

# 11 years of limnological research in the Gran Paradiso National Park (GPNP, Torino, Italy): between research and conservation

Rocco Tiberti<sup>1,2,\*</sup>, Stefano Brighenti<sup>1</sup>, Rocco Iacobuzio<sup>3</sup>, Matteo Rolla<sup>4</sup>, von Hardenberg Achaz<sup>1,5</sup>, Bruno Bassano<sup>1</sup>

<sup>1</sup> Alpine Wildlife Research Centre, Gran Paradiso National Park, Italy. <sup>2</sup> DSTA-Dipartimento di Scienze della Terra e dell'Ambiente, University of Pavia, Italy. <sup>3</sup> DBS-Dipartimento di Bioscienze, Università degli Studi di Milano, Italy <sup>4</sup> Department of BioSciences, Swansea University, UK; <sup>5</sup> Department of Biological Sciences, University of Chester, UK. \* e-mail contact: rocco.tiberti@gmail.com

## Chronology of the limnological research and conservation activities

**1921** the GPNP is one of the oldest protected areas in Europe. It has the invaluable merit of having saved from extinction the Alpine ibex (*Capra ibex*), the symbol of the GPNP as well as of the alpine wilderness.

In the last decades most of the local threats to the GPNP biodiversity derived from exploitation and mismanagement of water resources (e.g. dams and connected infrastructures construction, channelization, alien fish, water eutrophication).

**2006** a long term monitoring campaign of alpine lakes began, starting an 11-years long research season on aquatic ecosystems, which turned out to influence the conservation policies of the GPNP.

In the following years the participation of the GPNP to EU projects and a series of collaborations (e.g. Uni. Pavia, ISE-CNR, ISAC-CNR, Uni. Genova, CEAB-CSIC, Uni. Swansea, Uni. Statale di Milano, Uni. di Milano Bicocca) fueled for a long time (2008-2017) the research and conservation activities.

**2008** The GPNP became partner of the FP7 ACQWA project (Assessing Climate Impacts on the Quantity and Quality of Water).

**2012** an important co-financing was obtained within the LIFE+ Project BIOAQUAE - Biodiversity Improvement of Alpine Aquatic Ecosystems [www.bioaquae.eu](http://www.bioaquae.eu)

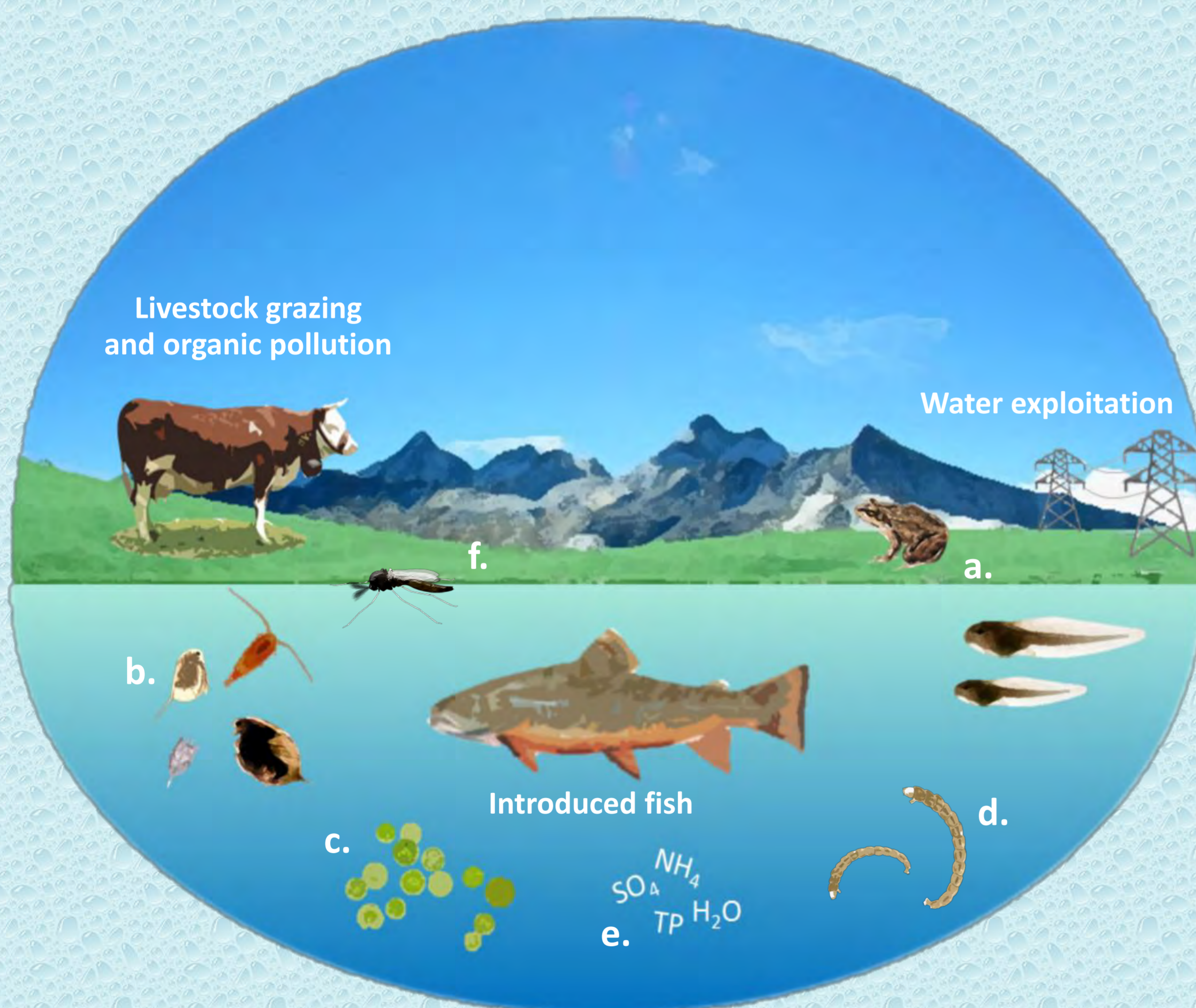
## Research lines and ongoing projects

The most prominent characteristic of the limnological research carried out in the GPNP is its strong connection to **applied conservation issues**, often providing feasible indications which convinced the GPNP authorities to take the path of **active conservation**. In particular the BIOAQUAE project and its conservation actions (the successful eradication of alien fish from alpine lakes, the re-oligotrophication of aquatic habitats through the use of phyto-pedo-depuration plants and the conservation actions for the Marble trout *Salmo marmoratus*) represent a first important achievement of this new attitude of GPNP towards the conservation of aquatic environments. At the same time, the long-term limnological studies are progressively creating a database of ecological variables which will provide a reference against which to quantify the effects of the global changes, inevitably affecting the protected area.

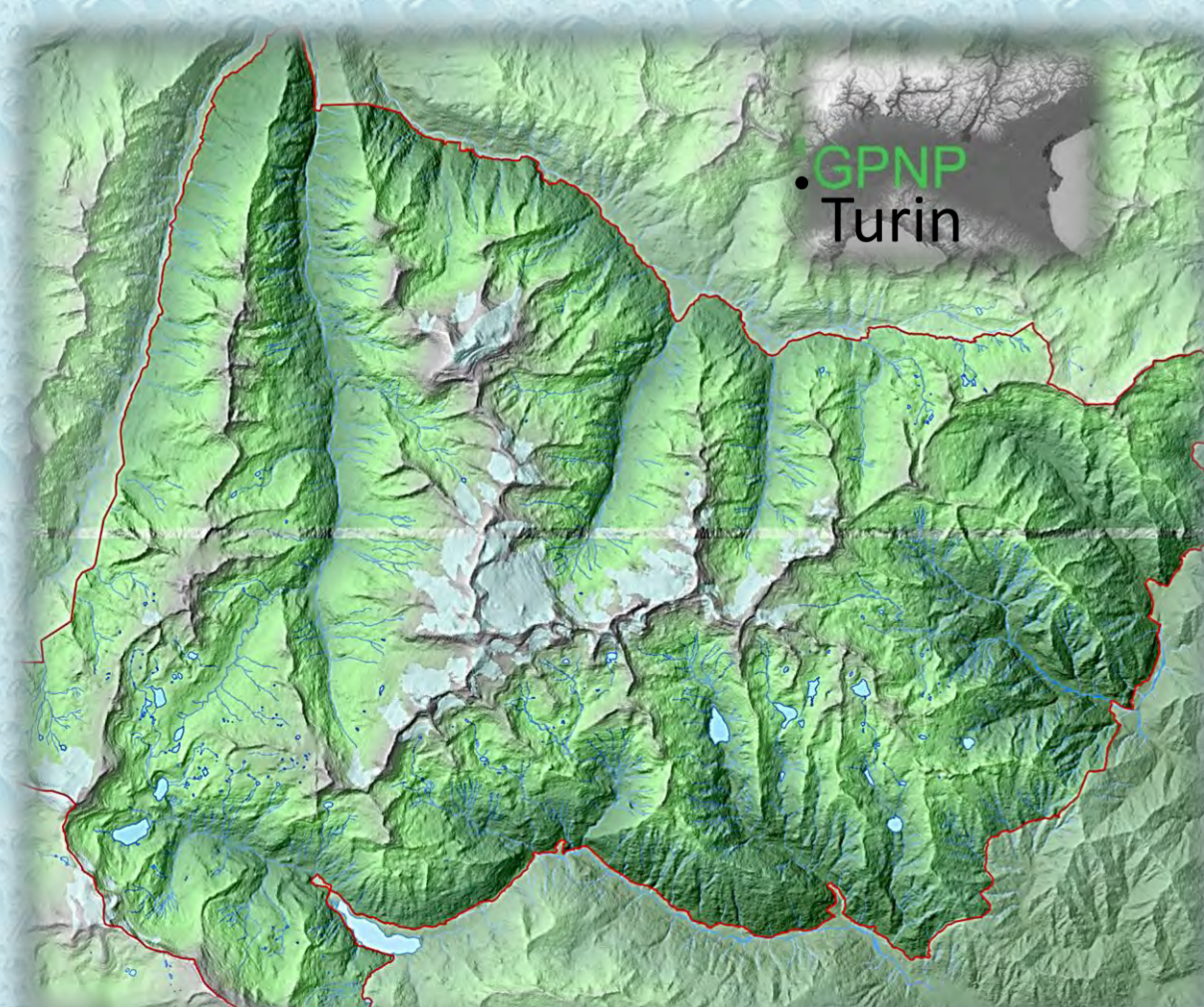
## Selected scientific production

1. Introduced fish [1-7]
2. Livestock grazing and organic pollution [8]
3. Water exploitation [9]
4. Alpine lakes hydrochemistry [8,10]
5. Zooplankton ecology and evolution [3, 11-14]
6. Ecological dynamics ISAC CNR [15]
7. Ecological restoration [16]
8. Climate change and bioindicators [17]

**REFERENCES:** [1] Tiberti and von Hardenberg. 2012. Impact of alien fish on Common frog (*Rana temporaria*) close to its altitudinal limit in alpine lakes. *Amphibia Reptilia* 33: 303-307; [2] Magnea et al., 2013. A model for high-altitude alpine lake ecosystems and the effect of introduced fish. *Ecological Modelling*, 251: 211-220; [3] Tiberti and Iacobuzio. 2013. Does fish predation influence the vertical distribution of zooplankton in high transparency lakes? *Hydrobiologia*, 709: 27-39; [4] Tiberti et al., 2014. Ecological impact of introduced fish in high altitude lakes: a case of study from the European Alps. *Hydrobiologia* 724:1-19; [5] Tiberti et al., 2014. Behind the impact of introduced salmonids in high altitude lakes: adult, not juvenile fish are responsible of the selective predation on crustacean zooplankton. *Journal of Limnology*, 73:593-597; [6] Tiberti et al., 2016. Changes in the insect emergence at the water-air interface in response to fish density manipulation in high altitude lakes. *Hydrobiologia*, in press; [7] Tiberti et al., 2016. The diet of introduced brook trout (*Salvelinus fontinalis*; Mitchell, 1814) in an alpine area and a literature review on its feeding ecology. *Journal of Limnology*, in press. [8] Tiberti et al., 2014. Ecological impact of transhumance on the trophic state of alpine lakes in Gran Paradiso National Park. *Knowledge and Management of Aquatic Ecosystems*, 415: 05. [9] Ranghetti, 2011. Impatto delle opere di captazione idroelettrica sugli ambienti lotici del Parco Nazionale Gran Paradiso, MSc Thesis, University of Pavia; [10] Tiberti et al., 2010. Geomorphology and hydrochemistry of 12 Alpine lakes in the Gran Paradiso National Park, Italy. *Journal of Limnology*, 69: 242-256 Tiberti 2011; [11] Morphology and ecology of *Daphnia middendorffiana*, Fisher 1851 (Crustacea, Daphniidae) from four new populations in the Alps. *Journal of Limnology*, 70: 239-247; [12] Iacobuzio and Tiberti. 2011. Cloud cover does not clearly affect the diurnal vertical distribution of crustacean zooplankton in naturally fishless alpine lakes. *Zooplankton and Benthos Research*, 6: 210-214; [13] Tiberti and Barbieri. 2011. Evidences of zooplankton vertical migration in stocked and never stocked alpine lakes in Gran Paradiso National Park (Italy). *Oceanological and Hydrobiological Studies*, 40: 36-42. [14] Bellati et al., 2014. A dark shell hiding large variability: a molecular insight into the evolution and conservation of melanistic *Daphnia* populations in the Alps. *Zoological Journal of the Linnean Society*, 171: 697-715; [15] Tiberti et al., 2013. Ecological dynamics of two remote Alpine lakes during ice-free season. *Journal of Limnology*, 72: 401-416; [16] Tiberti et al., 2013. Preliminary studies on fish capture techniques in Gran Paradiso alpine lakes: towards an eradication plan. *Journal of Mountain Ecology*, 9: 61-74; [17] Khamis et al., 2014. The use of invertebrates as indicators of environmental change in alpine rivers and lakes. *Science of the Total Environment*, 493: 1242-1254.



**Fig. 1** Picture above: main local ecological threats and impacted ecological compartments in a typical alpine aquatic habitat. a. amphibians; b. zooplankton; c. bacterial and primary production; d. aquatic invertebrates; e. water chemistry; f. emerging insects



**Fig. 2** GPNP is an example of integration between biodiversity conservation and scientific research, in a protected area which is just an hour's drive from the conference venue.

## ACKNOWLEDGEMENTS.

The authors would like to thank Giuseppe Bogliani (University of Pavia), the Park wardens and many students and field assistants. Funding and logistic support for this research was provided by the GPNP within the framework of the LIFE+ project BIOAQUAE (Biodiversity Improvement of Aquatic Alpine Ecosystems).