OF MOUNTAINS AND MARMOTS:
CLIMATE CHANGE IN THE FRENCH ALPS

2013
FIELD REPORT
Of Mountains and Marmots: Climate Change in the French Alps

2013 FIELD REPORT

Background Information

LEAD PI: Aurélie Cohas
REPORT COMPLETED BY: Aurélie Cohas & Marion Tafani
PERIOD COVERED BY THIS REPORT: July 15, 2012 to July 15, 2013

CHANGES TO:
PROJECT SCIENTISTS: Leaving: Sophie Lardy Marion Tafani
Entering: Pierre Dupont, PhD
Cindy Canale, Postdoc
Benjamin Rey, engineer
Entering next January: Coraline Bichet, Postdoc Marie-Lea Travers

RESEARCH SITE: No
RESEARCH SITE LATITUDE / LONGITUDE: No
PROTECTED AREA STATUS: No
Dear all,

Thank you so much for your deep investment in this field season that permitted us to complete a very successful 2013 season. We are really grateful to the first teams who were facing particularly difficult weather conditions but kept smiling and joking everyday! Thanks to all of you. Thanks to your involvement, we captured 132 marmots and 64 pups.

We started monitoring 6 new marmot territories and captured the 44 marmots occupying these territories. We also managed to monitor a completely new marmot population at the golf course of Tignes, determining territories and boundaries, and also mapped all the burrows and captured up to 50 new marmots from 17 different families. Additionally, more smell experiments have been realized, insuring enough sample size to start running deep analyses on these data! After an especially late first emergence of the pups this year (7 days late compared to the 23 previous years...), we finally saw the first pup’s nose!

We warmly thank all the volunteers involved in searching and counting pups for their dedication to a task that is not always very rewarding. Indeed, your help was especially precious this year as all the pups emerged in a really short period of time, making their capture really difficult and time-consuming for the scientific team. We would also like to warmly thank everyone for the processing of the data: hair cutting, blood cell counting, and data entry. Finally, thanks for all the translation jobs that permitted us to finish the translation of our website in English and preparing next year’s protocols involving vegetation surveys and frog monitoring in the Alps!

Your help was very much appreciated,

We hope to see you again soon,

The marmot team
SECTION ONE: Scientific research achievements

TOP HIGHLIGHT FROM THE PAST SEASON
This year we conducted the first ultrasounds of Alpine marmots and we were able to see and count the small fetuses in the belly of two dominant females! This opens a wide range of new opportunities to access an unknown area in burrowing mammals, which is neonatal mortality and pup mortality before their first emergence from the natal burrow!

REPORTING AGAINST RESEARCH OBJECTIVES
We are not done with analyzing the effect of local climatic variables on litter size.

The way that plants and animals respond to climate change varies widely among species but the biological features underlying their actual response remains largely unknown. Here, from a 20 year long monitoring study, we document a continuous decrease in litter size of the Alpine marmot (Marmota marmota) since 1990. To cope with harsh winters, Alpine marmots hibernate in burrows and their reproductive output should depend more on spring conditions compared to animals that are active year-round. However, we show that litter size decreased over years because of the general thinning of winter snow cover that has been repeatedly reported to occur in the Alps over the same period, despite a positive effect of an earlier snowmelt in spring. Our results contrast markedly with a recent study on North American yellow-bellied marmots (what’s the contrast? was there an increase in litter size?), suggesting that between-species differences in life histories can lead to opposite responses to climate change, even between closely related species. Our case study therefore demonstrates the idiosyncratic nature of the response to climate change and emphasizes, even for related species with similar ecological niches, that it may be hazardous to extrapolate life history responses to climate change from one species to another.

Figure 1. Yearly variation in litter size of Alpine marmots and average snow cover in winter (from December to March) at La Grande Sassière (French Alps). Litter size is represented in red (with confidence interval around the average in grey) and snow depth in blue.
Figure 2. Annual variation in residual body mass of female Alpine marmots at La Grande Sassière (French Alps) between 1996 and 2011, after accounting for possible confounding effects of capture date, gestation status (pregnant vs. lactating) and spring conditions (April temperature and precipitations). Filled circles represent the average body mass per year across all females with their standard error bars (grey). Lines represent the regression of residual body mass through time (bold) and its associated confidence interval (dashed). The mean relative abundance of turtles across creeks was determined through abundance surveys. The greatest abundance was seen in Half Sound and Winding Bay and the fewest were in Deep Creek and several tidal creeks were no turtles were observed (Figure 2).
SECTION TWO: Impacts

PARTNERSHIPS

Current active partnerships:

- Vanoise National Park: provide authorization to capture the marmots and validate field protocol as well as provide punctual logistic support and a fixed contact point during field season
- University of Lyon, LEHNA: Thierry Lengagnes: collaboration on communication regarding Alpine marmot
- University of Barcelona: Bernat Claramunt Lopez: running a similar study on an introduced population of Alpine marmot
- Slovak Academy of Sciences: Radovan Vaclav: collaboration on genotyping of Marmota marmota latirostris
- Polish Academy of Sciences: Jacek Radwan: collaboration on MHC genotyping of Alpine marmot
- NASA: provide NAO and NDVI data
- Meteo France: provide climatic data (temperature, precipitation, etc…) over different meteorological stations around the study site
- Service des pistes de Tignes and Val d’Isère: provide snow cover data for Tignes and Val d’Isère
- Centre d’étude de la neige: provide model of snow cover over the study site
- Mairie de Tignes: provide a local to store the field outside field season

New partnerships of this year:

- Golf de Tignes: ensure access to a second population of marmots
- University of Zurich: Arpat Ozgul: collaboration regarding marmot population dynamics
- University of Strasbourg: collaboration regarding measuring body fat in marmots
- University of Montpellier: Roger Pradel: Group dynamics and impact on population dynamics

CONTRIBUTIONS TO CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS

- **International**
  The marmot project is part of a European network of research teams working on alpine marmots (one team from the CREAF (Barcelona, Spain) in the Pyrenees. Other teams are from both the Gran Paradiso National Park and the UQAM (Quebec, Canada), and from the Institute of Zoology of the Slovak Academy of Sciences (Bratislava, Slovakia) in the Tatra mountains, who are studying the endangered subspecies M. marmota latirostris. Additionally, this year, one team from the University of Zurich is starting a new study on Alpine marmot. All these teams are conducting the protocol we defined for the purpose of comparison and generalization of our findings. The marmot project is also part of an international network of researchers, all working on different species of marmots. A conference on marmot research is held every three years by this group.

- **National or regional**
  Dominique Allain is a member of the scientific committee of the Vanoise National Park, and as such, his expertise acquired through the project is taken into account, especially when in relation to management plans. Since last summer, a management plan proposed by Dominique Allain has been implemented to mitigate social conflicts between land owners and marmots in the Maurienne valley (France). Aurélie Cohas and the marmot project is involved in the ESCN, a newly created working group composed of young researchers from all over France that work in close proximity with managers. This working group aims at transferring scientific knowledge acquired from each scientific project such as the marmot project to managers and to educate and help managers towards the practical environmental issues they are facing.

- **Local**
  Dominique Allain is a member of the scientific committee of the Grande Sassière National Reserve, and therefore his expertise is taken into account for the reserve management plans.
DEVELOPING ENVIRONMENTAL LEADERS

- Creation of an association “Les amis des marmottes alpines/ Friends of the Alpine marmots” which aims will be to communicate to the widest public possible the research done on the Alpine marmot project as well as to specifically keep in touch with the Earthwatch volunteers. This association is now recognized of “Public interest” by the French administration.
- The “marmot day” where tourists are invited to discover the work conducted during a half day in the field with a tour and a talk of Aurélie Cohas; Retransmission of the marmot day on local press, radio and TV.
- Summer conference held in Tignes by Dominique Allainé to present the Alpine Marmot Project.
- We hosted a local teenager for 15 days who was interested in studying biology.
- Education relating to the environment via the schemes ASTEP and “La main à la pâte” in primary schools: explaining the societal challenge of biodiversity conservation.
- Master level classes (M1 and M2) in Conservation Biology, Evolutionary Biology and Behavioural Ecology.
- 5 graduate and postgraduate students involved in the field.
- 2 master students, one continuing in PHD with us the other one searching for a PHD funding
- 2 PhD students
- 1 PhD thesis completed
- 2 postdocs

ACTIONS OR ACTIVITIES THAT ENHANCE NATURAL AND/OR SOCIAL CAPITAL

Conducting such a project on an endemic species of the Alpine Arc is all the more relevant because the climate change threats on distribution range and extinction risks are particularly acute at high latitude and high elevation ecosystems (Arctic, Antarctic, Alpine range). And indeed, many warning signs have been documented over the last 10 years for Alpine or high Arctic species such as caribou, polar bear, or ptarmigan. These areas are highly relevant indicators for the monitoring of consequences to climate change on our environment and its biodiversity. Moreover, the Alpine marmot is a keystone species of the alpine ecosystems, birds of prey rely on marmots to feed and marmots through grazing enhance the biodiversity of endemic alpine plants species. Thus, maintaining marmots is crucial to the maintenance of alpine ecosystems and monitoring marmots, as a bio-indicator, will help assess the health state of the alpine ecosystem.

CONSERVATION OF TAXA

Beyond our research on Alpine marmots, we are launching long-term monitoring of climate data (installation of a weather station to record climatic data), monitoring of the phenology of several endemic plant species present in the reserve, as well as the mitigating of bird and amphibian species (the protected common red frog).

CONSERVATION OF HABITATS

See above

IMPACTING LOCAL LIVELIHOODS

The Alpine Marmot Project has an impact on the local community through:

- **economy:** renting a flat, buying local goods (especially food), employing one local person at a moment where there is no much economical activities in Tignes (ski resort closed);
- **training:** through informal discussions with the Vanoise national park rangers: presentation of the Alpine marmot project scientific results, help to establish scientific protocols, networking;
- **education:** through informal and formal discussions with the local people when visiting the field or coming to conferences.
LOCAL COMMUNITY ACTIVITIES

- From this year and every year now, we organize a “Marmot Day”, the occasion for the local community and the tourist to visit the field site and discover The Alpine Marmot Project;
- Each year: one local teenager is invited to spend from one day to 15 days in the field with us to collect data and discover The Alpine Marmot Project;
- One conference to discover The Alpine Marmot project held every summer in Tignes;
- Informal talk with the hikers visiting the field site;
- Special links to the local rangers (see above);
- Special links to local guides that make the visit to The Alpine Marmot Project, a highlight of their tour.

DISSEMINATION OF RESEARCH RESULTS

Scientific peer-reviewed publications
Earthwatch is acknowledged in the following publications


Publications can be found: [http://projetmarmottealpine.org/publications/scientific-publications/](http://projetmarmottealpine.org/publications/scientific-publications/) and are provided all year round once published to Kate Grounds

Grey literature and other dissemination
Available at: [http://projetmarmottealpine.org/publications/](http://projetmarmottealpine.org/publications/)

Printed:

Educational resources:
- Teaching resources for primary school (hope to put that on the web next year)
- Master classes resources (available only to the University students)

Meetings and conferences:
- Local community meetings and events
- The marmot Day
- Tignes Marmot Conference

MEDIA AND WEB

Press

Websites
- [http://projetmarmottealpine.org](http://projetmarmottealpine.org)
SECTION THREE: Anything else

PROJECT FUNDING

• One intra-European fellowship for the 2 year-postdoctoral fellowship of Cindy Canale (20 000 euros + salary);
• One AXA research grant for Aurélie Cohas and Cindy Canale that will allow us to buy some field materials necessary to study the response of marmots to climate and the physiological mechanisms behind it (30 000 euros);
• A French Research Agency grant (ANR Jeune chercheur) for Aurélie Cohas to continue on the mate choice project for the three next years (287,000 euros);
• A FR41 grant to understand genetic diversity of Alpine marmots across the Alps and the Pyrenees (6,000 euros);
• 3 new PhD students: Vérane Berger (salary), Pierre Dupont (salary) and Celia Rezouky (salary + 5,000 euros).

IS THERE ANYTHING ELSE YOU WOULD LIKE TO TELL US?

Please notice that we put most of the information you can be interested in on our website:
http://thealpinemarmotproject.org/

ACKNOWLEDGEMENTS

The Alpine Marmot Project is supported by the University Claude Bernard Lyon 1 and the CNRS. Running The Alpine Marmot Project would not be possible without the authorization of the Vanoise National Park. Thanks are also extended to all the Vanoise National Park's rangers, Gwendal, Jean-Luc, Sabine and Vanessa and to all the EDF employees. We also acknowledge the important contribution of staff at the Earthwatch Institute, warm thanks to Lucy and Kate for always being there.