



**ADVANCES IN THE POPULATION ECOLOGY
OF STREAM SALMONIDS - V**

INTERNATIONAL SYMPOSIUM

MAY 20-25th, 2019

GRANADA, SPAIN

Salvelinus umbla, which occurs in high alpine lakes, four named relatives of Brown Trout are endemic to Italy, *Salmo fibreni*, *S. carpio*, *S. cettii*, and *S. marmoratus*; another taxonomically complex group of Brown Trout relatives has been found in North Africa. Three nonnative species from North America have established naturalized populations in the region: Rainbow Trout *Oncorhynchus mykiss*, Brook Trout *Salvelinus fontinalis* and Lake Trout *S. namaycush*. The chapter examines the distribution, status, socioeconomic value, and management context of each species, organizing the discussion using hydrological and political boundaries in order to accommodate the natural biogeography of the species and the disparate availability of relevant data across the region.

Antonino Duchi

Geometrical arrangements in the flank spot pattern of a Sicilian *Salmo cettii* population

The use of natural marks for the identification of individuals in a population is a simple, cheap and non harmful method, compared to other techniques like: fin clipping, tattoos, external and internal tags. Various researches have shown the practical use of melanophores to identify individual fish. An analysis of the images of 105 individuals of *Salmo cettii* from the River Irminio, in South East Sicily, allowed identifying a series of geometrical arrangements (from square to octagon) which have the potential to be used for the individual identification of this salmonid.

Daniel Eisendle, Josef Wieser Josef, Andreas Meraner and Andrea Gandolfi

Supportive breeding program of Marble trout (*Salmo marmoratus*) in the Province of Bolzano - Italy

The marble trout populations of the Northern Adriatic basin are threatened by human mediated hybridisation with exotic brown trout. Therefore, conservation measures are urgently needed to counteract further hybridization of this endemic species. The novel supportive breeding program described in this poster, applied within the Province of Bolzano since 2016, aims to conserve the genetic integrity of marble trout, while avoiding both domestication effects and the reduction of effective population size. Local wild marble trout spawners, selected by a genetic screening of each single individual, constitute the basis of the program. To minimize a potential reduction of effective population size induced by supportive breeding, full or partial factorial crossing is conducted. The main part of fertilized eggs is stocked back into the rivers of origin. However, currently it is also a necessary measure to hatch a fraction of the descendants of each trout family under semi-natural conditions. This is done in order to increase the number of available parental fish, and further to be able to provide adequate quantities of fertilised eggs, used for stocking in artificial nests of all river stretches. The genetic screening of wild marble trout (N=578 in 2018) showed a significant hybridization for 80 percent of the phenotypically preselected spawners. The elevated degree of genetic introgression is hampering the here described supportive breeding programs, since it will be more and more difficult to maintain

sufficient number of breeders and, in general, pose a serious threat for the conservation of the species within the area of interest.

Manu Esteve, Brahim Bezzi, Bzza Ghira and Najma Said

A review of the three endemic species of trout in Northern Africa

Published literature, personal communications and three expeditions to the High Atlas Mountains in Morocco (2011, 2018 & 2019) are used to present the current available information for three species of trout endemic of Northern Africa: *Salmo akairos* from Lake Ifni, *Salmo viridis* from Lake Isli and *Salmo multipunctata* from the Dades and Mgoun Rivers.

José E. Larios-Lopez, **Miguel Galiana-Garcia**, Carlos Alonso and José M. Tierno de Figueroa

Distribution of brown trout (*Salmo trutta* Linnaeus, 1758) in its southwesternmost European limit: possible causes

Andalusian brown trout (*Salmo trutta*) populations represent the southwestern limit of this species in Europe, show a high genetic diversity, are subjected to extreme habitat conditions and environmental alterations, and are very sensitive to extinction. However, there is a lack of scientific studies on them. A necessary first step to preserve these populations is to describe their spatial distribution. We detected the species in eastern Andalusia along almost 710 km of rivers, finding 38 populations inhabiting streams and reservoirs in the upper reaches of three basins (Guadalquivir, Segura and South) in an altitude range between 200 and 2200 m above sea level. Populations are constrained by natural causes in their upper limits, and by anthropogenic causes in their lower limits (mainly related to water management). Currently, the populations are very isolated in protected areas (62% of their distribution) or downstream of those areas (32%), and a range displacement towards higher altitudes compared with their distribution in the nineteenth century is observed. In Sierra Nevada, we studied ten rivers during the period 2005-2018. In 2008, the brown trout habited in 178,5 km of these rivers. Ten years later, when we sampled in 2018, the populations occupied 159,3 km. The main causes of this spatial decline could be attributed to multiple threats, such as habitat destruction, over-exploitation, climate change, poaching and invasive species (*Oncorhynchus mykiss*). In the study here presented, empirical evidence is provided for: i) the threatening effects of the current climate change on some of the native brown trout populations in Southern Europe; and ii) the expected adverse consequences of the forthcoming climate change on the conservation status of the species. Based on our data, the combination of the described pernicious factors will irreversibly drive to extinction the brown trout populations of Sierra Nevada in a close future.