

Final report WG1 of COST Action ES1304

European network on invasive parakeets: understanding invasion dynamics and risks to agriculture and society (ParrotNet).

Tasks, milestones and outlook

The objective of working group 4 (impacts on society/economy/environment, and public perception) was to define and quantify the current impacts of parakeets on European agro-economy, society and wildlife, and to evaluate the socio-ecological feasibility of policies aiming at reducing those impacts. This task involved compiling datasets from published and unpublished sources on the impacts of parakeets on agriculture, environment, the economy, human health and society. Although parakeets are well-established alien species in Europe, available evidence about their impacts, the methods to mitigate or control their population, and the way that the general public perceives them, remains scarce. We therefore focused on collecting additional data and on harmonizing methodologies to promote further, more relevant data collection on the consequences of parakeets' invasion and on the means to mitigate them. WG1 comprised Action participants, including researchers in ecology and social science, as well as practitioners and other field experts with experience in parakeet management from various perspectives. Following the MOU, the work was carried out according to the three tasks proposed to meet three related milestones:

Task 1: Identify main categories of potential impact spanning both natural and social science areas and evaluate quantity and quality of information available.

Milestone 1: Produce schematic flowchart identifying main categories of impacts informed by data evaluation and key knowledge gaps.

Task 2: Harmonise data sets and approaches used to quantify parakeet impacts. Develop protocols and propose pan-European standardised methods for data collection and synthesis. Identify key gaps in data.

Milestone 2: Propose standardised methods for data collection.

Task 3: Assess actual and expected impacts of parakeets on agricultural, human health, environmental and socio-economic sectors at national and European scales and evaluate to what extent public perception may constrain actions. Where possible, spatial and temporal trends in impacts will be quantified.

Milestone 3: Publish trends in parakeet impacts and circulate to stakeholders, database managers and EC officers.

Task 1, M1: Identifying main categories of impacts

During the first year of our COST action, two action participants, Emillio Morri and Mattia Menchetti, published a review of the main impacts of parrots on a global scale (Morri and Menchetti 2014). Although this work partly achieved Milestone 1, it was not EU oriented and it did not attempt to systematically map the existing evidence. In particular, it did not systematically cover peer-reviewed as well as grey literature, nor did it ensure a coverage of the different languages and regions of Europe. We therefore decided to map all the existing evidence on parakeet impacts by conducting a multi-linguistic systematic review of each of the different parrot species found in Europe. This work was initiated during the first and second COST **meetings in the Canterbury, England and in Doñana, Spain** (Year 1). In September 2014, we held an additional **workshop in the University of Kent, England** to identify and classify the main categories of potential impacts, therefore achieving the first part of **Task 1** and **Milestone 1**.

During the meeting in Heidelberg (Year 2), we developed a novel review procedure, the wiki review, to carry out the systematic mapping and evaluation of the evidence across languages, regions and types of evidence. For each of the impacts categories identified, one or two members from our COST action volunteered to write a short 3-4 pages sub-review that covered all parrot species found in Europe. An initial database of all relevant data sources was then compiled from the sources identified by each of the sub-reviews composers. The resulting sub-reviews and database were then reviewed and assessed by most of our COST members, as well as by additional experts, during the **Florence meeting** (Year 2) and afterwards. Reviewers were asked to add any additional relevant information or data sources from their countries. At the end of the process, a database of 384 impact entries from Europe and across the world was obtained. Additionally, it was decided in the Florence meeting to supplement this evidence base by a survey of various stakeholders, in order to ensure that we identified all sorts of impacts within Europe, not only published ones. Stakeholders included farm associations, regional/national government officials responsible for agricultural damage, public complaints officer, bird or nature conservation NGOs. Altogether, over 80 stakeholders from eight different countries were contacted, resulting in only limited additional evidence about parakeet impacts. An **STSM by Dr. Rachel White** (vising Israel, year 3) was then used to compile these sub-reviews and map the evidence. Altogether, this work has yielded the most comprehensive database on parakeet impacts in Europe and worldwide. This database allows to assess the risk of parakeets'

invasions by impact category and shows the gaps in knowledge. The objectives of **Task 1** have thus **been fully achieved, as well as the first part of task 2**, “harmonise data sets and approaches used to quantify parakeet impacts”. This work was recently presented at the International Conference of the Society of Conservation Biology in Cartagena, Colombia and it is at advanced stages of writing, soon to be submitted to one of the leading journals in the field of Invasion Biology.

Task 2, M2: Propose standardised methods for data collection

In task two, we aimed to harmonise datasets and approaches to quantify the impacts of parakeets and to develop protocols and propose pan-European standardised methods for data collection and synthesis. For this purpose, we held a first **workshop in Leeds, England** in Year 1 to explore how experience assessing the impacts of birds as pests might relate to an invasive species, such as parakeets. During the second year, we held an additional **workshop in Tallinn, Estonia** for developing protocols and harmonizing methodologies. We did this for the impact category with the highest potential to cause damage in Europe. To this end, workshop participants were asked to collect information about the impacts of parakeets in their country prior to the meeting. Damage to agriculture emerged as the highest risk, especially in Mediterranean Europe. The workshop then focused on developing three protocols for assessing damage to orchards, sunflowers and vegetables, respectively. **The methodological report** produced in the Tallinn workshop was **uploaded to the website** of our COST action as part of our dissemination efforts.

These methods were further assessed and developed in Spain and Israel, the only locations with reports of significant damage to agriculture. In Year 2 and 3, Alvaro Luna and Jose Postigo from Spain each made an **STSM** to Israel to test-trial and further develop those methods. The results of the second STSM were presented at the 10th European vertebrate pest control conference in Seville 2015 and this work has already yielded a publication in a leading journal in agriculture and pest management (Postigo et al. 2016 Pest Management). Additionally, participants from our COST action implemented these protocols in their own research (over 12 fields in Spain and Israel and one experiment in an almond orchard). Several studies aiming to assess the impact of parakeets on agriculture are currently underway, at different stages of advancement. **Milestone 2**, “propose standardised methods for data collection” has thus been achieved, and even surpassed by conducting field research using the methods and tools that were developed.

Task 3, M3: Assess actual and expected impacts of parakeets

The key output of Task 1 (the wiki review), which is at an advanced stage of writing, already achieve Milestone 3 “publish trends in parakeet impacts and circulate to stakeholders”. However, one of the key and early output of Task 1 indicated that the **knowledge on impacts was scarce and consisted mostly on evidence form the native range and from anecdotal evidence** from Europe. We therefore started to explore how such information is being used or can be used to inform policy and got aquatinted with impact/risk assessments protocols. Plethora of different IAS risk and/or impact assessment protocols have been proposed, but it remains unclear whether, how and why the outcomes of such assessment protocols may differ. To answer this gap in knowledge, we have organized a **workshop in Paris, France** (Year 2), in which we have assessed the consistency among four prominent protocols for assessing IAS impacts, by applying them to the same species. The workshop, followed by an **additional STSM of Dr. Diederik Strubbe to Israel**, has led to two publications on the topic in leading journals (Turbe et al. 2017 Diversity & Distributions; Vanderhoeven et al. 2017 Biological Invasion). This work was also recently presented at the International Conference of the Society of Conservation Biology in Cartagena Colombia. We show that there is substantial variation in the estimated impacts depending on the protocol and the assessment method used to apply the protocol. These results are of high policy relevance for the EU. Species can be designated as 'IAS of European concern' after having been assessed through any one of a set of risk assessment protocols that meet minimum requirements, however, it is possible that different conclusions would be reached with another protocol/assessment methodology. Currently, lack of transparency in the impact assessment methodologies and underlying data used to reach assessment conclusions, hinders repeatability.

Drawing sound, scientifically-informed, policy and management recommendations for parakeets thus remains a difficult task. On the one hand, findings from earlier tasks and from the impacts database show that there are various types of evidence, that vary in their quality and that can be conflicting. On the other hand, we have identified limitations with the existing impact/risk assessment protocols used to compile this evidence, and with the way that they are applied. Undiscerning assessments may cause more damage than good. For instance, the risk in making ill-conceived calls for mitigation of charismatic alien species may result in a public backlash, causing funding agencies and managers to shy away from the problems posed by invasive alien species. We therefore used the last **three meetings in Turkey, Porto and Israel** to discuss and develop a novel framework for conducting

risk/impact assessments that map all available evidence and provide transparent and repeatable analysis of impacts to allow taking informed policy decisions. We are currently in the final stages of writing a concept paper calling for this step change and suggesting this framework. We test- case this framework using the database collected in the wiki review about the impacts of alien parakeets in Europe. We expect to submit this manuscript soon to Conservation Letters.

The work conducted in Task 1 also revealed that the potential human well-being benefits of charismatic non-native species have so far been overlooked. Ring-necked parakeets, for example, present a risk to Europe's agro-economy and environment, prompting calls to control the species. Yet, many people like to interact with them within parks and gardens. This represents a complex socio-environmental conflict that may constrain actions for charismatic species. Two studies are conducted to explore this interesting issue that is pivotal for the implantation of any mitigation program for those species. The first project used psychometric methods to compare perceptions between different stakeholders (e.g., visitors to gardens with/without parakeets, people living in close proximity to roost sites). This study was conducted in collaboration between Dr. Assaf Shwartz from Israel and Dr. Pim Edelaar from Spain and as part of this work **Alvaro Luna came to Israel for an STSM** in year 1 of the COST action and we are now currently writing the manuscript. Another way to tackle this issue is by using an economic approach. Choice experiments (a stated preference non-market valuation technique) were used to quantify people's willingness-to-pay (WTP) for management of morphologically similar pairs of non-native and native species (which can also be pests). Questionnaires were administered to 3,000 people in the UK, Netherlands and Germany, using a split design (half the respondents were given impact information for each species). A pilot of the survey was administered and the final questionnaire design is currently being created, informed by these responses. We plan to analyse these data and write the manuscript during the first half of 2016.

Finally, several members of our COST action have conducted a critical assessment of the new EU legislation regarding invasive alien species. Together with members of COST Action TD1209, we wrote a paper which was published in Conservation Letters (Tollington et al. 2016). This work was also disseminated and presented in the international Neobiota conference (Antalya, Turkey November 2014) by a COST Action member. The four ongoing studies on parakeets' impacts, people's perceptions on parakeets and the novel concept of transparent and inclusive risk/impact assessment, together with the already published work conducted tasks 1 & 2 **achieve Milestone 3** "publish trends in parakeet impacts and circulate to stakeholders, database managers and EC officers". However, to ensure that the work of this COST Action will be also disseminated to various stakeholders, practitioners and EC officers, we are currently in the final stages of producing a policy brief regarding alien parakeet in Europe. This policy brief summarizes all the knowledge gathered in this COST Action,

also taking into account the information collected on parakeet impacts, which was the main objective of this WG.

Lists of outputs year 1: (excluding the general cost meetings)

Workshops:

- The systematic review workshop (September 2014, Kent UK): The meeting included a review of the concept of systematic reviews and existing frameworks for assessing impacts of alien species in order to assist in consolidation of guidelines necessary for creating a protocol for conducting a systematic review to assess the impacts of parrots in Europe. Those topics were presented and discussed during the first day and the following day was dedicated for taking decisions on the framework that will be adopted in this systematic review and identifying the impact categories. (16 participants from 7 countries)
- Parakeets as agriculture pest workshop (July 2014, Leeds UK): we explored expertise in assessing the impacts of birds as agriculture pests and how that experience might related to an invasive species, such as the rose-ringed parakeet. (four participants from two countries)
- Evaluating methodologies to assess the potential risks caused by parrots (March 2016, Paris France): The aim of this two days' workshop was to conduct impact assessments for the two most widespread invasive alien parakeets in Europe, the Monk parakeet (*Myiopsitta monachus*) and the Rose ringed parakeet (*Psittacula krameri*) following four protocols that are close to meeting the minimum standards set by the EU regulation (Roy et al., 2014) : Harmonia+ (Dhondt et al. 2015), Great Britain Non Native Species Risk Assessment (Defra), GISS (Kumschick and Nentwig, 2010) and GISS IUCN (Blackburn et al., 2014). This would enable a comparison of the outcomes for the same species under different methodologies and to critically assess the risks posed by non-native parakeets in Europe. (16 participants from 11 countries)
- Developing and harmonizing methods to assess the damage of parakeets to agriculture system and society (July 2015, Tallinn Estonia): The objective of this two days' workshop was to develop protocols for assessing the damage parakeet cause to agriculture system and society. Although some parakeets are known to cause much damage to agriculture, infrastructures and society, most evidence remain anecdotal and it is therefore important to harmonize research methodologies to enable prediction of agricultural, economic, societal impacts to promote evidence based policy. The meeting included three parts: (1) review of current knowledge on societal and agriculture impacts and assessing potential impact for the relevant MS. This was accomplished by asking representatives from each country to first information about impacts of parakeets on agriculture, infrastructure or noise. Second identify the potential crops that are at risk for each country from a list of crops that are known to be attractive for parakeets; (2) an overview of existing methods of evaluating agriculture and societal damages; and (3) protocol development - based on that information, three protocols had been developed, accounting for three types of crops that are widespread in Europe and that known to be favoured by parakeets (i.e., sunflowers, fleshy fruits and tomatoes). Other societal impacts, such as noise and damage to infrastructure had been mentioned as well, but had not been thoroughly addressed during the meeting.

We decided to develop simple protocols for several stakeholders (e.g., farmers, researchers and governmental officials, undergrad and research students). Based on the information presented in the meeting and the extent of the problem regarding several specific crops, the protocols will focus on three types of representative crops: sunflowers (and corn) fleshy fruits (orchards), vegetable (e.g., tomatoes). Accordingly, three protocols were developed and they will be tested during the next agriculture seasons in Europe (spring-summer 2016). Regarding noise nuisances, DICE in Kent University have suitable equipment for measuring bird noise, which can be used to shed some light on this potential damage. Damage to infrastructure seems to be relatively negligible and will not be addressed at the moment. (20 participants from 10 countries)

STSMs:

- Dr. Thomas Lundhede, University of Copenhagen (DK) hosted by Dr. Zoe Davies, University of Kent (UK) – this STSM initiated a process of developing a stated preference questionnaire to evaluate public preferences for invasive parrots in Europe.
- Alvaro Luna, University Pablo de Olavide, Sevilla (ES) hosted by Dr. Assaf Shwartz Technion (IL) in this STSM a MSc student travelled to obtain supplementary training in analysing of social data on the way parakeets are perceived by different stakeholders.
- Jose Postigo, University of Granada, (ES) hosted by Dr. Assaf Shwartz Technion (IL) in this STSM a MSc student travel to develop and test methods for assessing the population size of monk parakeet and their distribution in close proximity to agriculture areas.
- Dr. Strubbe Diederik, University of Antwerp (BE) hosted by Dr. Assaf Shwartz Technion (IL) in this STSM Dr. Strubbe travelled to work on the analysis of the workshop held in Paris about risk/impact assessment.
- Alvaro Luna, University Pablo de Olavide, Sevilla (ES) hosted by Dr. Yariv Malih from the Israeli Nature and Park Authority (IL) in this STSM a MSc student came to share knowledge on methods to assess impact of parakeet on agriculture and test try methods developed in the workshop in Tallinn.
- Dr. Rachel White, University of Briton (UK) hosted by Dr. Assaf Shwartz Technion (IL) in this STSM Dr. White came to work on the wiki review, develop the framework and conduct the analysis to advance the key output of WG1 the wiki review.

Publications (chronological order):

- Menchetti M. & Mori E. (2014) Worldwide impact of alien parrots (Aves Psittaciformes) on native biodiversity and environment: a review, *Ethology Ecology & Evolution* 26, 172-194.
- Tollington S., Turbé A., Rabitsch W., Groombridge J. J., Roy H. E., Scalera R., Essl F. & Shwartz A. (2016) New Invasive Alien Species policy in Europe will require Member States to take the lead. *Conservation Letters*.
- Postigo J.L., Shwartz A., Strubbe D., and Muñoz A.R. (2016) Unrelenting spread of the invasive monk parakeet *Myiopsitta Monachus* in Israel. Is it time to sound the alarm?" *Pest management Science* 73, pp 249-353.

- Turbé A., Strubbe D., Morid E., Carrete M., Chiron F., Clergeau P. González-Moreno P., Le Louarn M., Luna A., Menchetti M., Nentwig W., Pârâum L., Postigo J.H., Rabitsch W., Senar J.C., Tollington S., Vanderhoeven S., Weiserbss A. and Shwartz A. (2017) Assessing the assessments: evaluation of four impact assessment protocols for invasive alien species. *Diversity and Distributions*
- Vanderhoeven S., Branquart Y., D'hondt B., Hulme P.E., Shwartz A., Strubbe D., Turbe T., Verreycken H. and Adriaens T. (2017) Beyond protocols: improving the reliability of expert-based risk analysis underpinning invasive species policies. *Biological Invasions*.

Conferences:

- Neobiota 2014 (Antalya, Turkey). Turbé A., Tollington S., Rabitsch W., Groombridge J. J., Roy H. E., Scalera R., Essl F. & Shwartz A. New Invasive Alien Species policy in Europe will require Member States to take the lead (**oral presentation**).
- 10th European vertebrate pest control 2015 (Seville, Spain). Postigo J., Shwartz A., & Muñoz A.R. Monk parakeet population growth in Israel and Malaga Spain: Is it time to sound the alarm? (**oral presentation**).
- International Congress for Conservation Biology 2017 (Cartagena, Colombia). Rachel W., Strubbe D., Edelaar P. & Shwartz A. Assessing impacts of biological invaders using a transparent and inclusive evidence-mapping framework (**oral presentation**).
- International Congress for Conservation Biology 2017 (Cartagena, Colombia). Shwartz A., Turbé A. & Strubbe D. Assessing the assessments: Evaluation of four impact assessments for Invasive Alien Species (**oral presentation**).

Dissertations:

- Alvaro Luna, University Pablo de Olavide, Sevilla (ES)