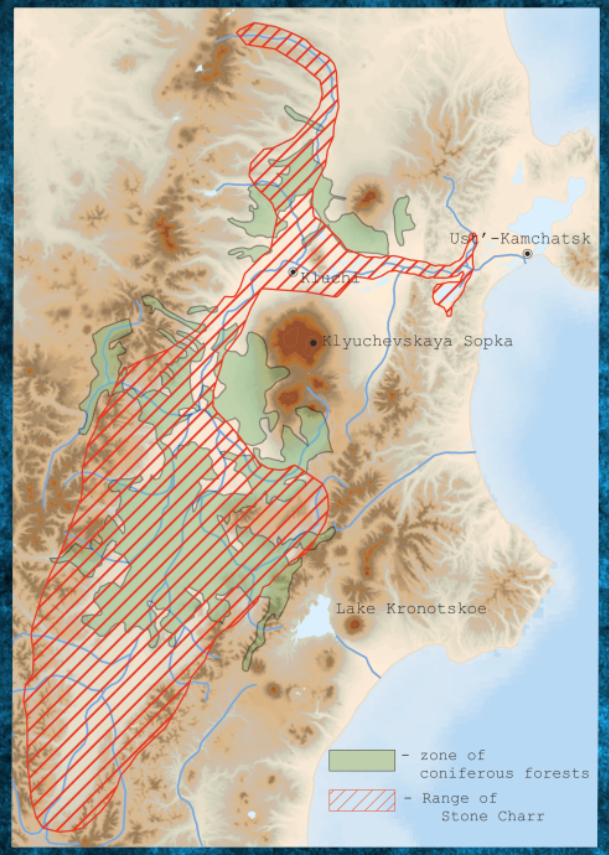
The Kamchatka River middle course. G. Markevich

LISTING IN THE RED BOOK

The amount of stone charr population in the middle course of the Kamchatka River is rather low. The rare fish is a desired target for both tourists and local fishermen. The main catch falls on the beginning of summer, when large individuals run down to the mouths of spawning tributaries and the main channel. There is indirect evidence that with the cutting down the coniferous forests stone charr population density is dramatically decreasing. Environmental protection measures such as restricting fishing and turning its breeding grounds into conservation areas should be taken in order to preserve this unique endemic charr. In 2017 due to the initiative of Kronotsky Natural Reserve the endemic stone charr was included in the regional Red Book; this could be viewed as the first step towards a fully-fledged protection strategy.

G. Markevich, E. Esin



Map. G. Markevich

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КРОНОЦКИЙ ЗАПОВЕДНИК

THE MYSTERIES OF EVOLUTION IN RIVER BASINS. STONE CHARR

Salmonid stream in a coniferous forest. G. Markevich

The spawning stream. G. Markevich

THE EVOLUTION OF SALMONID FISHES

Salmonids exhibit an outstanding ecological plasticity throughout various species on Earth. They have successfully adapted to diverse food and spawning niches in dozens of lakes with stable environmental conditions. Local morphs usually possess a set of specific features directly tailored to exploiting a particular resource. After these features were genetically fixed, the co-existing morphs become reproductively isolated promoting speciation. In Kamchatka, in the most vivid form, the sympatric speciation of salmonids took place in the Lake Kronotskoe basin.

In contrast, riverine conditions are usually less stable, so fish frequently change their food or spawning niches. Thus, genetic fixation becomes irrelevant from an evolutionary perspective. Separate morphs of fish with a specialized type of feeding are known only for tropical rivers flowing through ancient valleys. No stable sympatric morphs from the cold-water rivers have been described for salmonids yet.

RIVER KAMCHATKA AS THE CRADLE OF PACIFIC CHARRS

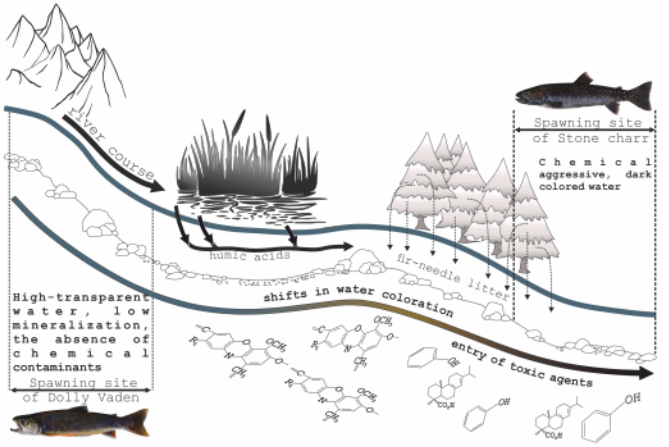
The Kamchatka River being the core waterway on the peninsula is the place where one of the most widespread salmonids in the region, Northern Dolly Varden (genus Salvelinus), probably originated. The river had not been shackled with ice during the last Ice Age, remaining the only sustainable habitat for Northern Dolly Varden, which then spread across the peninsula again after the glacier retreated.

In modern conditions anadromous and resident Dolly Varden inhabit the entire river system reaching the most remoted tributaries and lakes. Surprisingly, today the river basin is inhabited by the related endemic charrs, evidently segregated at the brink of the Last Glacial Period.

One of the most peculiar is stone charr, a large (up to 60 cm and 2200 g) black fish with numerous speckles across the body and fins. It is an ambush predator spawning in the tributaries that flow from the swamps of Central Kamchatkan Highlands. The age limit of stone charr is 12 years, maturation begins at the age of 5–6 years, i.e. later than in the riverine Dolly Varden.

Evolutionary proximity between the stone charr and Dolly Varden combined with reproductive isolation shows that the Dolly Varden ancestor must have evolved into a separate morph over the last few thousand years.

The external appearance of stone charr. E. Esin



Ecological mechanisms of isolation. G. Markevich

ECOLOGICAL MECHANISMS UNDERLYING EVOLUTON

The mechanisms and factors which could have lead to the origin of an isolated group still remain obscure. According to the recent studies headed by the Kronotsky Nature Reserve, the stone charr specialization can be attributed to spawning in the tributaries abundant in coniferous downfall. Toxic phenol and diterpene compounds extracted from the needles decreased the survival rate of Dolly Varden eggs. Eventually, the group enhancing its resistance to permanent toxicity which spawned in the taiga area evolved into stone charr. Experimental studies of this adaptation are presently being carried out; their results will hopefully shed light on the mechanisms behind the emergence of a new riverine morph alongside its more widespread relative - Northern Dolly Varden.