

## Strategies for the sustainable management of salmonid fish populations in Alpine waters with special emphasis on protected areas and national parks

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### Abstract

Alpine freshwater fish fauna has entered a crisis phase. In fact, numerous Alpine taxa face a multitude of anthropogenic disturbances, exhibit increasingly restricted distribution areas and are officially ranked in red-list threat categories. Major threats derive from hydro-morphological alterations (e.g. disrupted continuum, flow modification, river regulation) leading to fragmented and often genetically isolated subpopulations, in many cases in conjunction with small population sizes and therefore reduced resilience.

Here we try to review existing, and discuss new management strategies to sustain, protect and/or restore natural salmonid fish populations in Alpine waters. Special attention is given to rivers and streams in protected areas and national parks. The presented concepts focus on brown trout (*Salmo trutta*) and grayling (*Thymallus thymallus*) populations as the two most important key species in Alpine headwaters and middle reaches. When aiming to restore native fish populations it is mandatory (1) to detect and/or define management units based on genetics (i. e. Evolutionarily Significant Units (ESUs) as well as (2) to develop mitigation and restoration concepts to re-establish migration routes and to improve habitat quality. Finally (3), if necessary ecologically sound restocking measures can be developed to recover or rehabilitate native populations and management measures can be set to conserve unique locally adapted populations where endemic/native populations still exist.

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