# 4.3. Monitoring populations of common trout

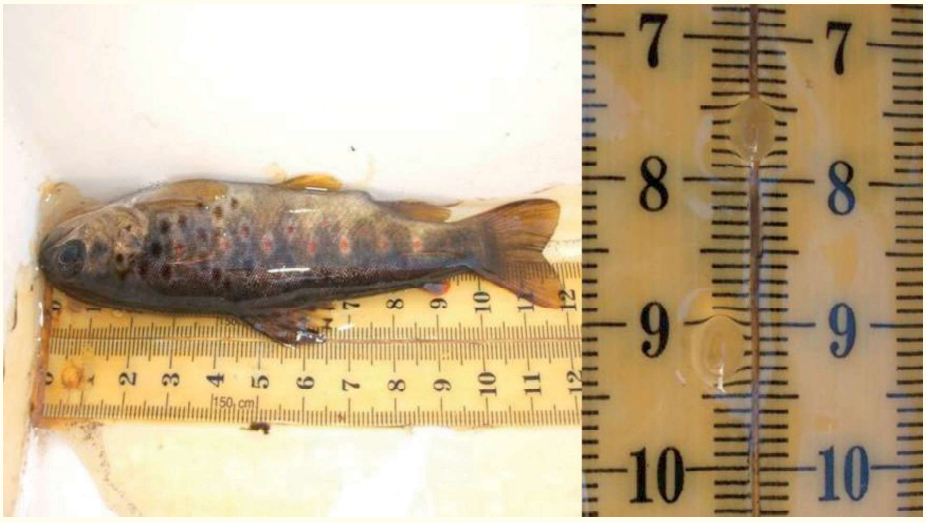
Galiana-García, M.; Rubio, S. and Galindo, F.J.
Environment and Water Agency of Andalusia

## Abstract

For 9 years the common trout populations in Sierra Nevada have been monitored. During this period, symptoms of increasing and decreasing cycles have been detected in the density and biomass of the populations sampled, associated with variations in environmental factors, such as precipitation. These variations have also been detected in the other areas inhabited by the common trout in Andalusia (i.e. in the protected areas of Castril, Sierras de Cazorla, Segura y Las Villas, and in Sierras de Tejeda, Alhama, and Almijara). In several rivers of the aforementioned natural areas as well as in Sierra Nevada, very similar patterns of variation in density and biomass have also been detected, and thus the populations may be behaving similarly with respect to the environmental variations caused by global change.

## Aims and methodology

The aim is to characterise the populations of common trout in Sierra Nevada and evaluate the effect of biotic and abiotic factors on the population dynamics. As a measure for estimating the population size, the weighted maximum-likelihood method was used to calculate the probability of capture and the standard error. The age was determined by growth equations and examining the scales to verify the population structure by mathematic models. Biomass was considered as the mean weight of the specimens captured. The precipitation was determined using the data of hydrometereological years of Environmental Information Network of Andalusia (REDIAM) and the Watershed function of ArcGIS 9.3 to establish the watershed basins. The reproductive phenology was monitored by abdominal massage of the specimens captured in different periods of the year, noting the formation of eggs or sperm for each individual without making a significant extraction of the reproductive material. More details on the methodology followed are available elsewhere [9].



Smallest mature female captured during the samplings: a specimen 12 cm long with eggs 4 mm long.

## Results

The results for density and biomass of the common trout during the study period show that at most of the census stations, there was a descending trend until the year 2008 (Figure 1). From 2009 on, the density and biomass values in general increased, with the exception of 2010, when the torrential rains substantially altered the common trout habitats, as reflected in the values of these parameters.

The increases in the density values of the years 2011 and 2012 were due mainly to the great number of hatchlings sampled in the census stations, often constituting the greatest recruitment during the entire sampling period.

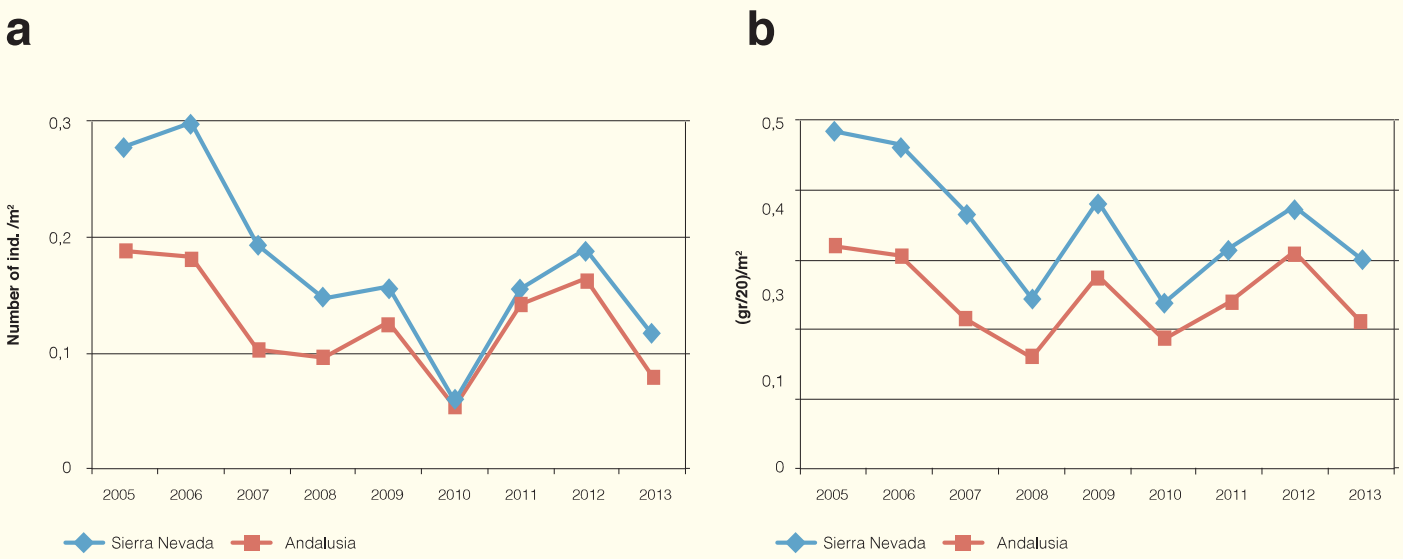
The variations in density were compared with the different annual precipitation values (for which data from hydrometeorological years were used), detecting correlations between the density values of the common trout and changes brought about by periods of drought and high precipitation, which significantly altered the population size (Figure 2). Torrential precipitation has direct effects both on trout populations as well as on macroinvertebrate numbers (see Chapter 4.2), strongly diminishing population density.

After these periods of torrential rains (e.g. 2010), as occurs with aquatic macroinvertebrate communities (see Chapter 4.2), the common trout recovered in the year after these periods of heavy precipitation. In addition, the lower precipitation values, as in 2012, significantly affected the number of hatchlings, as detected in samplings of 2013.

With respect to the age classes captured, the general trend was for the populations to have a low number of adult specimens, these being absent from many samplings (Figure 3).

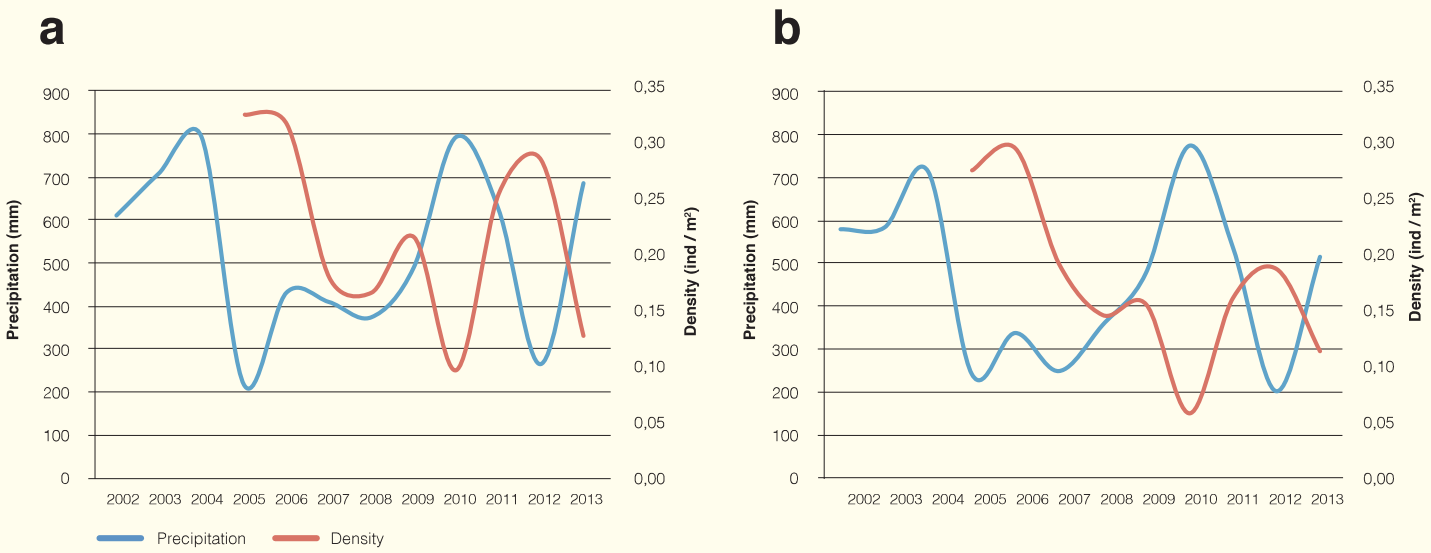
Generally, the common trout reproduces in autumn or winter—the higher the latitude and elevation, the earlier in the year, due to low water temperatures and longer incubation periods [10, 11]. In its natural distribution area, the average date of spawning occurs at the beginning of October in Finland or Norway [12], and in February in southern populations such as Asturias [13] or Granada [11] (Spain). In the river Castril (Granada province), the reproduction period is very long (5 months), the last nest being constructed at the beginning of April [11] (Figure 3). In works conducted in Sierra Nevada, reproductive specimens have been detected, some even of small size, from the month of October to the first two weeks of May.

**Figure 1**




Densities (a) and biomass (b) of common trout in Sierra Nevada (blue line) and in the overall region of Andalusia (red line) (Fishing Census from Regional government).

**Figure 2**




Evolution of the trout density (red line) and precipitation (blue line) in Sierra Nevada (a) and Andalusia (b). (hydrometeorological years)

## Discussion and conclusions

The greatest densities and biomass in Andalusia have been located in Sierra Nevada, in the Guadalfeo and Genil basins. Of all of the populations sampled, only the populations of the rivers Chico de Soportújar and Lanjarón can be considered abundant in terms of biomass, evidencing the delicate state of this salmonid in Andalusia.

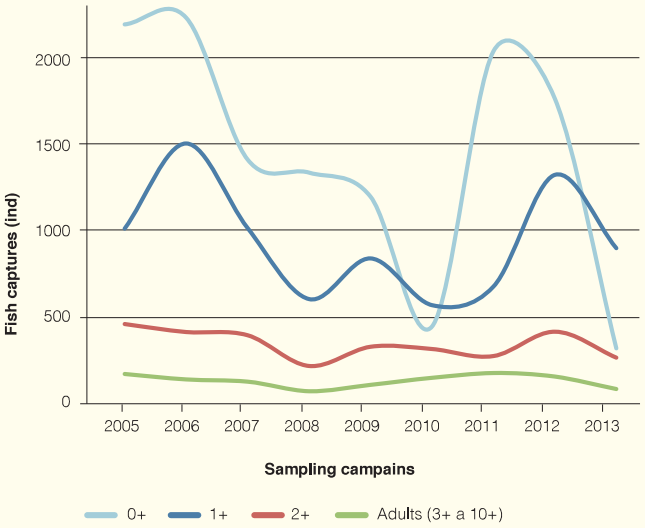
Furthermore, several river courses are subjected to drying phenomena due to hydroelectric diversions (Dílar, Monachil) and irrigation channels (Bérchules, Chico de Soportújar, Torrente, Trevélez, Andarax, Mecina), implying a grave threat to the common trout populations in these rivers.

The relation detected between the annual rainfall regime and the variations in the density of the common trout populations implies that this species is very sensitive to environmental variations, as demonstrated by the influence of droughts and torrential rains in the number of specimens detected in the samplings. After the phenomena of torrential rains, which can inflict abrupt declines in the communities sampled, the populations recuperate almost immediately. This is probably due to the adaptation of the trout populations to these rather common phenomena in Sierra Nevada.

However, despite the detection in 2011 and 2012 of a great number of hatchling and juvenile trout, in many of the sampling stations the numbers of adult specimens have been low during the entire census period, the age structure being strongly unbalanced, with a strong predominance of classes 0+ and 1+. The low availability of refuge for adults during certain periods of the year appears to constitute the most important part of this limiting factor, although other factors such as droughts determine the scarcity of adults.

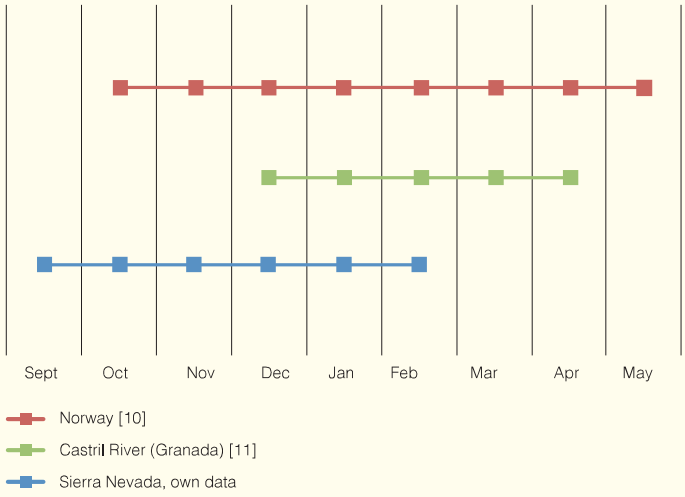
As described above, the reproductive period of the trout in Sierra Nevada is longer than any other described in the scientific literature (Figure 4). As suggested by other authors [11], this long reproductive period offers an advantage in a highly unpredictable hydrological regime, such as that of Sierra Nevada.

## Figure 3




Graph of number of captures (expressed by age classes) of the common trout from the year 2005. Over the sampling period the hatchlings captured constitute a mean of 50.3% of the captures. Around 32.8% of the captures correspond to juvenile specimens, and the remaining 16.9% to adults. Of the adult specimens, some 71.7% were in the age class 2+, and thus captures of age 3+ or older are rare (only 4.8% of the total captures).

## Figure 4




Spawning periods of the common trout

*Salmo trutta*