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Marie Curie Actions – International Fellowships

Project No: 300077

Project Acronym: RAPIDEVO

Project Full Name: Rapid evolutionary responses to climate change in natural populations: Integrating molecular genetics, climate predictions and demography into an eco-evolutionary modelling framework

Marie Curie Actions

Mid-term Report

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Project coordinator name:
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Project coordinator organisation name:
POLITECNICO DI MILANO

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Mid-term Report

PROJECT MID-TERM REPORT

Grant Agreement number:	300077
Project acronym:	RAPIDEVO
Project title:	Rapid evolutionary responses to climate change in natural populations: Integrating molecular genetics, climate predictions and demography into an eco-evolutionary modelling framework
Funding Scheme:	FP7-MC-IOF
Period covered - start date:	01/01/2013
Period covered - end date:	31/12/2013
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1. WORK PROGRESS AND ACHIEVEMENTS DURING THE PERIOD

Please provide a concise overview of the progress of the work in line with the structure of Annex I of the Grant Agreement.

- A summary of progress towards objectives and details for each task;
- A summary of the progress of the researcher training activities/transfer of knowledge activities/integration activities (as it applies for the MC action);
- Highlight clearly significant results;
- If applicable, explain the reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning;
- If applicable, explain the reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning (the explanations should be coherent with the declaration by the project coordinator) ;
- A statement on the use of resources, in particular highlighting and explaining deviations between actual and planned researcher-months in Annex 1 (Description of Work)
- If applicable, propose corrective actions.

Work progress and achievements during the period:

- A summary of progress towards objectives and details for each task;

As described in the GANTT of the RAPIDEVO project, Dr. Vincenzi had the following tasks to be completed in the first year of the RAPIDEVO project:

1. Developing genetic markers for marble trout;
2. Statistical analysis of field data, including a literature review;
3. Preparation of data for the analysis of common garden experiment.

For all 3 tasks, Vincenzi is on track and achieved relevant results. For (1) Vincenzi developed a panel of SNPs for marble trout that will be soon used to reconstruct pedigrees in marble trout populations. For (2) Vincenzi carried out an extensive literature review and analyzed growth trajectories of marble trout living in the monitored populations. The problem of analyzing the determinant of growth trajectories in marble trout motivated the development of novel statistical and computational techniques to separate the relative contribution of shared and individual processes to the realized growth trajectories. For (3) Vincenzi had to prepare a database with the information on the common garden experiment that started in 1998 in the fish farm of Tolmin (Slovenia). The information was quite messy, but thanks to Vincenzi's effort the database is now in much better shape.

- A summary of the progress of the researcher training activities/transfer of knowledge activities/integration activities (as it applies for the MC action);

In term of training activities, the GANTT defined for the first year of the RAPIDEVO project training in SNPs and their application for parentage analysis. Vincenzi had training both in the wet lab and in bioinformatics for Next-Generation sequencing using Illumina miseq sequencer, genome assembly, SNPs discovery and use of SNPs for parentage analysis using general and ad hoc software. Vincenzi presented the results of the study of the demographic traits of marble trout with an oral presentation in San Diego, CA, US in June 2013 at the meeting of the Society for Industrial and Applied Mathematics. Vincenzi also presented two seminars on demographic and genetic traits of marble trout at the National Marine and Fisheries Service's Lab in Santa Cruz, CA, US (April and September).

Vincenzi is also co-supervising 2 PhD students at the University of Parma as part of the transfer of knowledge activities.

- Highlight clearly significant results;

Vincenzi identified SNPs panels for marble trout population with sufficient power to reconstruct the pedigree of fish that have been sampled in the monitored population. In the next six months, the reconstruction of pedigrees will be completed.

Vincenzi developed a theoretical model to investigate the evolution of somatic growth rates when flood events periodically cause population collapse (see submitted publication #1). He found that the evolution of growth rates following the occurrence of flood events does not increase the probability of persistence of populations, an interesting and counterintuitive result.

Vincenzi developed and analyzed a computer model of the evolution of a quantitative trait and associated population dynamics when a climate trend is accompanied by an increase in climate extremes (such as high temperatures) and point extremes (such as storm and floods) (see submitted publication #2). He found that selection on the quantitative trait is the most important determinant of extinction risk and that the interaction between climate processes (trends and extremes) contributes little to population and extinction dynamics after the individual role of the processes has been accounted for.

Vincenzi analyzed growth trajectories of marble trout (as part of the task “analysis of field data”) and developed a novel and sophisticated methodology to distinguish between the shared and the individual determinants of growth (see submitted publication #3). In particular, Vincenzi developed an Empirical Bayes approach that provides stable, efficient, and fast estimation of parameters of random-effects models. By applying the Empirical Bayes method, Vincenzi found that cohort effects (probably mechanistically caused by climatic vagaries in the first year of life of marble trout) are the major determinant of individual growth trajectories.

Vincenzi submitted the following manuscripts associated with the RAPIDEVO project:

1. “Eco-evolutionary dynamics induced by massive mortality events” submitted to Journal of Fish Biology
2. “Extinction risk and eco-evolutionary dynamics in a variable environment with increasing frequency of extreme events” submitted to Proceedings of the Royal Society Interface.
3. “Determining individual variation in growth and its implication for life history and population processes using the Empirical Bayes method” submitted to PLoS Computational Biology

- If applicable, explain the reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning;

There were no deviations from Annex I. All critical objectives have been achieved during the first period and no deviations have been observed between the actual and planned research months.

- If applicable, explain the reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning (the explanations should be coherent with the declaration by the project coordinator);

The project is on schedule and is achieving the critical objectives.

- A statement on the use of resources, in particular highlighting and explaining deviations between actual and planned researcher-months in Annex 1 (Description of Work)

Vincenzi worked full time on the RAPIDEVO project, as planned.

- If applicable, propose corrective actions.

There are no necessary corrective actions.

2. ADDITIONAL INFORMATION

Comments:

3. PROJECT MANAGEMENT

Please use this section to summarise management activities during the period:

- Project planning and status - from management point of view;
- Problems which have occurred and how they were solved or envisaged solutions;
- Changes to the legal status of any of the beneficiaries, in particular, SME status;
- Impact of possible deviations from the planned milestones and deliverables, if any;
- Development of the project website (if applicable);
- Gender issues; Ethical issues;
- Justification of subcontracting (if applicable);
- Justification of real costs (management costs);
- Other

For 2007 and 2008 calls a detailed description of costs related to management and overhead is requested

Project management:

- Project planning and status – from management point of view;

Vincenzi had a brilliant first year of the RAPIDEVO project. All training, research, dissemination activities have been carried out as scheduled in Annex I and the Career Development plan. Next year Vincenzi will focus on investigating adaptive divergence and adaptive evolution in marble trout population as well as reconstructing the pedigrees. In addition, Vincenzi will develop a demographic model for marble trout.

- Problems which have occurred and how they were solved or envisaged solutions;

Up to December 2013, no problem occurred.

- Changes to the legal status of any of the beneficiaries, in particular, SME status;

There was no change of status of any of the beneficiaries.

- Impact of possible deviations from the planned milestones and deliverables, if any;

There were no deviations from planned milestones and deliverables.

- Development of the project website (if applicable);

A section of the academic website of Vincenzi (<http://simonevincenzi.com/rapidevo/>) is devoted to inform the public of the status of the project. Preprints and computer code are publicly available either on the website or on the figshare page of Vincenzi's (http://figshare.com/authors/Simone_Vincenzi/388646).

- Gender issues; Ethical issues;

There were neither gender nor ethical issues.

- Justification of subcontracting (if applicable);

No subcontracting was necessary up to December 2013.

- Justification of real costs (management costs);

Dr. Vincenzi had the following expenses related to the project Marie Curie and associated activities:

- Meeting of the European Society of Evolutionary Biology 2013, in Lisbon (Portugal) -- \$3723.85 (flight + hotel + conference fee + general expenses)
- Trip to Italy and Slovenia for sampling of marble trout, June 2013 – \$2307.65 (flight +

accommodation + general expenses)

- Purchase of office material and repair of a Macbook -- \$372,00
- Health insurance -- \$1288,00 (from 1st of January until 31st of August 2013).

Attachments

The content of this report has been approved by the researcher and the scientist in charge assigned to this project. The electronic submission of this report shall replace their signatures.

This declaration was visaed (signed) electronically by Marino GATTO (ECAS user name ngattomn) on 07/01/2014