Dorogobuzh, it is found randomly in the Pripyat', Sozh and Berezina rivers and only a few specimens have been reported for the Desna River (Zhukov 1965, Pavlov 1980); 3) Previously, anadromous *Huso huso* distribution extended up the Dnieper River as far as the city of Kiev and some tributaries (Sozh River), and a few specimens were recorded for Belarus and even for Dorogobuzh region. After construction of the Kakhovskoye Reservoir, *H. huso* breeding sites in the Dnieper River basin were lost, its numbers decreased sharply, and the population is maintained by artificial reproduction only. This species is now becoming very rare, practically extinct in most parts of the basin and randomly occurs in Dnieprovsky-Bugsky lagoon only (Zhukov 1965, Pavlov 1980); 4) Anadromous *Rutilus frisii* was previously found up the river as far as the city of Smolensk (more than 1200 km) and was recorded in a number of its tributaries in Belarus territory (Zhukov 1965). Recently, this form has lost all its breeding sites in upper parts of the basin, has completely disappeared there and randomly occurs in Dnieprovsky-Bugsky lagoon and in the Lower Dnieper (below Kakhovskaya dam) only (Pavlov 1980). Specimens of the freshwater form are occasionally recorded in the Desna River between Trubchevsk and Vygonichi in the Bryansk

District (Lavrov 1983); 5) *Barbus barbus* was previously one of the important commercial fishes in the Dnieper River. It occurred in the channel up to the city of Smolensk and in the largest upper tributaries in the Bryansk District. But it was the most abundant in the channel between Kremenchuk and Zaporozhje, at first on the rapids (Berg 1949b, Movchan & Smirnov 1981, Lavrov 1983). As a result of hydrological changes, barbels have become very rare and the species has practically disappeared from the Middle and Lower Dnieper (Red book of Ukraine 1994). Recently, it occurs in the Upper Dnieper of Belarus, where it is more or less abundant in the channel between Orsha and Dubrovno (Zhukov 1965). Probably it has disappeared from the Desna and Sozh rivers in the Bryansk District (Bogutskaya 1998a); 6) *Alburnoides bipunctatus* previously was a common species in the Lower Dnieper at the Dnieprovskie rapids but rare in the Upper Dnieper (Zhukov 1965, Movchan & Smirnov 1983, Shevtsova et al. 1986, Uglyanets & Korolets 1991). Recently, it has practically disappeared from the main channel and occurs only in the Upper Dnieper basin in the Smolensk (Dnieper), Bryansk (Snov) and Kursk (Seim) Districts of Russia (Meĭnikov et al. 1965, Lavrov 1983, Movchan & Smirnov 1983, Poltavchuk & Tsherbukha 1988); 7) The semi-anadromous form of *Chalcalburnus chalcoides* was never abundant in the Dnieper River basin (Berg 1949a), but recently its numbers have decreased sharply, and it occurs only rarely in Dnieprovsky-Bugsky lagoon and the lowest part of the channel (Movchan & Smirnov 1983); 8) Semi-anadromous *Sander marina* also was never a common or numerous species. Previously it was rare in the lower part of the Dnieper River basin and its breeding occurred in Dnieprovsky-Bugsky lagoon (Berg 1949a). Recently its numbers have decreased due to over fishing and habitat changes (Red book of Ukraine 1994), but as a result of hydrological changes in lagoon its breeding area increased somewhat (Tsherbukha 1982); 9) *Cottus gobio* occurs in upper parts of small rivers and springs of the Upper Dnieper only and is recorded for the Pripyat' River (Zhukov 1965, Uglyanets & Korolets 1991); 10) *Umbrina cirrosa* is a marine fish that occurs in low number, rarely in Dnieprovsky-Bugsky lagoon (Tsherbukha 1982). It has recently been included in the Ukraine list of rare species (Red book of Ukraine 1994).

Anguilla anguilla, Sander volgensis and *Romanogobio albipinnatus* also belong to rare species in the Dnieper River. The latter species is extinct in most areas and in recent years is recorded for the Sozh River only (Zhukov 1965, Belyaev 1965, Movchan & Smirnov 1981). *Anguilla anguilla* previously occurred in the Middle Dnieper and its tributaries (Oster River) and reached as far as the cities of Mogiljev and Pinsk in the Pripyat' (Pavlov 1980). This species is becoming very rare: small specimens sometimes are found in the Desna River drainage in the Bryansk District (Lavrov 1983), in the Pripyat' River and in Kakhovskoye Reservoir (Novitsky 2001). It is supposed to enter the Pripyat' River drainage from the West Bug River by Dniepr-Bug system of channels (Zhukov 1965). *Sander volgensis* previously occurred in the channel up to the city of Kremenchuk (Berg 1949a), but recently it has become rare and its small populations occur in Dnieprovskoye, Dneprodzerzhinskoye, and Kakhovskoye reservoirs only (Tsherbukha 1982, Novitsky 1999).

Ten other species are also in decline. They are *Acipenser gueldenstaedtii, A. stellatus, Abramis ballerus, Chondrostoma nasus, Leuciscus borysthenicus, Vimba vimba, Pelecus cultratus, Cyprinus carpio*, *Sander lucioperca,* and *Gymnocephalus cernuus* (Zhukov 1965, Bugai 1977, Pavlov 1980, Movchan & Smirnov 1981, 1983).

L. borysthenicus was previously recorded for the Middle and Lower Dnieper with its tributaries (Berg 1949b, Pavlov 1980). Recently it has disappeared in many parts of the area and is recorded for the Desna River drainage only (Poltavchuk & Tsherbukha 1988, Kotlyar 1991). Semi-anadromous *V. vimba* previously extended up to Dnieprovskye rapids and sometimes reached Belarus, recently, its breeding territory has been reduced by about 3.5 times and reproduction occurs in the Lower Dnieper only (Bugai 1977, Movchan & Smirnov 1983). The freshwater form is recorded for the Upper Dnieper above the City of Orsha and for some tributaries: Sluch, Ros', Desna, Sozh (Zhukov 1965, Movchan & Smirnov 1983, Lavrov 1983). Semi-anadromous *P. cultratus* lost its breeding sites in the lower part of the channel and recently it breeds in the lagoon only. Breeding sites of the semi-anadromous form of *C. carpio* also decreased (Bugai 1977). The numbers of freshwater *S. lucioperca* decreased due to pollution mainly (Zhukov 1965), and its semi-anadromous form has decreased due to a reduction in its breeding area in Dnieprovsky-Bugsky lagoon (Bugai 1977). *A. ballerus* was previously numerous throughout the basin, but recently its numbers have decreased and now it is more or less abundant in reservoirs only (Pavlov 1980). *C. nasus* also has become rare in the channel (Movchan & Smirnov 1981).

Five species are characterized by decreasing distribution. *Alosa immaculata* occurred previously in the Dnieper River basin in two forms. The anadromous form entered the river for breeding and reached Dnieprovskye rapids and occasionally Kiev (Berg 1948). Recently, this form was mainly replaced by the lagoon form, which breeds in both the lagoon and the Lower Dnieper: from the mouth to as far up as the city of Prognoisk (Bugai 1965, 1977). Anadromous *Salmo labrax* previously entered the Dnieper River and reached as far upstream as the city of Kremenchuk with some subsequently occurring in Dnieprovsky-Bugsky lagoon (Berg 1948). However, in the last 35–40 years, it has not been recorded in the Dnieper River basin (Pavlov 1980). But its freshwater form occurs in the Upper Dnieper. More or less stable populations of *Silurus glanis* occur in several reservoirs, but it has become a rare species in other water bodies (Zhukov 1965, Movchan 1988). As a result of various human impacts, *Alburnus alburnus* and *Leuciscus idus* have disappeared from the floodplain lakes of the Lower Dnieper (Kozlov 1979).

At the same time, 12 native species appear recently to have prospered. Euryhaline *Clupeonella cultriventris* previously occurred in the lagoon and in the lower part of the channel as far as the city of Nikopol' (Pavlov 1980). After reservoir construction, this species has become widely distributed, has formed freshwater populations there and recently occurs in the entire Lower and Middle Dnieper (Bulakhov 1965, Mel'nikov et al. 1965). *Atherina boyeri* previously occurred in Dnieprovsky-Bugsky lagoon and lower part of the channel up to the city of Berislav. Recently, it inhabits Kakhovskoye Reservoir and has become common and enough abundant there and seems to be expanding to other reservoirs (Movchan 1988). *Neogobius fluviatilis* previously occurred mainly in the lower part of the basin, but now it is quite common in the channel up to Kiev. It is also abundant in the region between Mogiljev and Dubrovna and is recorded for the Smolensk District (Pripyat', Sozh, Desna) (Zhukov 1965, Lavrov 1965, Smirnov 1986, Poltavchuk & Tsherbukha 1988, Uglyanets & Korolets 1991). *Benthophiloides brauneri* previously occurred in Dnieprovsky-Bugsky lagoon and lower part of the channel as far as Berislav and Kakhovka, but recently its range extends up to Kiev. *Benthophilus stellatus* has recently become common in the lagoon and has extended its range to Dnieprovskoye Reservoir, Kiev, the mouth of the Desna River, and possibly Kievskoye Reservoir.

Caspiosoma caspium is now distributed in the Lower Dnieper and its range extends to Kakhovka and even Kiev (S m i r n o v 1986, 1998). *Neogobius gymnotrachelus, N. kessleri,* and *Proterorhinus marmoratus* have recently extended their ranges upstream from the mouth to Kiev (S m i r n o v 1986, 1998). The latter species has become abundant in Dnieprodzerzhinskoye Reservoir (B e l y a e v et al. 1965). Recently, *Neogobius melanostomus* occurs in high numbers in the main channel as far up as the middle river stretch as well as its main tributaries (S m i r n o v 1986). *Mesogobius batrachocephalus* was previously unrecorded for the Dnieper River basin (B e r g 1949a), but recently occurs in Dnieprovsky-Bugsky lagoon and upstream as far as Kherson, Berislav and Kakhovskoye Reservoir (S m i r n o v 1986). As a result of various human impacts and irrigation, *Carassius auratus* has increased in the floodplain lakes of the Lower Dnieper (K o z l o v 1979).

D n i e s t e r R i v e r b a s i n

The Dniester list of ichthyofauna recently includes 91 species from 31 families (Table 1). Seven species from the former list (B e r g 1949a) are now considered extinct. Anadromous *Acipenser nudiventris* was previously rare and recently has been recorded in the Black Sea only (P a v l o v 1980, B o d a r e u 1993). *Huso huso* was also rare, occurring up the river as far as Mogilev-Podol'sky (about 330 km) as well as Kuchurgansky lagoon (E g e r m a n 1926, B e r g 1948, P a v l o v 1980). This species is now completely extinct from the Dniester River basin (C h e p u r n o v & K u b r a k 1965, B o d a r e u 1993) as are *Leuciscus borysthenicus, Abramis ballerus,* and *Sander volgensis,* which were previously (B e r g 1949b) recorded for the Lower Dniester. Other extinct species (C h e p u r n o v & K u b r a k 1965, P a v l o v 1980, B o d a r e u 1993, D o l g i i 1993a) are *Chalcalburnus chalcoides*, previously recorded as rare in Kuchurgansky lagoon (E g e r m a n 1926), and *Alosa maeotica,* which occurred in Dniestrovsky lagoon (B e r g 1949a).

The recent list of ichthyofauna also includes 13 exotic species. *Ctenopharyngodon idella, Hypophthalmichthys nobilis,* and *H. molitrix* were introduced to Kuchurgansky lagoon in 1964–1965. Recently, the two latter species are quite abundant there due to natural reproduction, as is the case in the lower part of the basin and in Dniestrovskoye Reservoir (C h e p u r n o v & K u b r a k 1965, B o d a r e u 1993), whereas *C. idella* is rare, as is introduced *Mylopharyngodon piceus, Ictiobus bubalus, I. cyprinellus,* and *Ictalurus punctatus* (B o d a r e u 1993, D o l g i i 1993a). The freshwater form of *Oncorhynchus mykiss* was initially introduced to the upper part of the Stryi River in 1938 and then in some other left bank tributaries of the Upper Dniester and in 1951 in lower part of the basin (P a v l o v 1980). *Polyodon spathula* was introduced to Dubossarskoye Reservoir, whereas *Acipenser baerii* occurs in some reservoirs of the lower part of the basin (D o l g i i 1993a,b). *Pseudorasbora parva* was accidentally introduced to the Dniester River basin (N a s e k a 1998), whereas *Lepomis gibbosus* and *Perccottus glenii* expanded into the basin from neighbouring river systems. The former species has been found in Kuchurganskoye Reservoir (C h e p u r n o v & K u b r a k 1965), whereas the latter was recorded in the Upper Dniester (K o r t e 1995).

Of 78 native fishes, 10 species are widely distributed throughout the basin: *Rutilus rutilus, Abramis brama, A. bjoerkna, Scardinius erythrophthalmus, Aspius aspius, Alburnus alburnus, Carassius auratus, Perca fluviatilis, Sander lucioperca,* and *Neogobius fluviatilis* (B o d a r e u 1993). Some less widely distributed species are *Leuciscus cephalus, Leucaspius delineatus, Barbus barbus, Abramis sapa, Vimba vimba, Cyprinus carpio*, *Esox*

lucius, Gymnocephalus cernuus, and *Neogobius melanostomus*. Such species as *L. delineatus, A. sapa, C. carpio,* and *E. lucius* are most common in floodplain water bodies and in tributaries, whereas *B. barbus, G. cernuus,* and *L. cephalus* occur in large numbers in the upper part of the basin (Shnarevich 1965, Bodareu & Karlov 1984, Bodareu 1993).

The distribution of some other species is limited to certain parts of the basin. As a result of dams, anadromous species (acipenserids, clupeids) have now restricted to the lower part of the channel, below the Dubossarskaya dam. The freshwater form of *Salmo labrax* occurs in the Upper Dniester only and is quite abundant in upper parts of its tributaries (Lomnitsa, Stryi). *Thymallus thymallus* and *Alburnoides bipunctatus* are abundant and common in mountain streams of the Upper Dniester and occur in low numbers in the middle part of the basin. *Phoxinus phoxinus, Cottus gobio, C. poecilopus*, and *Lota lota* occur in mountain streams, whereas *Orthrias barbatulus* inhabits warm and calm waters of the Upper Dniester. *Barbus carpathicus* apparently occurs in the Upper Dniester (Poland) only. *Chondrostoma nasus* is common in the upper and middle parts of the channel and its tributaries but is rare in Dubossarskoye Reservoir and is probably extinct in Kuchurganskoye Reservoir. *Proterorhinus marmoratus* and *Neogobius gymnotrachelus* occur mainly in the Lower Dniester and its tributaries and in Dubossarskoye Reservoir. Endemic *Gymnocephalus acerinus* inhabits upper parts of the basin and its right bank tributaries but rarely occurs in the left bank tributaries. Its abundance in the middle part of the basin has notably decreased after creation of Dubossarskoye Reservoir. *Anguilla anguilla* randomly occurs in the lower part of the basin only, namely in Dniestrovsky lagoon and Kuchurganskoye Reservoir (Opalatenko 1965, 1966, Chepurnov & Kubrak 1965, Shnarevich 1965, Pavlov 1980, Tsherbukha 1982, Smirnov 1986, Bodareu 1993, Dolgii 1993a,b, Kotlík et al. 2002).

Nineteen marine or euryhaline species occur in the Lower Dniester only. Marine *Engraulis encrasicolus, Atherina boyeri, Percarina demidoffi, Diplodus annularis, Mugil cephalus* (adult and young specimens), *Liza saliens, L. aurata, Belone belone, Pomatomus saltator,* and *Psetta maeotica* have been recorded for Dniestrovsky lagoon, as well as *Mesogobius batrachocephalus, Gobius ophiocephalus*, and *Neogobius syrman.* Euryhaline *Clupeonella cultriventris* occurs in the lagoon, lower part of the channel and in Kuchurganskoye Reservoir. *Nerophis ophidion, Syngnathus typhle*, and *S. abaster* occur in the lagoon and lower part of the channel, whereas *Benthophilus stellatus* and *Platichthys flesus* are distributed up to the city of Bendery (Chepurnov & Kubrak 1965, Pavlov 1980, Tsherbukha, 1982, Smirnov 1986, Movchan 1988, Bodareu 1993, Dolgii 1993a,b).

There are 8 protected species in the Dniester River basin: 1) *Eudontomyzon mariae* has been recorded for the upper and middle parts of the main channel and some of the right bank tributaries (Berg 1948, Pavlov 1980, Red book of Ukraine 1994). After the 1960s, its numbers decreased sharply due to habitat destruction; 2) *Acipenser ruthenus* previously occurred throughout the basin, but mainly between the city of Mogilev-Podol'sky and the area recently occupied by Dubossarskoye Reservoir (Pavlov 1980). In recent years, it has become very rare or extinct in most parts of the basin but is more or less abundant in the upper (above Dubossarskoye Reservoir) or lowest part (between Chobruchi and Mayaki villages) of the basin (Chepurnov & Kubrak 1965, Pavlov 1980, Bodareu 1993, Dolgii 1993a, Red book of Ukraine 1994); 3) The anadromous form of *Rutilus frisii* previously had a range as far as the upper parts of the Dniester River and its tributaries.

Recently, most breeding sites have been lost and its numbers decreased sharply, so the species is very rare in most parts of the basin below the city of Kamenets-Podol'sky, whereas its freshwater populations occur in the Upper Dniester basin only (M o v c h a n & S m i r n o v 1981, B o d a r e u 1993); 4) *Umbra krameri* was never numerous in the Dniester river basin, its numbers have decreased sharply during the last 50 years, mainly as a result of habitat destruction. It now occurs in the lower parts of the basin only, including Dniestrovsky lagoon and Kuchurganskoye Reservoir (D o l g i i 1993a,b); 5) *Thymallus thymallus* inhabits the Upper Dniester and its tributaries: Lomnitsa, Stryi and Opora. In most of the Ukraine, this species is not numerous and further habitat destruction may result in subsequent population decline; 6) *Sander marina* inhabits salted lagoons and also has been recorded for Dniestrovsky lagoon (Red book of Ukraine 1994), but habitat destruction and over fishing have seen its numbers decline; 7) Previously, *Zingel zingel* was sufficiently abundant in upper and middle stretches of the Dniester River basin, but its numbers declined recently (T s h e r b u k h a 1982); 8) *Z. streber* is present but rare in the upper part of the Dniester River basin as well as Dniestrovskoye Reservoir (B o d a r e u 1993).

Besides the protected species, *Anguilla anguilla* also belongs to rare fishes and four other native species are decreasing in number: anadromous and semi-anadromous *Acipenser gueldenstaedtii, A. stellatus, Pelecus cultratus,* and *Vimba vimba* have decreased recently (Table 1) due to loss of breeding sites. Two other native species are characterized by decreased area. Anadromous *Alosa immaculata* was previously abundant and commercially exploited. Its range extended up to the city of Yampol (about 260 km), but recently its range did not even reach Tiraspol (about 90 km), and it is rare in Kuchurganskoye Reservoir (P a v l o v 1980, B o d a r e u 1993). *Barbus barbus*, which was previously common throughout the basin, is recently limited in distribution mainly to the upper part of the basin (B o d a r e u & K a r l o v 1984). Thus, 22 species are recently vulnerable or becoming victims of human impacts. At the same time, only one species, *Carassius auratus*, recently becomes more or less abundant. Previously, this species was relatively rare, but now it is one of the dominate species in the middle and low parts of the basin (C h e p u r n o v & K u b r a k 1965, B o d a r e u 1993).

P e r s p e c t i v e s

Thus, considerable, even dramatic changes have taken place in ichthyofauna of the main rivers of the northern coast of the Black Sea following dam construction. Firstly, anadromous and semi-anadromous fishes experienced complete or substantial loss of their breeding sites in the middle and upper parts of the basins, with anadromous sturgeons becoming rare or extinct. The same was experienced by anadromous and semi-anadromous clupeonids, by some cyprinids and by *Salmo labrax*. In some cases, anadromous forms have been replaced by conspecific nonanadromous populations. For example, *Alosa immaculata* previously occurred in the Dnieper River basin in two forms. The anadromous form previously entered the river for breeding and reached Dnieprovskye rapids or sometimes the city of Kiev (B e r g 1948), but this form was replaced by lagoon populations, which breed in lagoon and in the lower Dnieper (from the mouth to the city of Prognoisk, B u g a i 1965, 1977). *Salmo labrax* recently is represented in its main breeding rivers of the northern coast of the Black Sea by the freshwater form only. This form occurs in some tributaries of the upper parts of these rivers. Such species as *Chalcalburnus chalcoides* and *Vimba vimba* formed small local freshwater populations in several reservoirs. And even semi-anadromous forms of several

Table 1. Fishes recorded for principal rivers of the northern coast of the Black Sea and their recent status: + - more or less abundant and common, R - rare, D - species with decreased number or area, P – protected, E - extinct, I – introduced, Im - immigrants, ? – unknown status.

Species	Kuban	Don	Dnieper	Dniester
Petromyzontidae				
Eudontomyzon mariae (Berg, 1931)	P	P	P	P
Acipenseridae				
Acipenser baerii Brandt, 1869	-	-	-	I
Acipenser gueldenstaedtii Brandt, 1833	D	D	D	D
Acipenser nudiventris Lovetsky, 1828	P	P	E	E
Acipenser ruthenus Linnaeus, 1758	R	P	P	P
Acipenser stellatus Pallas, 1771	D	D	D	D
Huso huso (Linnaeus, 1758)	P	P	P	E
Polyodontidae				
Polyodon spathula (Walbaum, 1792)	I	-	-	I
Anguillidae				
Anguilla anguilla (Linnaeus, 1758)	R	+	R	R
Clupeidae				
Alosa immaculata Bennet, 1835	R	D	D	D
Alosa maeotica (Grimm, 1901)	R	R	E	E
Alosa tanaica (Grimm, 1901)	D	D	+	+
Clupeonella cultriventris (Nordmann, 1840)	+	+	+	+
Sprattus sprattus (Linnaeus, 1758)	R	-	+	-
Engraulidae				
Engraulis encrasicolus (Linnaeus, 1758)	+	-	-	R
Cyprinidae				
Abramis ballerus (Linnaeus, 1758)	-	+	D	E
Abramis bjoerkna (Linnaeus, 1758)	+	+	+	+
Abramis brama (Linnaeus, 1758)	+	+	+	+
Abramis sapa (Pallas, 1814)	+	+	+	+
Alburnoides bipunctatus (Bloch, 1782)	+	P	P	+
Alburnus alburnus (Linnaeus, 1758)	+	+	D	+
Aspius aspius (Linnaeus, 1758)	+	+	+	+
Barbus barbus (Linnaeus, 1758)	-	-	P	D
Barbus brachycephalus Kessler, 1872	?	-	-	-
Barbus carpathicus Kotlík, Tsigenopoulos, Ráb et Berrebi, 2002	-	-	-	+
Barbus tauricus Kessler, 1877	+	-	-	-
Carassius auratus (Linnaeus, 1758)	+	+	+	+
Carassius carassius (Linnaeus, 1758)	+	+	+	+
Chalcalburnus chalcoides (Güldenstädt, 1772)	P	P	P	E
Chondrostoma colchicum Derjugin (ex Kessler), 1899	+	-	-	-
Chondrostoma nasus (Linnaeus, 1758)	-	?	D	+
Chondrostoma variabilis Jakowlew, 1870	-	D	-	-
Ctenopharyngodon idella (Valenciennes, 1844)	I	I	I	I
Cyprinus carpio Linnaeus, 1758	+	+	D	+
Eupallasella perenurus (Pallas, 1814)	-	-	+	-
Gobio gobio (Linnaeus, 1758)	+	+	+	+
Gobio kesslerii Dybowski, 1862	-	-	-	+
Hypophthalmichthys molitrix (Valenciennes, 1844)	I	I	I	I
Hypophthalmichthys nobilis (Richardson, 1846)	I	I	I	I
Leucaspius delineatus (Heckel, 1843)	+	+	+	+
Leuciscus aphipsi Aleksandrov, 1927	+	-	-	-
Leuciscus borysthenicus (Kessler, 1859)	+	-	D	E
Leuciscus cephalus (Linnaeus, 1758)	+	D	+	+
Leuciscus danilewskii (Kessler, 1877)	-	P	-	-
Leuciscus idus (Linnaeus, 1758)	+	+	D	+
Leuciscus leuciscus (Linnaeus, 1758)	-	R	+	+
Mylopharyngodon piceus (Richardson, 1846)	I	I	I	I
Pelecus cultratus (Linnaeus, 1758)	+	D	D	D
Phoxinus phoxinus (Linnaeus, 1758)	+	+	+	+
Pseudorasbora parva (Temminck et Schlegel, 1846)	I	I	I	I

Table 1 – continued

Rhodeus sericeus (Pallas, 1776)	+	+	+	+
Romanogobio albipinnatus (Lukasch, 1933)	-	+	R	-
Romanogobio ciscaucasicus (Berg, 1932)	+	-	-	-
Romanogobio pentatrichus Naseka et Bogutskaya, 1998	+	-	-	-
Rutilus frisii (Nordmann, 1840)	I	P	P	P
Rutilus rutilus (Linnaeus, 1758)	+	+	+	+
Scardinius erythrophthalmus (Linnaeus, 1758)	+	+	+	+
Tinca tinca (Linnaeus, 1758)	+	+	+	+
Vimba vimba (Linnaeus, 1758)	D	D	D	D
Cobitidae				
Cobitis melanoleuca Nichols, 1925	+	+	-	-
Cobitis rossomeridionalis Vasiľeva et Vasiľev, 1998	+	+	+	+
Cobitis taenia Linnaeus, 1758	-	R	+	-
Misgurnus fossilis (Linnaeus, 1758)	R	+	+	+
Sabanejewia aurata (Filippi, 1865)	+	+	+	+
Sabanejewia caucasica (Berg, 1906)	?	-	-	-
Balitoridae				
Orthrias barbatulus (Linnaeus, 1758)	+	+	+	+
Orthrias merga (Krynicki, 1840)	?	-	-	-
Catostomidae				
Ictiobus bubalus (Rafinesque, 1819)	I	-	-	I
Ictiobus cyprinellus (Valenciennes, 1844)	I	-	-	I
Ictiobus niger (Rafinesque, 1820)	I	-	-	-
Siluridae				
Silurus glanis Linnaeus, 1758	+	D	D	+
Ictaluridae				
Ictalurus nebulosus (LeSueur, 1819)	-	-	I	-
Ictalurus punctatus (Rafinesque, 1818)	I	I	-	I
Esocidae				
Esox lucius Linnaeus, 1758	+	+	+	+
Umbridae				
Umbra krameri Walbaum, 1792	-	-	-	P
Coregonidae				
Coregonus albula (Linnaeus, 1758)	-	-	I	-
Thymallidae				
Thymallus thymallus (Linnaeus, 1758)	-	-	-	P
Salmonidae				
Oncorhynchus mykiss (Walbaum, 1792)	-	-	?	I
Salmo labrax Pallas, 1814	P	E	D	+
Lotidae				
Lota lota (Linnaeus, 1758)	?	+	+	+
Gadidae				
Merlangius merlangus (Linnaeus, 1758)	-	-	R	-
Atherinidae				
Atherina boyeri Risso, 1826	+	+	+	R
Poeciliidae				
Gambusia holbrooki (Girard, 1859)	I	-	I	-
Belonidae				
Belone belone (Linnaeus, 1761)	R	-	-	R
Adrianichthyidae				
Oryzias latipes (Temminck et Schlegel, 1846)	I	-	-	-
Gasterosteidae				
Gasterosteus aculeatus Linnaeus, 1758	+	+	+	+
Pungitius platygaster (Kessler, 1859)	+	+	+	+
Syngnathidae				
Nerophis ophidion (Linnaeus, 1758)	+	-	+	+
Syngnathus abaster Risso, 1826	+	+	+	+
Syngnathus typhle Linnaeus, 1758	R	-	+	+
Moronidae				
Morone saxatilis (Walbaum, 1792)	I	I	-	-
Cichlidae				
Oreochromis mossambicus (Peters, 1852)	I	-	-	-

Table 1 – continued

Cottidae				
Cottus gobio Linnaeus, 1758	-	P	P	+
Cottus poecilopus Heckel, 1837	-	-	-	+
Centrarchidae				
Lepomis gibbosus (Linnaeus, 1758)	-	-	Im	Im
Percidae				
Gymnocephalus acerinus (Güldenstädt, 1774)	R	+	+	+
Gymnocephalus baloni Holčik et Hensel, 1974	-	-	+	-
Gymnocephalus cernuus (Linnaeus, 1758)	+	+	D	+
Perca fluviatilis Linnaeus, 1758	+	+	+	+
Percarina demidoffi Nordmann, 1840	R	R	+	+
Sander lucioperca (Linnaeus, 1758)	+	+	D	+
Sander marina (Cuvier, 1828)	-	-	P	P
Sander volgensis (Gmelin, 1788)	+	P	R	E
Zingel streber (Siebold, 1863)	-	-	-	P
Zingel zingel (Linnaeus, 1766)	-	-	-	P
Pomatomidae				
Pomatomus saltator (Linnaeus, 1766)	-	-	R	R
Sparidae				
Diplodus annularis (Linnaeus, 1758)	-	-	-	R
Mugilidae				
Liza aurata (Risso, 1810)	+	-	+	+
Liza haematocheila (Temminck et Schlegel, 1845)	I	-	-	-
Liza saliens (Risso, 1810)	+	-	+	+
Mugil cephalus Linnaeus, 1758	+	-	+	+
Odontobutidae				
Perccottus glenii Dybowski, 1877	-	Im	-	Im
Gobiidae				
Benthophiloides brauneri Beling et Iljin, 1927	-	-	+	-
Benthophilus magistri Iljin, 1927	R	+	-	-
Benthophilus stellatus (Sauvage, 1874)	+	+	+	+
Caspiosoma caspium (Kessler, 1877)	R	+	+	-
Gobius ophiocephalus Pallas, 1814	R	-	-	+
Knipowitschia caucasica (Berg, 1916)	+	-	+	-
Knipowitschia longecaudata (Kessler, 1877)	+	+	+	-
Mesogobius batrachocephalus (Pallas, 1814)	-	R	+	+
Neogobius cephalargoides Pinchuk, 1977	-	-	+	-
Neogobius constructor (Nordmann, 1840)	+	?	-	-
Neogobius fluviatilis (Pallas, 1814)	+	+	+	+
Neogobius gorlap Iljin in Berg, 1949	-	Im	-	-
Neogobius gymnotrachelus (Kessler, 1857)	R	R	+	+
Neogobius kessleri (Günther, 1861)	-	-	+	+
Neogobius melanostomus (Pallas, 1814)	+	R	+	+
Neogobius syrman (Nordmann, 1840)	+	R	+	+
Pomatoschistus marmoratus (Risso, 1810)	+	-	-	-
Proterorhinus marmoratus (Pallas, 1814)	+	+	+	+
Sciaenidae				
Umbrina cirrosa (Linnaeus, 1758)	+	-	P	-
Scophthalmidae				
Psetta maeotica (Pallas, 1814)	-	-	+	+
Pleuronectidae				
Platichthys flesus (Linnaeus, 1758)	+	I	E	+
Soleidae				
Solea nasuta (Pallas, 1814)	-	-	+	-

Data included: Berg 1949a, Fedorov 1960, 1970, Zhukov 1965, Belyaev 1965, Chepurnov & Kubrak 1965, Pavlov 1980, Movchan & Smirnov 1981, 1983, Tsherbukha 1982, 1989, Lavrov 1983, Smirnov 1986, Poznyak 1987, 1998, Troitskii & Tsunikova 1988, Movchan 1988, Poltavchuk & Tsherbukha 1988, Babushkin 1990, Uglyanets & Korolets 1991, Klyavin 1992, Shebzukhova 1992, Bodareu 1993, Dolgii 1993a,b, Red book of Ukraine 1994, Davydenko, 1995, Emtyľ 1997, Reshetnikov 1998, Vasiľeva 1998, Vasiľeva & Vasiľev 1998, Moskul 1994, 1998, Naseka 1998, Nadtoka & Abramenko 1998, Plotnikov 2000, Kotlík et al. 2002, my unpublished data.

common and numerous species, such as *Rutilus rutilus* and *Abramis brama,* partially lost their breeding sites in the Dnieper River basin (B u g a i 1977).

Several freshwater species (*Eudontomyzon mariae, Acipenser ruthenus, Alburnoides bipunctatus*, and *Sander volgensis*) became rare and recently extinct in some rivers or some parts of their basins. And thus the number of recently protected fish species varies from 5 in the Kuban River basin to 10 in the Dnieper and Don River basins. And the total number of native species that are extinct, protected or became rare species, and species with decreased numbers or area, recently reached at least 19.0 % of native species in the Kuban River basin to 35.6 % in the Dnieper River basin. And these indices may be under-estimated because there is insufficient information on all species and on their current status throughout the basin. For instance, according to C h i k h a c h e v (1998), there are 11 rare, 10 vulnerable or decreasing, 3 dangerous, one extinct and 11 species with uncertain status in the delta of the Don River.

Secondly, the proportions of rheophilous and limnophilous fishes has changed in every basin, with rheophilous species restricted to the upper parts of rivers and their tributaries and limnophilous fishes becoming more common and abundant in many parts of the river systems. The most common of limnophilous fishes distributed throughout the basins are *Rutilus rutilus, Perca fluviatilis, Abramis brama, A. bjoerkna, Scardinius erythrophthalmus,* and *Alburnus alburnus*. The numbers and range of *Carrassius auratus* have increased substantially in the Dnieper and Dniester River basins in recent years. And now this fish even becomes one of dominant species in the middle and low parts of the Dniester River. In recent years, its numbers also begin to grow in the Don River basin.

Thirdly, the new hydrological regime has caused the invasion of euryhaline and even marine species into most of the river basins, extending their upstream distribution. Thus, *Clupeonella cultriventris*, which previously occurred in lagoons and deltas, is now widely distributed in some reservoirs of the Dnieper and Don River basins and has formed freshwater populations there. Nine species of gobies and *Atherina boyeri* are penetrating upstream into the Dnieper River basin.

Besides changes in specific composition of native ichthyofana and relations in numbers and distribution of species, the character of the rivers has also been modified by the introduction and establishment of exotic species, which now form from 10 % (in the Dnieper River basin) to 17 % (in the Kuban River basin) of the fish assemblages. The most common alien species are *Ctenopharyngodon idella, Hypophthalmichthys nobilis*, and *H. molitrix,* which were introduced for commercial purposes. And now *H. nobilis* and *H. molitrix* belong to the main commercial fishes in the Middle and Low Dniester River, at first in Dubossarskoye and Kuchurganskoye reservoirs (D o l g i i 1993a). A similar situation has also been observed for *C. idella* and *H. molitrix* in the Kuban River basin. Unfortunately, only the commercial effects of these introductions are currently taken into consideration. And there have been no studies to examine the ecological, genetic and parasitic impacts on native species.

In conclusion, quite new fish assemblages now exist in the main rivers of the northern coast of the Black Sea. And as a result of modified hydrology, there are no means of returning to the past. Further, changes to these river systems by pollution, eutrophication, thermal and hydrological modifications will continue to modify the ichthyofauna. Thus, objective and practical consideration had to be kept in mind in any attempts to restore and conserve aquatic habitats and fish species.

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