

## RIVER VARZUGA AT KOLA PENINSULAR, NW RUSSIA – A FRESHWATER PEARL MUSSEL RIVER WITH CONSERVATION VALUES OF GLOBAL INTEREST

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River Varzuga has the world's greatest (known) population – 140,000,000 specimens – of the Freshwater Pearl Mussel *Margaritifera margaritifera*. It also probably hosts the largest population of Atlantic Salmon *Salmo salar* in the world. The reason for that is that the river itself and the catchment are little affected by human activities, i.e. it is a pristine river.

Studies of water quality, bottom fauna and fish were made by Swedish scientists in 1995 and 1997. They concluded that River Varzuga (1) has very high conservation value, due to a high degree of naturalness and rarity, (2) is a pristine river and can be used as an unaffected reference for affected rivers in the northern part of Scandinavia, (3) is utilised for commercial as well as recreational fishing in a sustainable way.

In 2006, WWF Russia and Kola Biodiversity Center compiled data on the catchment. They concluded that the River Varzuga catchment: (1) can be divided into three large and uniform areas with different vegetation and human impact, (2) has areas of high terrestrial conservation value, e.g. old-age spruce forest, (3) the human impact is low or moderate, being most pronounced in the western part, mainly due to forestry.

This means that not just the river itself but also the whole catchment is of conservation interest. The potential threats are increased exploitation of natural resources like forest and minerals, and, perhaps, the salmon parasite *Gyrodactylus salaris* and the introduced salmon *Oncorhynchus gorbusha*.

River Varzuga and its catchment have extremely high conservation values not only in Russian but also in an international perspective. The river is of global interest concerning aquatic biodiversity. Therefore, a strategy for management and/or protection ought to be developed as soon as possible.

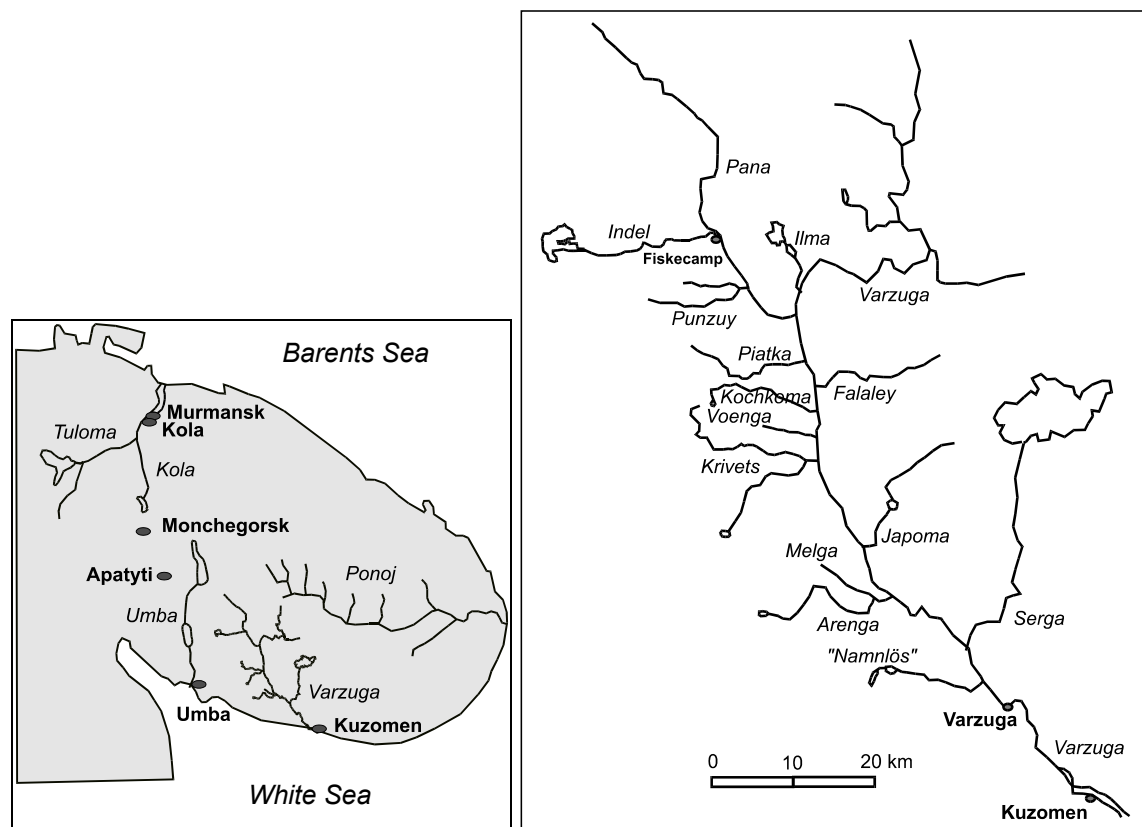
*Key words:* Russia; *Margaritifera margaritifera*; freshwater pearl mussel; status; conservation, pristine river

## INTRODUCTION

The Varzuga River originates from the central part of the Kola peninsular, Russia, crosses the Arctic Circle, and empties into the White Sea (Fig. 1). The catchment is very little affected by human activities: limited forestry and agriculture; no alteration of the main river channel; unaffected water flow, minimal effects by air pollution, restricted fishing. The river is of international interest because of its great populations of the Freshwater Pearl Mussel *Margaritifera margaritifera* and Atlantic Salmon *Salmo salar*. In addition, there are a lot of historical and cultural monuments, as wells as venerated springs.

The Varzuga River was studied by a Russian-Swedish expedition in 1995 and 1997 (Bergengren et al., 2004). The objectives were (1) to study the Freshwater Pearl Mussel population, fish population, bottom fauna and water quality, (2) to assess the value of Varzuga as an unaffected reference for affected Swedish rivers. The results may also be used if protection measures are taken. In 2006, WWF Russia and Kola Biodiversity Center compiled data on the catchment (Belkina et al., 2006).

The objective of this paper is to present Varzuga and its conservation values.



**Fig.1.** Maps showing River Varzuga on the Kola Peninsular (left) and the water system (right) (from Bergengren *et al.*, 2004).

## DESCRIPTION OF THE RIVER AND ITS CATCHMENT

The river length is 254 km and the drainage area is 9 885 km<sup>2</sup>. The width is around 80 m on average (300 m at max) and the depth is 0.2–2.5 m. The annual mean water discharge is 85 m<sup>3</sup>/s with a peak in May. The water flows rather slowly (0.2–1.5 m/s), and there are no waterfalls in the main channel. There are more than two thousand lakes, occupying 3 % of the catchment area. There is a dam in the upper part of the tributary Indel, and a man-made canal built for timber floating leads from this dam to the adjacent Umba catchment.

The bedrock mainly consists of Proterozoic rocks and Quaternary deposits moraine. The catchment belongs to the boreal taiga subzone and is covered with forest (birch, pine, spruce) in dry sites and plenty of mires. Natural fires are important “processes” forming the forests. One third of the catchment is old-age forests where rare and red-listed species can be found (Table 1). The uppermost/northern part is tundra, and here the highest site, 629 m a.s.l., is found. The climate is warmer than in many other areas at the same latitude due surrounding sea. The annual precipitation is 500–600 mm. The average annual temperature is -0.6 °C.

**Table 1.** Vegetation types in the Varzuga River catchment (from Belkina *et al.* 2006)

Vegetation type	Percentage cover
Old spruce forests	32.5
Old pine forests	5.1
Old birch forests	0.6
Wetlands	212
Cleared and burnt-over areas, 50 years	19
Other communities	21.8

The land use is forestry, agriculture, tourism and prospecting/exploration for minerals. However, these human activities apparently affect the catchment and the river to a minor extent.

One hundred species red-listed in the Murmansk region live in the area. The most spectacular ones are the White-tailed Sea Eagle *Haliaeetus albicilla*, Grey Wolf *Canis lupus*, Brown Bear *Ursus arctos*, and the Freshwater Pearl Mussel. The Muskrat *Ondatra zibethicus* is an alien species that may predate on the Freshwater Pearl Mussel.



**Fig. 2.** River Varzuga and the beautiful church at the Village of Varzuga  
Photo by *Lennart Henrikson*

### WATER QUALITY

Bergengren et al. (2004) conclude from the analysis of the water quality that the water in the Varzuga catchment is brown coloured due to humic substances from the mires, the content of anthropogenic sulfate and a small difference in the hardness and alkalinity indicate a very low impact of acidification, low or moderate content of total phosphorus and the lack of pollution indicate low impact of eutrophication. This is supported by data from Belkina et al. (2006).

### AQUATIC BIOLOGY

The fish fauna comprises 18 species, of which one – pink salmon *Onchyrhynchus gorbusha*, is introduced. The Atlantic Salmon reach a size of 5–6 kg. Brown trout *Salmo trutta* are found as “brook trout» and “sea trout” but the stronger competitor – the Atlantic salmon dominates. Atlantic salmon densities are very high in the main channel as well as in the tributaries. The Varzuga River has very large areas (2,000,000 ha) suitable for salmon production, and the river probably hosts the largest population of Atlantic salmon in the world. Infection by the salmon parasite *Gyrodactylus salaris* is found.

Bergengren *et al.* (2004) found 14 benthic species listed in Scandinavian red lists. The water colour may explain differences in e.g. species composition between different streams in the Varzuga system. The bottom fauna of the Varzuga system has more taxa sensitive to acidification or pollution than Swedish streams. The bottom fauna indicates minor impact by human activities.

The Freshwater Pearl Mussel population is the largest in the world (approx. 140 millions specimens) (Ziuganov *et al.*, 1994). The population is viable, as indicated e.g. by a great proportion of young mussels. The conservation value of the mussel population is very high.

## HUMAN IMPACT

The catchment is generally used in an extensive mode, for example in the lower parts around the Varzuga village. Today, there are only few local forestry companies operating in the western part. The hydromorphology is also little affected, but the dam in Indel prevents fish passage. The water quality, as well as air quality, is very good. The waters are used for canoeing, sport fishing and commercial fishing. The latter is practiced at the Varzuga village, and can be regarded as sustainable fishing. An overall conclusion is that the human impact is very low.

## SYNTHESIS AND CONCLUSIONS

Based on Bergengren *et al.* (2004) and Belkina *et al.* (2006) the following conclusions can be drawn:

- The River Varzuga and its catchment have very high conservation value, due to a high degree of naturalness and rarity.
- The conservation values and the naturalness values are extremely high in the Russian as well as in the international perspective.
- Present-day land and water use do not severely affect the aquatic ecosystem.
- The fish population is utilised for commercial as well as recreational fishing in a sustainable way.
- The main threat to River Varzuga is exploitation of natural resources like forest and minerals in the catchment. The potential threats of the salmon parasite *Gyrodactylus salaris* and the introduced salmon *Oncorhynchus gorbusha* must be evaluated.
- A strategy for management incl. protection ought to be developed as soon as possible. The catchment basin is heterogeneous, and differentiated approaches to nature management and nature protection should be employed, with the variety of natural conditions and different history of nature management in different sites within its area being taken into account.

In conclusion, River Varzuga and its catchment is of very high conservation value not only in Russian but also in an international perspective. Most rivers in the world are strongly or moderately affected by human activities, such as fragmentation, regulation by dams, and pollution. Especially in Europe only a few rivers may be regarded as pristine – River Varzuga is one of these. The river is of global interest in terms of aquatic biodiversity but also as an unaffected reference for affected rivers in the northern part of the world. Therefore, a strategy for management and/or protection ought to be developed as soon as possible.

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