

Unwanted intruders, or welcome guests?

Deliberate movements of fish species by people from one part of the world to another also concerns the Czech Republic. If we want to be a little more familiar with the processes that accompany the entry of non-native fish species into our biocenosis and aquaculture, it is worth revisiting some technical terms.

Introduction means that people have brought a species into a location where they originally did not occur in order for them to live permanently in the wild or to be bred. After introduction, **acclimatization** may follow, during which they adapt to their new conditions but are not yet able to reproduce naturally to create a stable population. If the introduced species later becomes capable of natural reproduction and forms an integral part of the biocenosis, we talk about **naturalization**.

Non-native species to the Czech Republic are those that did not previously exist in a particular catchment, although they were already in another part of our country or the Central European region. Examples are the **common nase** (*Chondrostoma nasus*) and the **huchen** (*Hucho hucho*), both of which come from the Danube River basin near Moravia, but have only recently come to the Vltava River basin, thanks to restocking.

An **exotic species** is one which originally did not live in Central Europe, whose current occurrence in the region is the result of their introduction from another geographic area. Exotic species include **rainbow trout** (*Oncorhynchus mykiss*) from North America, and **grass carp** (*Ctenopharyngodon idella*) from the Far East.



A rainbow trout jumps above the water. This species is native to North America. In our open waters, it is maintained only by the planting of a young population.
Photo Krasowit

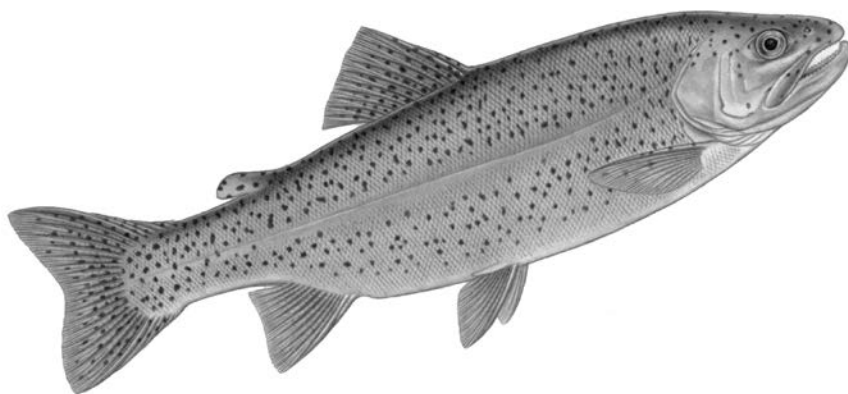
Introduced species that threaten biological diversity by their outbreak and spread are known as **invasive**. **Naturalized invasive species** can reproduce naturally and create large stable populations. **Goldfish** (*Carassius auratus*) are an example. **Conditionally invasive species** that are in the phase of acclimatization, and which may become harmful if too many individuals are bred in a particular area, include the grass carp.

From the 18th century to the present day, over 50 alien fish species have been brought to our country. The reasons for these imports are various: to increase fish production with the use of a free food supply in ponds and reservoirs;

to intentionally influence aquatic ecosystems; to broaden the spectrum of species for sport fishing; or for aquaculture experiments. About half of these alien species were imported to the Czech Republic in the second half of the 20th century. They were introduced mostly from North America, but also from Asia, Africa, and parts of Europe. In addition, some fish species came to our territory naturally (possibly with some „help“ from people) from the surrounding regions. Let's take a closer look at some of these alien fish species in our territory.

Intentional introductions

To increase fish production or to attract fishermen, rainbow trout, brook trout (*Salvelinus fontinalis*), brown bullhead (*Ameiurus nebulosus*), largemouth bass (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*) were imported from North America at the end of the 19th century. Of these species, only the first two play an important role today. As for rainbow trout, the initial intention was to extend the original species composition of our trout waters by adding another trout that would reproduce naturally. This attempt failed. Rainbow trout are maintained in open waters only by stocking fry. However, they can be intensively bred in aquacultures. The continuous presence of brook trout also is possible only



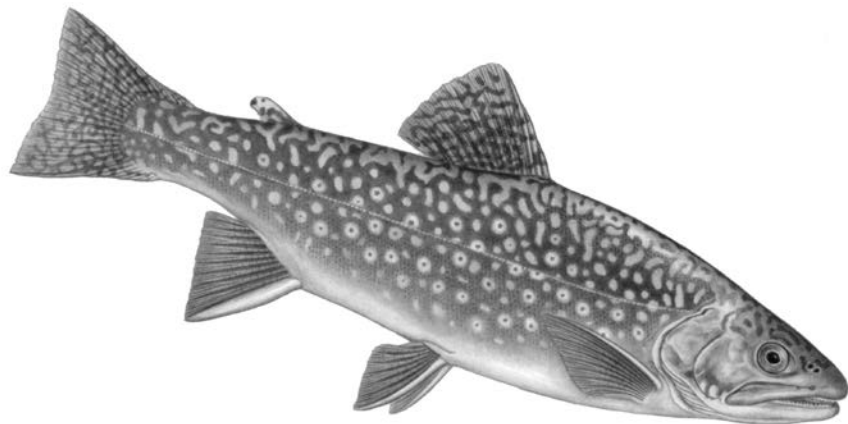
Rainbow trout

thanks to regular stocking of fry. Brown bullheads were imported for breeding in ponds. Fishermen gradually introduced them into reservoirs, ponds, and rivers almost throughout our country. Breeds regressed, however, and brown bullheads now occur only occasionally in the Czech Republic. Largemouth bass completely disappeared from our territory, and smallmouth bass occur only rarely in the open waters of South Bohemia.

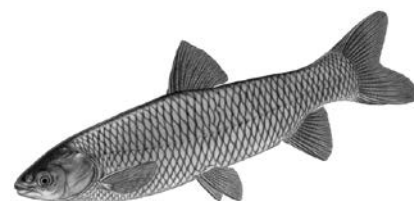
in some reservoirs. Hybrids of maraena and peled are characterized by faster growth, so they are bred deliberately; but, due to the difficulty of distinguishing between hybrids and parental species, the uncontrolled crossing of native species and hybrids occurs. Currently, these two species in genetically pure populations are virtually absent in our country, and their existence here depends on artificial spawning and stocking of fry.

that they no longer occur in our country. Similarly, imports of Baikal black graylings (*Thymallus baicalensis*) and lake trout (*Salvelinus namaycush*) from North America ended in failure.

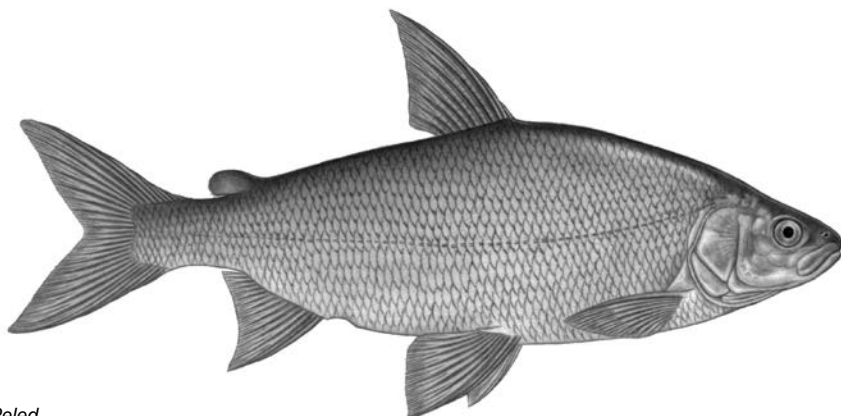
In the mid-20th century, three new species of carp were introduced here from the former Soviet Union: grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*), and bighead carp (*H. nobilis*). The first two of these are native to the Amur basin; the third comes from central and southern China. Grass carp are put into waters rich in vegetation, where they can significantly limit ingrown embankments. When introducing them, it is necessary to take into account the risk of a substantial loss of aquatic and marsh plants, which form an essential basis for the spawning of phytophilous



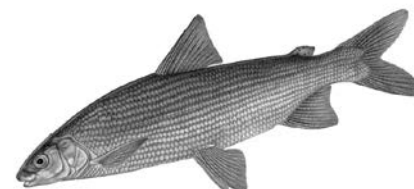
Brook trout



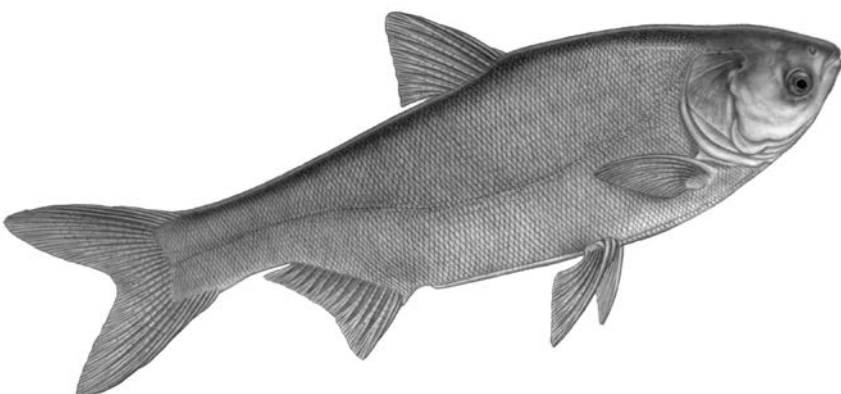
Grass carp



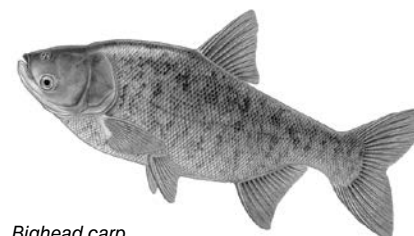
Peled



Maraena whitefish



Silver carp



Bighead carp



Brown bullhead

With the same intention at the end of 19th century, two kinds of whitefish were imported: from Polish lakes came maraena whitefish (*Coregonus maraena*); and from the northeast of the former Soviet Union, the peled (*Coregonus peled*). They are useful in larger ponds with cleaner water, and

As for the past experimental introduction of vendace (*Coregonus albula*), fera (*C. fera*), Arctic cisco (*C. autumnalis*), blue whitefish (*C. wartmanni*), zubatak (*Salmo dentex*), Arctic charr (*Salvelinus alpinus*), and some other species of fish, there are few reports. We only know

fish (which spawn on plant substrate). Grass carp may also in some locations completely eradicate some protected plant species. Their faeces also increase the eutrophication of water. Silver carp were imported mainly in order to dampen excessive development of phytoplankton in eutrophic waters; but the effect is not as pronounced as expected, since the cause of eutrophication (excessive intake of nutrients into rivers and reservoirs) persists. These three carp do not reproduce naturally here. Their presence

is maintained by artificial spawning and stocking of fry. Because they can grow to be large and heavy, they are prized catches.

In the 1950s, northern snakeheads (*Channa argus*), which are native to the Far East, were experimentally introduced from the former Soviet Union. Several dozen individuals were planted in pools in the lowlands of the Labe River; but a flood washed them away, and we have no news of their fate.

The introduction of the three-spined stickleback (*Gasterosteus aculeatus*) in some of our waters can be considered as intentional. The first reports of their occurrence in our nature came during the First World War, particularly from the Vltava, Labe, and Orlice rivers, and from some Moravian sites. Most of the findings seemed incidental or temporary. Nowadays, we encounter the three-spined stickleback only occasionally, and it does not have any significant impact on the ecosystem and biodiversity. The area of its original occurrence covers almost the whole of Eurasia and much of North America. In the Czech Republic, it seems to have been „given its freedom“ by aquarists in whose tanks it appeared as the sole rare inmate.

The supply of other non-native fish into our country is encouraged by owners and operators of private fishing grounds. Over the last decades, they imported many exotic species which, in terms of our open waters, have failed, and so now are used commercially for decorative pur-



Three-spined stickleback

poses. These include especially American paddlefish (*Polyodon spathula*) and several sturgeon species such as Siberian sturgeon (*Acipenser baerii*). The Nile tilapia (*Oreochromis niloticus*) was imported in 1985 from near Khartoum in the Sudan. It is a species which can breed in warm water; and, as a tasty fish, it appears also in our food markets. African sharptooth catfish (*Clarias gariepinus*), introduced in 1986, are also kept as a culinary speciality in warm-water aquaculture. They are usually smoked when sold as food.

For fishing, four species of the cichlid genus *Oreochromis* were also imported. These, however, turned out not to be useful for production breeding.

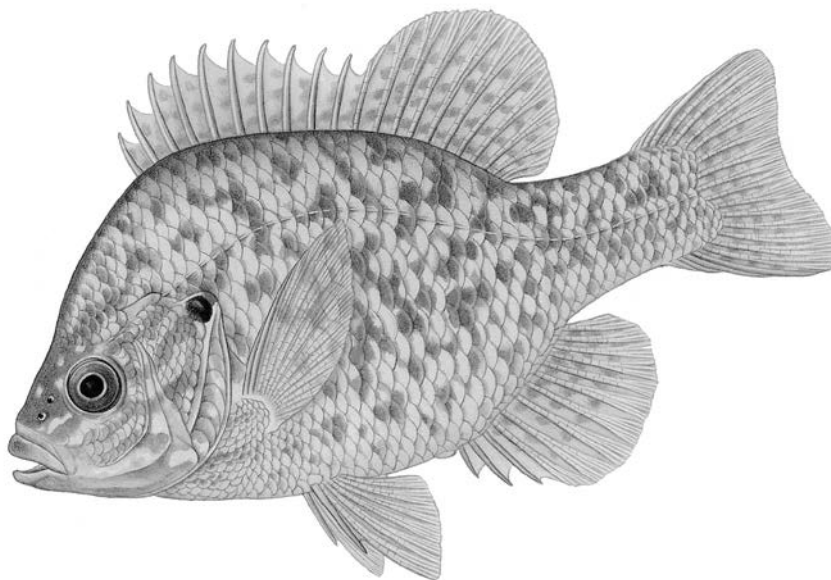
In 1985, two species from the *Ictiobus* genus were imported from North America: bigmouth buffalo (*Ictiobus cyprinellus*) and black buffalo (*I. niger*). They acclimated successfully, but have been maintained so far only in experimental farms. In the same year, channel catfish (*Ictalurus punctatus*) were imported from the United States. They appear in artificial breeds, rarely being introduced in commercial sports districts for diversification.

The use of Asian black carp (*Mylopharyngodon piceus*) is being evaluated. They could suppress the occurrence of certain species of molluscs which are intermediate hosts of some parasites; but their introduction could also threaten protected species of shellfish in some areas.

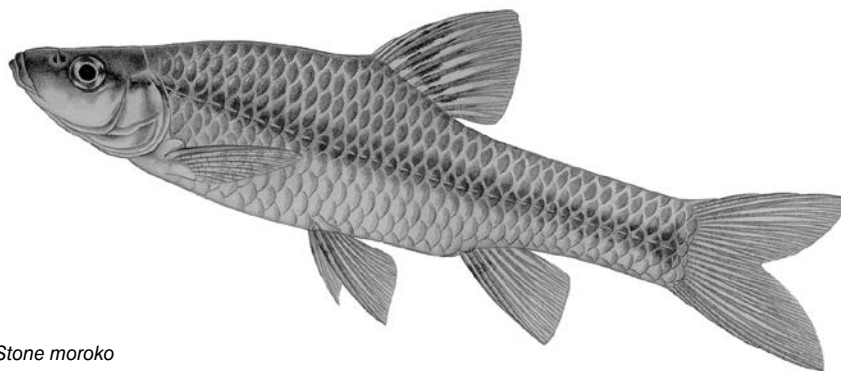
Unintentional introductions

Unintentional introductions of fish occur mainly during the importation of fingerlings, into which the fry of an alien species have accidentally found their way. Pumpkinseed (*Lepomis gibbo-*

species, with high ecological plasticity applied, produced a very large population. It mainly contributes to the retreat of the original species of sunbleak (*Leucaspis delineatus*), with which it competes, and to which it transmits a disease which prevents reproduction and causes a higher mortality rate. With transfers of young populations of other fish species, stone moroko spread to most ponds throughout the country. Natural populations of this species in flowing waters are usually few in number; their abundant presence is mostly connected with ponds. It is worth mentioning the facultative (occasional) parasitism of



Pumpkinseed



Stone moroko

stone moroko in carp ponds, where it damages the carp's skin, which is then affected by a fungus. The occurrence of the black bullhead (*Ameiurus melas*), arising from USA and Canada, was confirmed in 2005 in ponds near Lomnice nad Lužnicí. Apparently, they were imported from Croatia with carp fry.

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Invasive species

The classic example of an invasive species is the goldfish (*Carassius auratus*), which got to Europe from China in the 17th century. Its name is

Stone moroko (*Pseudorasbora parva*) from East Asia probably also got into our waters in the 1970s with fry of grass carp and silver carp which had been planted in various parts of Bohemia and Moravia. With intensive fish farming there, this



Goldfish, whose name is understood as a complex of several taxa, originated in China. Pictured is the „form“ *gibelio*, which was extended to us through a natural migration from southern Europe across the lower reaches of the Morava River, settling in all eligible natural and artificial waters in the Czech Republic.
Photo Vladimír Wrangel

now understood as a complex system of multiple taxa, sometimes considered as separate species, of which the dominant one is „form“ *gibelio* (sometimes bearing the generic name *Carassius gibelio*). Around 1975, it came here by a natural migration from the Slovak-Austrian section of the Morava River to the confluence of the Morava and Dyje rivers. In subsequent years, gradually also with the help of humans, it inhabited all suitable natural and artificial waters in the Czech Republic. Because of its high numbers, it significantly suppressed the incidence of indigenous species, especially the crucian carp (*Carassius carassius*) and the tench (*Tinca tinca*), as it competes with them for both food and space. Furthermore, it is known for its „sexual parasitism“: When triploid females of goldfish spawn with males of other carp, their reproductive potential is reduced. This is known as gynogenesis, meaning that hybrids are not produced from such mating, but only goldfish females.

Brown bullheads, which were mentioned above, did not meet the expectation that they would grow faster here than in their homeland, so their introduction was stopped. However, they naturalized in large rivers basins. In the first half of the last century, in suitable locations (especially in the lower and middle parts of the Elbe River and adjacent waters in the flood area), brown bullhead populations peaked, which was also reflected in the number of catches. In this period, they could be considered an invasive species

because, in many places where they occurred in larger numbers, they pushed other species of fish from stream embankments. Later, though, they disappeared from most parts of the Czech Republic.

Original, or unoriginal?

For some fish species, it is not clear whether their spread to our territory was natural or was helped by people. These include the western tubenose goby (*Proterorhinus semilunaris* – in Czech publications previously referred to as *Proterorhinus marmoratus*), and the round goby (*Apollonia melanostomus*), which was found for the first time in our country in 2008. Both species migrated from the Danube to the Morava and Dyje rivers, perhaps naturally, perhaps with the assistance of people. Fishermen, in fact, use them as bait fish, and unconsumed bait may end up in the river. Also, in the Danube, their dissemination upstream could have been accomplished by their being in the ballast water of transport vessels. If we admit that they spread naturally, then their spread would be seen as the expansion of the original Danube species into a neighbouring region, which enriched the range of the indigenous species of the Czech Republic. We can assume that other goby species will penetrate from the Danube to our territory, which is suggested by the current situation in the Slovak Republic.

Species of random and short-term occurrence

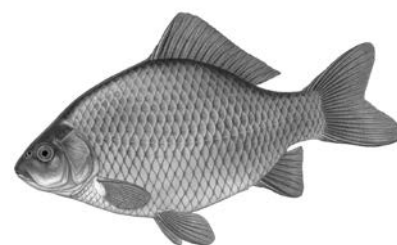
These are fish that have escaped from farms, or were released into the wild by irresponsible aquarists. This would explain the sporadic catches of the Nile tilapia in the Ohře River or in the Nechranická Reservoir. In the fishing district of Olše 2 in 1998, a fisherman caught a piranha, but the species was not specified. (Aquarists keep both herbivorous and carnivorous piranhas, and they can be very similar.) In both cases, they are thermophilic species which are not able to survive in our waters all year round.

Conclusion

Only four introduced species of fish naturalized in the Czech Republic: three-spined sticklebacks, brown bullheads, stone moroko, and goldfish. The last two show strong invasive potential. It should be emphasized that non-native species, in the event of a successful naturalisation, are always competition with native species. Each introduction represents a significant health risk from the possibility of their carrying specific parasites or infections that can seriously threaten our native species. Findings from catastrophic floods show that experimental farms cannot be perfectly secured to prevent the escape of an alien species. Another permanent risk from imports consists of impurities in batches of species which are exploited in fishing. Also, imports carried out by amateur aquarists increase the risk of planting exotics in our nature. And increasing the number of species attractive to sports fishermen cannot be considered appropriate as, due to widespread fishing tourism already in place, it appears to be unnecessary.

It is obvious that, in the future, the species composition of our ichthyofauna will vary somewhat, mainly due to fishermen, and possibly to aquarists. The main focus of responsible fisheries workers, however, should be to preserve the current biodiversity of our indigenous species.

Prof. RNDr. Lubomír Hanel, CSc.,
Faculty of Education,
Charles University in Prague
Drawings: Lenka Vybíralová



Goldfish

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