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Influence of weather-climate conditions on the breeding success of rock partridge *Alectoris graeca* in a population of the western Alps

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Abstract – The reproductive success of rock partridge *Alectoris graeca* is likely to be influenced by weather events, intense rainfalls and temperatures, which may occur during the reproductive period. On this basis we compared the data obtained from the count of rock partridge, made through the use of pointer dogs in an area of the Southern Alpes (Alpi Cozie, Varaita Valley, CN), with data recorded by automatic monitoring meteorological stations of the regional network. In particular we took into account data, from 2000 to 2010, on meteorological parameters such as number of days of rain, intensity of individual rainfall events, number of consecutive days of uninterrupted rain and average temperature, minimum and maximum, recorded during the reproductive season (from the second half of May to the first half of August) in order to evaluate their impact on both eggs and chicks. As for the demographic parameters measured during the summer counts, the number and consistency of broods counted and the ratio of young/adult (reproductive success) were taken into account. The purpose of this paper is therefore to evaluate the relationship among climate parameters and reproductive success. The results show that climatic conditions that occur during the reproductive season are crucial in the reproductive success. The climatic parameter that showed the strongest negative correlation with the reproductive index (R.I.) proved to be the maximum accumulation for single rainfall event in the second half of July.

Key-words: *Alectoris graeca*, breeding success, climate condition, rainfall, pointer dogs.

INTRODUCTION

The dynamics of rock partridge *Alectoris graeca* populations, as with other alpine Galliformes, is influenced by climatic and environmental factors (Cattadori *et al*. 1994, 2000, Bernard-Laurent & Leonard 2000, Rotelli 2006, Provenzale 2008).

Some studies report that the period of crucial importance for rock partridge breeding is the month of July (Rotelli 2006, Bernard-Laurent 2000, Cattadori *et al*. 2000), pointing out low temperatures and abundant rainfalls as the most limiting. Climate change can also be crucial for reproductive success for all alpine grouses because of the extreme phenomena it can cause; i.e. sudden temperature drops, abundant rainfall and long or repeated periods of dry weather (Bocca 2007). At the moment, our knowledge of these phenomena is incomplete and targeted studies are needed.

Aim of the present paper is therefore to verify how climatic and weather conditions can influence breeding success, population density and dynamics of the rock partridge.

STUDY AREA

Data was collected in Comprensorio Alpino CN2, which coincides with the Varaita Valley (Alpi Cozie, Cuneo province, Piedmont, Italy).

The area has a surface of 47,831 hectares with an altitude between 400 meters (city of Manta) and the 3,841 m of Monviso, the most important peak in this section of the Alps. The sample area used for Rock Partridge counts has an extension of 4,131 ha and is divided into 34 sectors; for the purpose of this paper only those lying in the Bellino territory have been taken into account (11 sectors, 1,833 ha).The sample areas were chosen according to their proximity with automatic weather station units belonging to Piedmont Region (possibility to use reliable climate parameters).

MATERIAL AND METHODS

The reproductive index (R.I.) is calculated using data acquired from the summer counts carried out by volunteer hunters with the use of pointer dogs. This method, indicated in the Regional Guide (D.G.R. 76-2075, 17-05-2011), performed during the second half of August, is based on brood detection, in order to estimate age classes. The parameter thus obtained for each sector of the sample area is the number of young animals per every adult, which indicates the reproductive success for the year.

To gather climate parameters (temperatures C°, and rainfall), automatic weather station units were used, installed at ground level by Arpa Piemonte (Agency for the Protection of the Environment in Piedmont).

Particular attention was paid to the data acquired by the weather station in the Bellino area, on Pian Melezé at an altitude of 1,805 m, during 2000 and 2010. This station registers daily the maximum and minimum temperatures, and the millimetres of fallen rain.

For the objectives of this study, the data taken into consideration were those ones collected from the 15th of May to the 15th of August of each year, subdivided into 6 periods of 15 days.

In order to identify the factors that influence reproduction, several specific parameters were established, i.e. "maximum rainfall per event" and "number of rainy days per event". All parameters are explained in table 1.

The climate parameters were compared to the reproductive index in order to identify possible correlations. The data obtained was analysed using the R software (version 2.13.2). A multiple regression analysis approach was used to evaluate the influence of climate parameters on the R.I. index.

RESULTS

The results of the correlation between the average temperatures in the first half of June, the maximum rainfall per event in the second half of July and the reproductive index are shown in Table 2.

The high value of adjusted R^2 (0.79) shows that the multivariate model explains the variance of most of the dependent variable (R.I.), with two single factors ("maximum rainfall per event" in the second half of July and "average T" in the first half of June).

In particular this analysis showef that the "maximum rainfall per event in the second half of July" parameter (see Table 1) is the prime limiting factor in rock partridge chick survival in the alpine environment (Tab. 2 and Fig.1).

Table 1. Description of climatic and meteorological parameters used in the analysis.

Parameters	Definition
Average temperature	Mean temperature (C°) calculated per each period (15 days)
No. rainy days	Total number of days with at least 0.1 mm of rain (per period)
Maximum rainfall per event	Millimetres of rain accumulated in a single rainfall event calculated from the last day with 0 mm of rain to the first day with 0 mm of rain
No. rainy days per event	Number of rainy days used for the parameter "Maximum rainfall per event"
Precipitations	Total millimetres of rain fallen during the 15-day period

Table 2. Multiple regression results with Reproductive Index (RI) as dependent variable.

	Value
Multiple R	0.92877
F	12.55907
R^2	0.86262
adjusted R^2	0.79394
p	0.00537
Intercept	6.04103
Average temperature June (first 15 days) **beta**	-0.59
Maximum rainfall July (second half) **beta**	-1.1

DISCUSSION

The results of this study confirm what literature reports (see references in Introduction). Weather and climate conditions in the June-July period have significant influence on rock partridge breeding success. Two specific factors suggest to impose a stronger effect on weight than others on chick survival: the average temperatures in the first half of June and the maximum rainfall per event in the second half of July. Both factors seem to have a negative effect on breeding success.

In our opinion the significant contribute to R.I.'s vari-

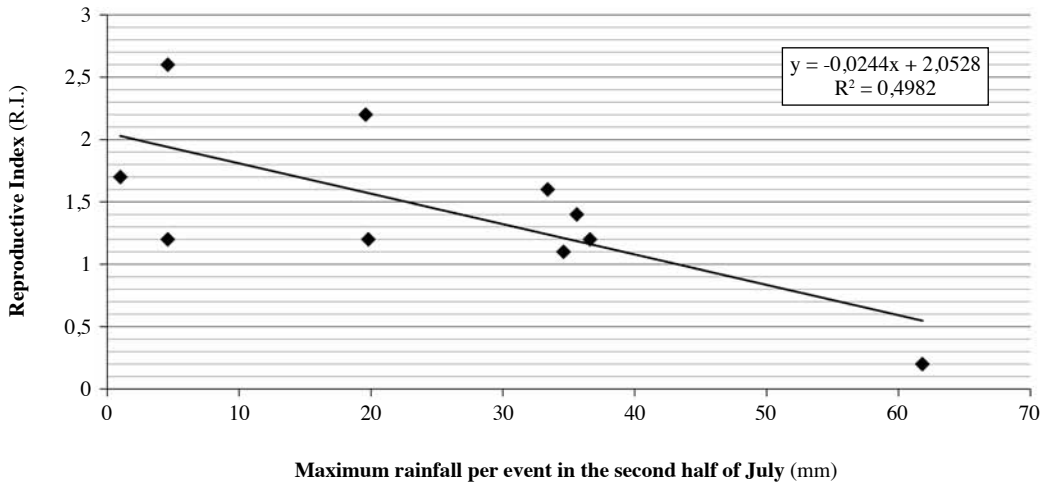

Figure 1. Correlation between Maximum rainfall per event in the second half of July and Reproductive Index.

ance of the "average T" parameter in the first half of June could be due not to a biological effect, but even to an evaluation error in the data collection during the counts. The fact that the first half of June presents optimal conditions could contribute to the successful rearing of early broods, thus favouring chick survival. During the period in which the counts are carried out (second half of August), the young from these broods could be so big as to be undistinguishable from the adults, or be classified as "undetermined". This could lead to an overestimate of the adult class with inevitable reduction of the apparent R.I. value.

The data gathered and analysed up to now, besides giving rise to interesting discussions on the effects of the climate, show how much further studies are necessary to enlarge the sample base and make these conclusions more reliable. Our objective in the near future is therefore to add the data gathered by other weather stations around the valley. These data will be then correlated with the reproductive index calculated in the corresponding sample areas of the Comprensorio Alpino CN2.

Strengthening our conclusions and the analysis on the correlation between the climate and Rock Partridge reproduction can be useful for the development of a predictive model to be used for the prediction of yearly R.I. value, based on the meteorological and climatic observations done during the summer months. Therefore this estimate could be extrapolated to the whole territory, using the results of R.I. from the sample areas. This can be done because the climatic variables are those that influence on a wide scale the species reproduction, thus providing important indications as to the reproductive trend. The estimate obtained in this way can be an important management tool together with traditional counts.

REFERENCES

Bernard-Laurent A., 2004. La Perdrix bartavelle (*Alectoris graeca*). Off. Nat. Chasse. Fiche technique, 7 p.

Bernard-Laurent A. & De Franceschi P.F., 1994. Status, évolution et facteur limitant les populations de perdrix bartavelle (*Alectoris graeca*): synthèse bibliographique. Gibier Faune Sauv. 11: 267-307.

Bernard-Laurent A. & Leinard Y., 2000. Vulnerability of an alpine population of rock partridge (*Alectoris graeca saxatilis*) to climatic events: evaluation with deterministic and stochastic models. Game & Wildlife Science 17: 63-79.

Bocca M., 2007. Galliformi alpini, pressione antropica e misure di tutela. Atti del Conv. I Galliformi alpini: esperienze europee di conservazione e gestione. Osservatorio regionale sulla fauna selvatica della Regione Piemonte, Torino, pp. 187-190.

Cattadori I. M., Hudson P. J., Merler S. & Rizzoli A., 1999. Synchrony, scale and temporal dynamics of rock partridge (*Alectoris graeca saxatilis*) populations in the Dolomites. J. Anim. Ecol. 68: 540-549.

Cattadori I. M., Merler S. & Hudson P. J., 2000. Searching for mechanisms of synchrony in spatially structured gamebird populations. J. Anim. Ecol. 69: 620-638.

Giordano O., 2010. Relazione sulle attività di censimento alle specie appartenenti alla Tipica Fauna Alpina. Comprensorio Alpino CN2, Relaz. Int.

Rotelli L., 2006. Fattori limitanti e cause di declino dei galliformi alpini in Italia: implicazioni gestionali e di conservazione. In: Atti Conv. I Galliformi alpini: esperienze europee di conservazione e gestione, Regione Piemonte, Assessorato Agricoltura, Tutela Fauna e Flora Ed., pp. 108-129.

Zbinden N., 2006. Status e gestione venatoria del Fagiano di monte in Canton Ticino, Svizzera. In: Atti Conv. I Galliformi alpini: esperienze europee di conservazione e gestione, Regione Piemonte, Assessorato Agricoltura, Tutela Fauna e Flora Ed., pp. 66-82.

Alectoris graeca (Roberto Audino)