SAKER FALCON TASK FORCE

COMPILATION REPORT ON WORKPLAN OBJECTIVES 4 – 8, INCLUDING A MODELLING FRAMEWORK FOR SUSTAINABLE USE OF THE SAKER FALCON *FALCO CHERRUG*

Nick P. Williams, Colin Galbraith and András Kovács

Coordinating Unit of the UNEP/CMS Raptors MoU

August 2013

RAPTORS MOU

CMS UNEP

Recommended citation

Williams, N. P., Galbraith, C. and Kovács, A. (eds.) (2013) Compilation Report on WorkPlan Objectives 4 – 8, including a modelling framework for sustainable use of the Saker Falcon *Falco cherrug.* UNEP/CMS Raptors MoU Coordinating Unit, Saker Falcon Task Force, Abu Dhabi.

Editors

Nick P. Williams (Programme Officer, UNEP/CMS Raptors MoU), Colin Galbraith (Chair of the Saker Falcon Task Force) and András Kovács (Specialist Technical Advisor)

List of Contributors

Adel Mohamed Al Awadhi (Bahrain), Abdulnasser Alshamsi (EAD, UAE), Michal Adamec (Slovakia), Monif AlRashidi (University of Hail, Saudi Arabia), Aurelie Boutrou (UNEP/CMS Raptors MoU), Evgeny Bragin (Kazakhstan), Nick Casey (Anatrack Ltd, United Kingdom), Nigel Collar (BirdLife International), Tom De Meulenaer (CITES), Andrew Dixon (IWC), Nicholas Fox (IWC), Colin Galbraith (Chair of the Saker Falcon Task Force), Maxim Gavrilyuk (Ukraine), Borja Heredia (CMS), Salim Javed (EAD, UAE), Daniel Kachelriess (CMS), Robert Kenward (IUCN), Umeed Khalid (Pakistan), Diane Klaimi (UNEP/ROWA), András Kovács (STA, UNEP/CMS Raptors MoU), Anatoly Levin (Kazakhstan), Gamal Gomaa Medani (MEW, UAE), David Morgan (CITES), Martiros Nalbandyan (Armenia), Elvira Nikolenko (Siberian Environmental Centre, Russia) Matyas Prommer (Saker Conservation LIFE+, Hungary), Tsogtsaikhan Purev (Mongolia), Jenny Renell (UNEP/CMS Raptors MoU), Katrin Schiffer (CMS Intern), Mohammed Shobrak (University of Taif, Saudi Arabia), Janusz Sielicki (International Association for Falconry and Conservation of Birds of Prey), Fernando Spina (CMS), Dragana Stojkovic (UNEP/CMS Raptors MoU), Mohammad Sulayem (Saudi Wildlife Authority), Andy Symes (BirdLife International), Johannes Stahl (CMS), Nick P. Williams (UNEP/CMS Raptors MoU) and Sadegh Zadegan (Islamic Republic of Iran).

Acknowledgements

We wish to extend our gratitude for the administrative and technical support for the report provided by the following people: János Bagyura (MME/BirdLife Hungary), Rosie Cooney (IUCN), Ivan Demeter (Hungary), Gergő Halmos (MME/BirdLife Hungary), Szabolcs Nagy (Wetlands International), Paulo Paixão (European Commission) and Laura Cerasi (CMS Secretariat).
For help with obtaining data we thank Mohammed Al Kathlan and the 37 falconers who completed questionnaires in the Kingdom of Saudi Arabia.

Prepared with financial contributions from the Environment Agency - Abu Dhabi on behalf of the Government of the United Arab Emirates, the Saudi Wildlife Authority on behalf of the Government of the Kingdom of Saudi Arabia, the European Commission on behalf of the European Union, the CITES Secretariat and CMS Parties.

Disclaimer

Cover image: Adult Saker Falcon © András Kovács/www.raptorimages.hu

Table of Contents

Introduction

CMS Resolution 10.28 (CMS, 2011) established the Saker Falcon Task Force (STF) and states that the Parties agree to provide financial and other resources to the operation of the Task Force and the implementation of the Concerted Action in cooperation with the Signatories of the Raptors MoU, Range States and other interested parties.

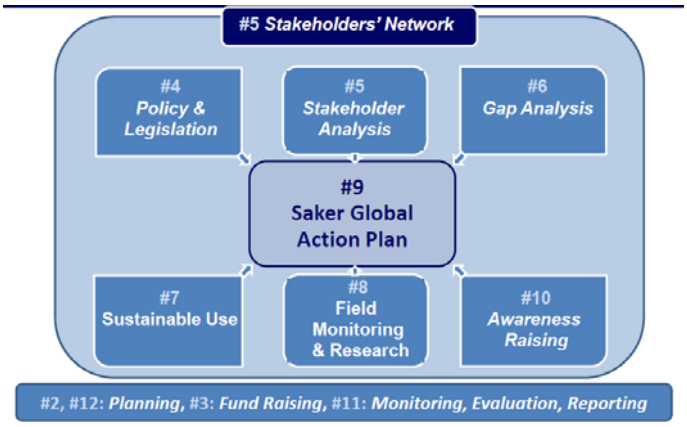
The Task Force brings together Range States of the Saker Falcon, co-operating Partners and other stakeholders to develop a coordinated Global Species Action Plan. Importantly, this Action Plan will include a management and monitoring system for the sustainable use of the species.

The Saker Falcon Task Force is expected to develop robust monitoring and management mechanisms to ensure that any use of the Saker Falcon is controlled and sustainable and is set within an adaptive management framework. This approach needs to be acceptable to the Parties potentially using and trading Saker Falcons, as well as to Parties not using this species but who have a keen interest in the overall implementation of the Convention. The viewpoints of the various stakeholders, including pro-use and conservation organisations, also need to be considered. The approach should, if possible, meet requirements from both CMS and CITES. The work requires clear, scientifically based evidence and a degree of practical knowledge to be effective.

The work on the Saker Falcon fits within wider initiatives on the conservation and management of birds of prey, and particularly within the framework of actions initiated under the UNEP/CMS Memorandum of Understanding on the Conservation of Migratory Birds of Prey in African and Eurasia (Raptor MoU).

The 1st meeting of the STF identified a number of key objectives and actions (*Figure 4*) required to develop the management and monitoring plan for the species.

Figure 1 Saker Falcon Task Force objectives and actions for developing the SakerGAP (STF, UNEP/CMS Raptors MoU, 2013)



The actions of Objectives 4 – 8 are of a preparatory character and planned to support the Action Planning process with the provision of important background information thematically. Due to the complexity of the conservation and management of the Saker Falcon, this information gathering should precede the Action Planning workshop.

Objectives 10 is aimed to raise awareness of stakeholders during and after the Action Planning process.

The necessarily working environment as the institutional, administrative, financial and technical background will be created and maintained by overall management actions under Objectives 1-3 and 11-12.

The priority objective of the WorkPlan is Objective 9: Develop a Saker Falcon Global Action Plan (SakerGAP).

The actions were primarily envisaged to be delivered by individual members of the Task Force and by the wider range of organisations involved. In addition, four short-term Working Groups were established thereby allowing further focussed discussion and collaboration between STF members, and the adoption of a common view for further review as part of the Global Action Plan Workshop later in 2013.

The four Working Groups (WGs) were:

Objective 4 Working Group to review relevant international policies and legislation

Objective 6 Working Group to conduct a knowledge gap analysis

Objective 7 Working Group to examine the sustainable use of wild origin falcons

Objective 8 Working Group to plan and implement fieldwork

The actions undertaken by the Working Groups were designed to explore the complexity and detail of the issues involved in the conservation and management of the Saker Falcon across the full extent of its range, throughout each of the stages of its annual cycle, including breeding, migration and wintering periods.

This Compilation Report covers the implementation of the STF WorkPlan Objectives 4 – 8 up to July 2013, by incorporating the reports produced by each of the 4 Working Groups, as well as a Stakeholder Analysis (Objective 5). It also includes the final report of a project carried out by consultants to elaborate a modelling framework to integrate population dynamics and sustainable use of the Saker Falcon *Falco cherrug*.

Saker Falcon Task Force, Objective 4 Working Group Report

A review of international policies & legislation in connection with the conservation, management and sustainable use of the Saker Falcon

Falco cherrug

Lead: András Kovács, Specialist Technical Advisor (UNEP/CMS Raptors MoU)

Contributors: Colin Galbraith (Chair of the Saker Falcon Task Force), Borja Heredia (CMS), Robert Kenward (IUCN), Diane Klaimi (UNEP/ROWA), Tom De Meulenaer (CITES), David Morgan (CITES), Katrin Schiffer (CMS Intern), Fernando Spina (CMS) and Nick P. Williams (UNEP/CMS Raptors MoU)

Draft: Final Draft

Date: 29 July, 2013

Acknowledgements

We wish to extend our gratitude for the administrative, technical and financial support for the report provided by the following people and organizations: Aurelie Boutrou, Dragana Stojkovic (Coordinating Unit, Raptors MoU); the Environment Agency, Abu Dhabi; the CITES Secretariat; Paulo Paixão (European Commission, Laura Cerasi (CMS Secretariat); and Mohammad Shobrak (Saudi Wildlife Authority, Kingdom of Saudi Arabia).

Recommended citation:

Kovács, A., Galbraith, C., Heredia, B., Kenward, R., Klaimi, D., Meulenaer, T. D., Morgan, D., Schiffer, K., Spina, F. and Williams, N. P. (2013) A review of international policies & legislation in connection with the conservation, management and sustainable use of the Saker Falcon *Falco cherrug*. *In:* Williams, N.P., Galbraith, C. and Kovács, A. (eds.) Compilation Report on WorkPlan Objectives 4 – 8, including a modelling framework for sustainable use of the Saker Falcon *Falco cherrug.* UNEP/CMS Raptors MoU Coordinating Unit, Saker Falcon Task Force, Abu Dhabi.

Table of contents

List of Tables

List of Figures

List of abbreviations

ASEAN	Association of South East Asian Nations
CBD	United Nations Convention on Biological Diversity
CBNRM	Community-Based Natural Resource Management
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
COP	Conference of Parties
CU	Coordinating Unit
GCC	Gulf Cooperation Council
ICU	Interim Coordinating Unit
IUCN	International Union for Conservation of Nature
IGO	Inter-Governmental Organisation
MEA	Multilateral Environmental Agreement
MoS	Meeting of Signatories
MoU	Memorandum of Understanding
NBSAP	National Biodiversity Strategies and Action Plan
NDFs	Non-detriment findings
NGO	Non-governmental Organisation
OECD	Organisation for Economic Co-operation and Development
Raptors MoU	UNEP/CMS MoU on the Conservation of Migratory Birds of Prey in Africa and Eurasia
SakerGAP	Saker Falcon Global Action Plan
STF	Saker Falcon Task Force
UAE	United Arab Emirates
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WWF	World Wildlife Fund

I. Executive summary

CMS Parties adopted Resolution 10.28 at the 10th Conference of Parties (COP10) held in Bergen, Norway on 25 November 2011. The Resolution acknowledges the listing of the Saker Falcon on CMS Appendix I, excluding the population in Mongolia, and decides to establish an immediate Concerted Action supported by all Parties. It also calls for the establishment of a Saker Falcon Task Force (STF) under the auspices of the Coordinating Unit (CU) of the UNEP/CMS MoU on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MoU).

The Task Force aims to bring together Range States of the Saker Falcon, as well as co-operating Partners and other interested parties, to develop a coordinated Saker Falcon Global Action Plan (SakerGAP), including management and monitoring mechanisms.

The purpose of this report is to gain an improved understanding of how the current legislative and policy background, and enforcement mechanisms could be reinforced with the support of the SakerGAP process, in order to gain more benefits for the conservation of the Saker Falcon.

The aim of this report is to document a review of relevant international policy and legislation, set as Objective 4 of the STF's 2012-2014 Work Plan, carried out by a temporary Working Group established by the STF

The report does not aim to review national legislation regarding the Saker Falcon and its implementation, although, it will be summarised in the SakerGAP on the basis of responses received to a Questionnaire circulated to all range countries of the species.

The geographical scope of the report is the global range of the Saker Falcon, including its breeding grounds, migration routes and wintering areas.

The approach used for to present the report contains: a problem formulation section; definitions of international legislation, policy and guidelines; compilation and analysis of the main relevant international legislative and policy tools and their interference, including a figure of international decision-making mechanisms in relevant leading MEAs and their synergetic implementation; and explanatory case studies to show underlying principles and potential solutions to similar conservation challenges.

A key task of the Saker Falcon Task Force is to develop expert opinion to feed into the SakerGAP, on whether current laws and policies relating to Saker Falcon, as pursued in recent decades, are effective or otherwise, or even counterproductive and harmful to the conservation and preservation/restoration of Saker Falcon in the long term/across its range.

The principal recommendation of the report is to involve international and national policy makers in the development of a synergetic and pragmatic legal and policy system that can potentially improve the present conservation status of the Saker Falcon in the long term through, *inter alia,* the controlled, legal and sustainable use of the species.

The recommendations will be developed further in the course of the SakerGAP process, especially after the Stakeholders' Meeting to be held in September 2013, and will be incorporated in the final report of a current Internal Cooperation Agreement between the Secretariats of CITES and CMS.

II. Introduction

Contemporary environmental problems, such as the rapid decline of the global Saker Falcon population (BirdLife International, 2013), require not only specialized knowledge about specific issues but also coordination and cooperation among close to two hundred countries of the world (Ivanova & Roy, 2007).

International environmental responsibilities and activities are spread across multiple organizations. The multiplicity of Multilateral Environmental Agreements, international conventions and agencies might seem necessary as environmental issues are complex and require specific responses that cannot be delivered by any single solution. The practical result, however, has been a series of jurisdictional overlaps, gaps, "treaty congestion", and an inability to respond as effectively as necessary to overarching environmental problems (Brown Weiss, 1995), although multiplicity in international environmental governance does not necessarily show complementarity, duplication, or conflict (Ivanova & Roy, 2007).

The present international legislative and policy background of the conservation of the Saker Falcon can be summarised as follows:

1. The Saker Falcon is currently listed on: CMS Appendix I, excluding the population from Mongolia which is included in Appendix II (as of August 2013); CITES Appendix II; Bern Convention Annex II; and EU Birds Directive Annex I (see chapter III.2 for more details). The Convention on Biological Diversity provides an overarching framework for biological conservation and as such it also covers the Saker Falcon. The CBD Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets include Target 12 about species protection that states: "*By 2020 the extinction of all threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained*".
   The Saker Falcon is listed in Category 1 (globally threatened species) of the CMS Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MoU), a legally non-binding agreement concluded under Article IV, paragraph 4 of the Convention.
   It is noteworthy that not all range countries are Signatories to relevant MEAs so the legislative basis concerning the Saker Falcon may differ to a large extent across its range and can result in inconsistent, and sometimes incompatible management measures internationally.
2. IUCN and BirdLife International currently classify the species as "Globally Endangered". IUCN "up-listed" the species from the "Vulnerable" category in 2012 because a revised population trend analysis indicated that it may be undergoing a very rapid decline (ca. 50% in the last 20 years).
3. Activity within or coverage of Multi-lateral Environmental Agreements (MEAs), in particular the biodiversity-related conventions, regarding the Saker Falcon has been extensive. MEAs encompass a wide range of threats to the Saker Falcon, from habitat degradation to the possibilities of legal or illegal harvest and trade. The level of co-operation among agencies responsible for implementing these MEAs varies from country to country, but in general, it would appear that there are significant opportunities for increased collaboration. The lack of communication and coordination between the responsible authorities and ministries at the national level under these MEAs may lead to ineffective and inconsistent implementation.

4. In order to enhance coherence and cooperation in implementation, a Liaison Group of Biodiversity-related Conventions has been established between the heads of the Secretariats of the six biodiversity-related conventions including CBD, CITES, CMS, Ramsar, the International Treaty on Plant Genetic Resources for Food and Agriculture and the World Heritage Convention in 2004 (CBD, 2013). The group meets regularly to explore opportunities for synergistic activities and increased coordination, and to exchange information.
5. International treaties and policies relevant to Saker Falcon conservation and management are generally well-known and often referred. However, the results of the laws and policies that may indirectly affect Saker Falcon populations have been less explored to date.
6. The policies of key stakeholders regarding the utilization of the Saker Falcon have often lacked a sound scientific approach and compliance to the principles of conservation of natural populations. This is partly due to extensive knowledge gaps in relevant aspects such as, population size in key range countries, the quantity of Saker Falcons used annually as well as socio-economic driving forces. In the case of the Saker Falcons policies are also highly influenced by market demands, money gains, tradition and prestige.
7. The decline of the global Saker Falcon population is thought to be a result of habitat degradation, unsustainable capture for the falconry trade and the impacts of agrochemicals. The rates of decline appear to be particularly severe in the species' central Asian breeding grounds (BirdLife International, 2013).
8. A strong dilemma exists as to whether stringent protection policies alone can halt the decline of the global population of the Saker Falcon, especially if these may impede management efforts that could benefit the species (Dixon, 2012).

This report is a background document to aid the development of the Saker Falcon Global Action Plan (SakerGAP) and aims to review international policies and legislation in connection with the conservation and management of the species. The objectives of the report are those of Objective 4 of the STF's 2012-2014 WorkPlan:

i. Identify any overlaps, omissions and contradictions in existing laws, policies and guidelines and discuss in STF how to resolve them.
ii. Investigate how STF support cooperative and supportive linkages between all levels of governance in order to avoid duplication of efforts or inconsistencies.
iii. Investigate the possibilities of improving law enforcement and develop tools to do so in range countries so as to reduce the level of illegal taking, illegal trapping and illegal trade of wild Saker Falcons.
iv. Investigate the possibilities of improving law enforcement and develop ways to incorporate sustainable use into national and international law.
v. Identify key stakeholders and decision making bodies.

The report has been compiled by the Objective 4 Working Group established by the Saker Falcon Task Force on its 1st meeting in Abu Dhabi, UAE, in March 2012. The meeting noted that this was an important objective and its implementation would allow the Task Force to have a clear overview of the legislative and policy framework at the international, and where possible, national level for the Saker Falcon.

III. A review of international policies and legislation

I.1 Problem formulation

Some MEAs (specifically CITES, CMS, CBD) contain provisions that are particularly relevant to the conservation of Saker Falcons. Most range States of the species are members of these MEAs and have enacted national legislation that allows them to implement these provisions. However, the enforcement of MEAs leaves much to be desired within and between most key range countries.

In addition, there are questions whether the implementation of existing or even more stringent international laws alone can:

- reduce the demand for Saker Falcons in general, and for birds of illegal origin in particular, given the deep cultural roots underpinning this;
- reduce the availability of wild-taken Saker Falcons to potential users in the breeding grounds or on migration routes;
- effectively address the problems related to the illegal trapping and trading of Saker Falcons, and deter individuals from becoming involved in these illegal activities;
- reduce crime levels associated with illegal Saker Falcon trade such as the potentially widespread bribery and corruption of public officials in certain countries;
- impact upon the huge profits and financial opportunity available to individual poachers and trappers and organized crime gangs engaging in the illegal Saker Falcon trade;
- provide meaningful alternative incomes and economic opportunities to those involved in or attracted to illegal Saker Falcon trapping and trade, acknowledging that currently, other avenues for similar financial advancement may be lacking;
- enhance the effectiveness of increasingly limited public resources allocated to law enforcement and repressive, 'penalty-based' policies to reduce and optimize overall government expenditures; for example by improving incentive-based compliance and exploring cost-effective, socio-economically acceptable measures to achieve policy goals concerning the conservation and management of Saker Falcons; and
- ensure habitat protection and eliminate the main threats to the species along its flyways.

A coherent global Saker Falcon conservation policy will need to address each of these issues.

Policies relating to the status, conservation and use of the Saker Falcon have gathered pace since the early 2000's when CITES imposed a trade ban for Saker Falcons from the United Arab Emirates. The CITES Animals Committee decided to include the Saker Falcon in its Review of Significant Trade process following a request by the United Arab Emirates.

Table 1 lists the subsequent international legal and policy changes and NGO activities that took place between 2004 and 2012.

Table 1 A history of recent policy changes relating to the status, conservation and use of the Saker Falcon (white rows: government-sanctioned policies; grey rows: IGO and NGO actions)

Year	Change
2002	**CITES imposed a trade ban for the Saker Falcon on United Arab Emirates**, strongly affecting the unregulated market there.
2003	**The CITES Animals Committee includes the Saker Falcon in its Review of Significant Trade** (at the request of the United Arab Emirates).
2004	The Red List status of the Saker Falcon was revised **from Least Concern to Endangered (globally threatened)** by IUCN.
2005, May	The CITES Animals Committee categorizes trade in Saker Falcons from 9 Range States as being of 'urgent concern' because detrimental to wild populations.
2006, November	CITES notifies that the **9 Range States have suspended Saker Falcon export permits**. However, **Mongolia continued to trade in Saker Falcons**.
2008, December	**Resolution 9.20 on the Saker Falcon is adopted by CMS COP9 (Rome, Italy), after a Croatian proposal to up-list the Saker Falcon on Appendix I of the CMS was rejected.**
2009, February	**CITES Standing Committee** recommends **that countries suspend trade in Saker Falcons with Mongolia**.
2009, April	**Specialist meeting on the conservation of the Saker Falcon**, Abu Dhabi. Point 5 of the meeting's resolution states: '*Parties must fulfil their obligations to multilateral environmental agreements (CMS, CITES), but MEAs should better reflect the various needs of Parties*'.
2009, April	**Mongolia** provides the CITES Animals Committee with a **document outlining a conservation programme based on artificial nests, linked to the development of a system of sustainable use of the Saker Falcon**.
2009, July	The **CITES Standing Committee withdrew its recommendation to suspend trade in wild Saker Falcons from Mongolia.** An annual export quota of 300 wild, live birds is agreed for the years 2009 and 2010.
2010, March	BirdLife International's **review on the status of the Saker Falcon.**
2010, May	The Red List **status** of the Saker Falcon was revised **from Endangered to Vulnerable** by IUCN.
2011, January	BirdLife International's **review on Saker Falcon conservation status and research requirements.**
2011, July	The **CITES Animals Committee** undertook a review and **endorsed the positive management regime for the Saker Falcon established by Mongolia**, **agreeing to an export quota of 300 live, wild birds.**
2011, November	Following a proposal submitted by the European Union, **the Saker Falcon is listed on Appendix I of the CMS at COP10 (Bergen, Norway) (excluding the Mongolian population, which is included in CMS Appendix II).**
2011, November	Resolution 10.28 on the Saker Falcon adopted at CMS COP10 (Bergen, Norway), including **the creation of the Saker Falcon Task Force.**
2012, February	**BirdLife International's consultation on revision of the Saker Falcon from IUCN Vulnerable to Endangered**
2012, March	The Red List **status** of the Saker Falcon was revised **from Vulnerable to Endangered by IUCN** using the precautionary principle.
2012, March	1st Meeting of the **Saker Falcon Task Force**, Abu Dhabi, UAE to agree and adopt an approach to develop the **Saker Falcon Global Action Plan (SakerGAP).**
2012, December	1st Meeting of Signatories (MoS1) of the UNEP/CMS Raptors MoU, Saker Falcon side event, Abu Dhabi, UAE.
2013, February	1st Online Teleconference of the Saker Falcon Task Force

I.2 A review of relevant international legislation, policies and guidelines (Point 4.1 of the STF 2012-2014 Work Plan)

Legislation

By definition legislation is law which has been promulgated (or "enacted") by a legislature or another governing body.

The terms “hard law” and “soft law” are often used to describe the nature of various agreements, particularly with respect to MEAs. The idea is that “hard law” has specific and legally binding obligations, and “soft law” is either not legally binding, or the obligations are flexible or lack specificity.

A MEA is considered to be a legally binding agreement between several States related to the environment. MEAs are only legal instruments to achieve shared international environmental management and policy objectives (UoJ, 2007).

A legal obligation is generally considered to be authoritative, prescriptive and binding. So “soft law” is considered by many to be a contradiction in terms. Treaty provisions are binding on all Parties to a treaty (unless a Party has made a valid reservation). To many, this means that all treaty provisions should be considered “hard law”. Nonetheless, some provisions are drafted with considerable flexibility. They may amount to little more than an expression of intent, with no clear standard for compliance, and much room for interpretation and discretion. Decisions may be taken under MEAs that do not result in legal obligations.

A MEA may provide authority to create subsidiary instruments such as codes of practice, statements of principle and guidelines that are not legally binding. In addition, even where clear standards are set, procedures and mechanisms used for compliance in MEAs are generally facilitative rather than coercive. This “soft law” approach is taken in order to encourage broader participation and collective action, especially where framework conventions are concerned, since the fundamental purpose of these agreements is to provide an inclusive discussion and decision-making forum.

Often, hard-law and soft-law can work together in a mutually re-enforcing scheme where an inclusive approach is taken to encourage participation, but is backed up by mandatory reporting and transparency requirements to encourage compliance.

There are various other forms of agreement, including Memoranda of Understanding (e.g. UNEP/CMS Raptors MoU) and political declarations, which may use stronger language, but which are generally not considered legally binding. Different Parties have different views, however. For example, MoUs may be considered binding by some. Accordingly, care should be taken to ascertain the intent of another Party. Nonetheless, declarations and MoUs are among the instruments which may be considered by some to be “soft law”. All forms of “soft law” carry the weight of good faith obligation, and are important in terms of the progressive development of the law. There is a concern held by many that ”soft law” is a slippery slope, and that it could result in the development of ”hard law” obligations without the clear consent of States, through the operation of customary law principles (UoJ, 2007).

To become Party to an MEA, a State must ratify it (”accept” or ”approve”) or ”accede” to it. The key point is that ratification or accession is generally the mechanism through which a Party accepts binding legal obligations in international law (UoJ, 2007).

It is important to point out that although MEAs are legally binding on Parties, they do not take the place of national laws. National enacting legislation is required to promulgate and implement the provisions of MEAs.

Relevant international legislation

Relevant Multilateral Environmental Agreements (MEAs) (see also Annex 1)**:**

- ***Convention on Biological Diversity (CBD)***
  Its 3 main objectives are
  1. the conservation of biological diversity,
  2. the sustainable use of the components of biological diversity, and
  3. the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

  The Biodiversity Convention requires Contracting Parties to establish a system of protected areas; promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings; as well as to rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies.

- ***Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES)***
  CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.
  The Saker Falcon is included in Appendix II. Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. International trade in specimens of Appendix-II species may be authorized by the granting of an export permit or re-export certificate. These should only be issued if the relevant authorities are satisfied that the specimens were legally obtained, and that trade will not be detrimental to the survival of the species in the wild.

  It is important to note that capture and flying of wild Sakers within a country has not been subject to CITES restrictions on international trade, and has therefore remained legal as long as it is permitted by national laws.

- ***Convention on the Conservation of Migratory Species of Wild Animals (CMS)***
  CMS aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale.
  The Saker Falcon is listed in Appendix I. Appendix I includes endangered migratory species categorized as being at risk of extinction throughout all or a significant proportion of their range. Parties strive towards strictly protecting such species, which are excluded from taking, apart from under recognized exceptional circumstances.

Relevant Regional Environmental Agreements:

- ***Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)***
  The Bern Convention is a binding international legal instrument in the field of nature conservation, which covers most of the natural heritage of the European continent and extends to some States of Africa. Its aims are to conserve wild flora and fauna and their natural habitats and to promote European co-operation in that field.
  The Saker Falcon is listed under Annex II. Annex II includes strictly protected fauna species. Species may be neither disturbed nor captured, killed or traded. In this regard, the Bern Convention supplements CITES, which solely governs international trade.

- ***Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds (EU Birds Directive)***
  The Birds Directive creates a comprehensive scheme of protection for all wild bird species naturally occurring in the European Union. It places great emphasis on the protection of habitats for endangered as well as migratory species (listed in Annex I), especially through the establishment of a coherent network of Special Protection Areas (SPAs) comprising all the most suitable territories for these species. The Saker Falcon is listed under Annex I. Species in Annex I are considered in danger of extinction, rare, vulnerable to specific changes in their habitat or requiring particular attention for reasons of the specific nature of their habitat.
  These species must not be deliberately killed, caught or disturbed, and their mating, breeding, feeding and roosting habitats must not be destroyed. The taking and destruction of eggs is prohibited as well as keeping of wild-caught birds. Member states must conserve most suitable territories as Special Protected Areas (EC, 2009).

- ***European Community (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (EU Habitats Directive)***
  Although bird species are not subjects to this directive, the Habitats Directive (together with the Birds Directive) forms the cornerstone of Europe's nature conservation policy. It is built around two pillars: the Natura 2000 network of protected sites and the strict system of species protection. All in all the directive protects over 1.000 animals and plant species and over 200 so called "habitat types" (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance (EC, 1992).

- ***Association of South East Asian Nations (ASEAN)***
  One of the ASEAN's commitments is to ensure that the rich biological diversity is conserved and sustainably managed toward enhancing social, economic and environmental well-being is reflected in the ASEAN Socio-Cultural Community (ASCC) Blueprint (2009 – 2015). Actions for promoting sustainable management of natural resources and biodiversity among others include the significant reduction in the current rate of loss of biodiversity through implementing relevant national, regional and international programmes of work; the strengthened control of trans-boundary trade in wild fauna and flora; joint surveys and monitoring of migratory wildlife; and the involvement of local communities to maintain biodiversity conservation and forest health by 2015.

- ***The Convention on the Conservation of Wildlife and Natural Habitats in the Countries of the Gulf Cooperation Council (GCC)***

The Saker Falcon is listed under Annex III as an Animal Species Threatened with Extinction. The Convention adopts measures to verify that any exploitation of such species is done in a rationalized way ensuring that the survival or existence of any of such species in nature is not threatened.
The Convention is the first legal instrument binding the six member States of the Gulf Cooperation Council (GCC) to coordinate their activities toward the conservation of wildlife and natural habitats (CCASG, 2013).

Policies

The New Oxford Dictionary of English defines the term as … "a course or principle of action adopted or proposed by a government, party, business or individual".

Policy-making has been also defined as the process by which governments translate their political vision into programmes and actions to deliver 'outcomes' – desired change in the real world.
Policy can take a range of different forms, including non-intervention; regulation, for instance by licensing; or the encouragement of voluntary change, including by grant aid; as well as direct public service provision. The general role of policy is to provide direction and guide decisions and actions in a particular area (START, 2012).

There is a large and extremely complex set of international and domestic policies with direct or indirect connections with the Saker Falcon. Policies regarding rural development, agriculture, forestry, mining, infrastructure developments and the conservation and management of natural resources, including sustainable use, may all have a profound effect on the viability of Saker Falcon populations.

Therefore, the listing of all international policies relating to Saker Falcon conservation is beyond the scope of this report. However, as an example we present European and multi-national legal and policy instruments in connection with the mitigation of bird electrocution on medium-voltage electric lines, one of the most often reported direct mortality factors to the Saker Falcon - Box 1.

Box 1 Multi-national legal and policy instruments in connection with the mitigation of bird electrocution on medium-voltage electric lines

Within the European Union any energy infrastructure development that is likely to affect one or more Natura 2000 sites has to undergo a step-by-step Appropriate Assessment procedure and, where necessary, apply the relevant safeguards for the species and habitat types of Community interest.

The Birds and Habitats Directives also require that Member States protect species of community interest throughout their natural range within the EU (cf. Article 5 of the Birds Directive and Article 12 of the Habitats Directive). Thus any energy infrastructure development must also take account of its potential impact on species of Community interest (covered by the two Directives) outside Natura 2000 sites.

Table 2 Different European/multi-national legal and policy instruments in connection with the mitigation of the electrocutions of birds, including the Saker Falcon.

Legal and policy instruments	Title
UNEP/CMS/Resolution 10.11 (2011)	Power Lines and Migratory Birds. Resolution 10.11 adopted including Guidelines on how to avoid or mitigate the impact of electricity power grids on migratory birds in the African-Eurasian region.
Birds Directive 2009/147/EC	Directive of the European Parliament and of the Council on the conservation of wild birds.
'EIA' Directive 2011/92/EU	Directive of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment.
Bern Convention Recommendation No. 110 (2004)	Recommendation of the Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats on minimising adverse effects of above-ground electricity transmission facilities (power lines) on birds.
'SEA' Directive 2001/42/EC	Directive of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.
Habitats Directive 92/43/EEC (1992)	Directive of the European Council on the conservation of natural habitats and of wild fauna and flora.

Guidelines

Even non-binding decisions should be carefully negotiated for several reasons. First, they rely on good faith and political expectations including that Parties will comply with the decision. Second, some decisions provide effective interpretations of a treaty that were not explicit in the original text. Third, some decisions may contain or approve guidelines on a particular topic that may become the subject of an amendment or separate international agreement at a later date. Indeed, it is possible that a non-binding text could be converted by Parties into a binding text through amendment (UoJ, 2007).

Table 3 Identified relevant key international guidelines

Developed by	Guidelines title	Area covered
CITES, 2013a	Resolution Conf. 16.7: Non-detriment findings	Sustainable use and trade; non-detriment findings
CMS, 2011	Resolution 10.11 adopted including Guidelines on how to avoid or mitigate the impact of electricity power grids on migratory birds in the African-Eurasian region	Electrocution and collision
UNEP/CMS Raptors MoU, 2008	Action Plan for the Conservation of Migratory Birds of Prey in Africa and Eurasia (Annex 3 of the Raptors MoU)	Conservation of migratory raptors
CITES, 2004	Resolution Conf. 13.2 (Rev. CoP14): Sustainable use of biodiversity: Addis Ababa Principles and Guidelines	Sustainable use
CBD, 2004	Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity	Sustainable use
CBD, 2004	The Ecosystem Approach	Adaptive management, sustainable use
IUCN, 2004 (Cooney)	The Precautionary Principle in Biodiversity Conservation and Natural Resource Management	Precautionary Principle
IUCN, 2002 (Rosser & Haywood)	Guidance For CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports.	Non-detriment findings

One of the most important guidelines regarding the conservation, more specifically, the international trade in the Saker Falcon is the Checklist to assist in making non-detriment findings for Appendix II exports (CITES, Rosser and Haywood, 2002).

In accordance with Articles III and IV of CITES, export permits for specimens of species included in Appendices I and II shall be granted only when the Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of the species (following a determination known as a 'non-detriment finding').

CITES COP15 recommended that, when Parties establish national voluntary export quotas, they do so on the basis of a non-detriment finding made by their Scientific Authority. Thus, a non-detriment finding for an Appendix II species such as the Saker Falcon is the result of a science-based assessment that verifies whether or not a proposed export is detrimental to the survival of that species.

In making a non-detriment finding, Scientific Authorities should consider the volume of legal and illegal trade (known, inferred, projected or estimated) relative to the vulnerability of the species (intrinsic and extrinsic factors that increase the risk of extinction of the species).

The making of an effective non-detriment finding relies upon a correct identification of the species concerned and verification that it is specimens of this species that are to be exported. The implementation of adaptive management, including monitoring, is an important consideration in making a non-detriment finding.

A non-detriment finding is based on resource assessment methodologies which may include, but are not limited to, consideration of:

A. species biology and life-history characteristics;

B. species range (historical and current);

C. population structure, status and trends (in the harvested area, nationally and internationally);

D. threats;

E. historical and current species-specific levels and patterns of harvest and mortality (e.g. age, sex) from all sources combined;

F. management measures currently in place and proposed, including adaptive management strategies and consideration of levels of compliance;

G. population monitoring; and

H. conservation status (CITES, 2013a).

Within a Cooperation Agreement between CITES and CMS, STF is developing a framework document on the methodology for how to undertake an NDF for the Saker Falcon, and how to sustainably use and trade in the species under an adaptive management framework that conforms to the needs of CITES and incorporates robust monitoring and feedback mechanisms. The framework document will be prepared by November 2013.

The following policy-relevant issues need to be incorporated into the document:

a. non-country-specific methods for making non-detriment findings through the assessment of population parameters such as distribution and abundance, population trends, threats to populations and other relevant factors (see for more in section III.2);

b. a generic guidance for developing a science-based population monitoring system, and establishing adaptive management programmes for harvesting of and trade in *F. cherrug*, taking into consideration the results of surveys, impacts of harvest and protection regimes, etc.

c. lessons learned from the experiences of and outputs produced by Mongolia, with regard to NDFs for Saker Falcons; and,

d. a section on how sustainable, legal and traceable trade can contribute to the livelihoods of rural communities, with reference to CITES Resolution Conf. 13.2 (Rev. CoP14) on *Sustainable use of biodiversity: Addis Ababa Principles and Guidelines.*

Decision making mechanisms of listing threatened bird species in CITES and CMS

Figure 1 shows the decision making mechanisms of listing threatened bird species in CITES and CMS. The listing of species in CITES Appendices I and II strictly adhere to criteria that have been developed and adopted by the CITES Parties (CITES, 2004a). In the vast majority of cases, listing proposals are developed, submitted and presented by Parties.

CITES listing criteria emphasize the biological and conservation status of a species, similar to IUCN's Red List criteria, but include also its status in international trade (species not in international trade do not qualify for CITES listing).

CMS listings are based on the provisions of Articles III and IV of the Convention which contain guidance on the meaning of Appendix I and Appendix II listing, respectively. The Scientific Council evaluates listing proposals submitted by Parties. IUCN's Red List criteria have been used as a decision support tool for CMS listing criteria, but there is not a strict comparison between Appendix I and II and the IUCN Red List categories, and the independent assessment by the CMS Scientific Council is based on best available data (CMS, 2002). Final decisions on listings are taken by the COP.

Figure 2 Decision making mechanisms of listing threatened bird species in CITES and CMS

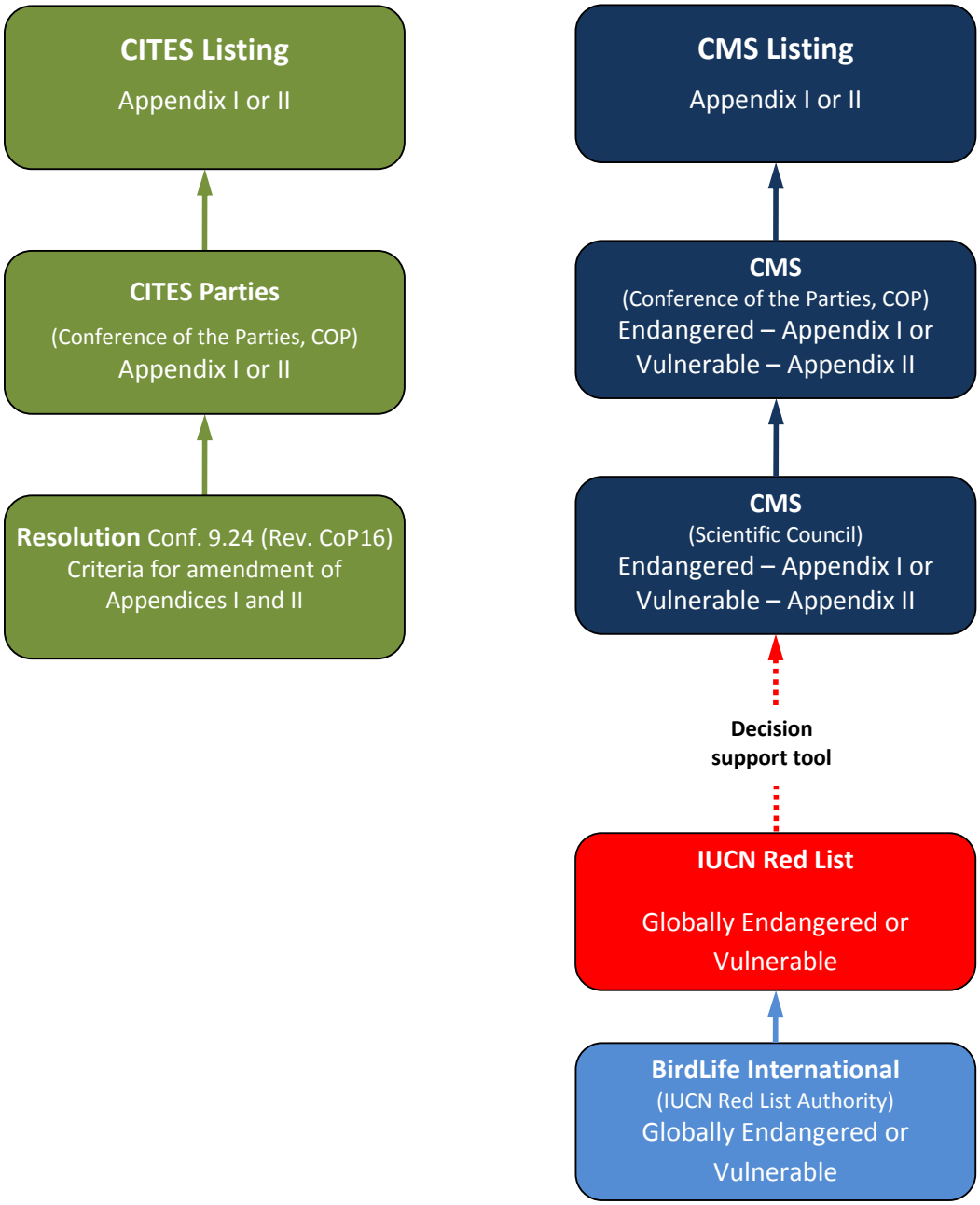


Table 4 A brief description of differences between Appendix I and II criteria in CITES and CMS

CITES	CMS
Appendix I	**Appendix I**
It includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances. These species cannot be traded internationally for primarily commercial purposes.	Migratory species that have been categorized as being in danger of extinction throughout all or a significant proportion of their range are listed on Appendix I of the Convention.
Appendix II	**Appendix II**
It includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival. These species can be traded internationally for commercial purposes, but within strict regulations, requiring determinations of sustainability and legality.	Migratory species that have an unfavourable conservation status or would benefit significantly from international co-operation organised by tailored agreements are listed in Appendix II to the Convention.

I.3 Identify any overlaps, omissions and contradictions in existing laws, policies & guidelines and discuss in STF how to resolve them (Point 4.2 of the STF 2012-2014 WorkPlan)

One still must acknowledge that international environmental treaty and policy making has often been segregated on the basis of topic, sector or territory, and the result has sometimes been overlapping and conflicting negotiation processes. It is also the case that the implementation of one treaty can impede on the principle of another. In such cases, conflicting principles should be investigated, analyzed and revised to achieve a more effective system of environmental governance (Kanie, 2007). A MEA frequently influences the development and effectiveness of other MEAs, and in return, it is also influenced by other policy instruments (Kanie, 2007).

Overlaps in the activities of conservation organisations do not necessarily entail conflicts, they can be complementary. International organizations may be active in the same issue area but engage in different activities - analytical, normative or operational (Ivanova & Roy, 2007).

Analytical activities involve research, monitoring, assessment, and analysis. The information produced as a result can serve to formulate various policy options.

Normative activities build on the analytics to produce new norms, rules, standards, guidelines, and policies. They may result in the adoption of hard or soft law at the national and international levels.

Operational activities are visible and tangible, “on the ground” actions. They involve carrying out plans, implementing projects or providing services in specific localities (Ivanova & Roy, 2007).

Despite the range of management and conservation measures that are in place, no overarching mechanism exists that brings the Parties of the MEAs together to identify joint solutions for common issues and shared concerns (UNEP-WCMC, 2012).

Recently, the National Biodiversity Strategies and Action Planning (NBSAP) process under the CBD has been identified as a potential overarching framework for the coherent implementation of all biodiversity-MEAs and mainstreaming biodiversity into national processes.

Table 5 contains specific issue areas where certain overlaps ("Agreement"), omission ("Non-existence") and potential contradictions ("Disagreement") can be observed between international and national laws, policies and guidelines. While not an exhaustive list of all Saker Falcon-related issues, these areas exemplify the core concerns on the current conservation agenda.

Table 5 Specific issue areas of overlap ("Agreement"), omissions ("Non-existence") and potential contradictions ("Disagreement") between MEAs and national laws, policies and guidelines and the potential roles of STF regarding them

I.	Overlaps ("Agreement") between MEAs and national laws, policies and guidelines	Status in MEAs and in national laws and assessment of implementation	Potential STF roles
I.1	Species conservation	Areas which are covered by similar MEA provisions or by national law in most range countries but only moderately implemented due to the lack of capacity or political will.	Promote enhanced implementation, particularly by those Range States that host the highest populations of Saker Falcons. Monitor and report on the progress of implementation.
I.2	Habitat conservation		
I.3	Trade regulations		
I.4	Law enforcement (illegal trapping, trade)		
I.5	Problem-driven research		
I.6	Monitoring of populations		
I.7	Awareness raising of Stakeholders		
1.8	Reporting		
II.	**Omissions ("Non-existence") in MEAs and national laws, policies and guidelines**	**Status in MEAs and in national laws and assessment of implementation**	**Potential STF roles**
II.1	Monitoring of the scale and methods of use of the Saker Falcon	Areas which are not explicitly covered by MEA provisions or by national law due to their specific character, therefore they are not implemented sufficiently in most range countries.	Seek to persuade Governments and in-country partners of the benefits of such policies and controls. Offer advice and practical support, wherever possible to promote new policies relating to conserving Sakers and promote implementation.
II.2	Individual identification and marking of all trapped Saker Falcons		
II.3	Effective registration of trapped Saker Falcons		
II.4	Genetic monitoring of wild Saker Falcon populations		
II.5	Incentives for sustainable use of the Saker Falcon		
II.6	Assessment of ecosystem services and socio-economic impacts		
II.7	Mechanisms to involve local communities in conservation		
II.8	Governance and mainstreaming		
III.	**Potential contradictions ("Disagreement") between MEAs and national laws, policies and guidelines**	**Status in MEAs and in national laws and assessment of implementation**	**Potential STF roles**
III.1	Use/harvest of wild Saker Falcons	Areas which are covered by MEA provisions or national law in most range countries, but not effectively regulated or harmonised in favour of the Saker Falcon.	Support Range States in identifying contradictory policies and promote steps to encourage harmonisation. Monitor and report on cross-compliance.
III.2	Use of hybrid falcons that involve Saker Falcon line		
III.3	Habitat use (International conservation vs. national agricultural policies e.g. increased grazing pressure)		
III.4	Perverse incentives (International conservation vs. national agricultural policies e.g. supporting intensive agriculture)		

I.4 Investigate how STF support cooperative and supportive linkages between all levels of governance in order to avoid duplication of efforts or inconsistencies (Point 4.3 of the STF 2012-2014 WorkPlan) and to support the development of polices and laws relate to SF based on existing governance processes.

Established by the Parties of CMS, the Saker Falcon Task Force may support governance linkages in many ways. For example, it can

- assess issues and problems related to the Saker Falcon independently from MEAs and governments;
- raise new issues and concerns to be addressed regarding the Saker Falcon on the agendas of MEAs and governments;
- introduce additional knowledge and information into the decision-making process relating to the conservation and use of the Saker Falcon;
- offer to provide specialist technical advice to support MEAs and Governments;
- investigate and propose alternative solutions and suggest initiatives that states may be unable to propose themselves but are willing to support;
- provide leadership to guide and oversee development of an implementation plan for the SakerGAP, including defining its objectives, priorities and framework for action;
- work tirelessly to ensure wide Stakeholder engagement and support;
- act as an independent and trustworthy broker to promote a broad consensus-building process to promote effective implementation of the SakerGAP;
- coordinate the implementation of SakerGAP, including monitoring and reporting regularly on progress.;
- develop, collate and disseminate information to promote the conservation of the Saker Falcon, including incorporating sustainable use, where appropriate; and,
- develop an ongoing communications strategy to raise stakeholder awareness.

I.5 Investigate the possibilities of improving law enforcement and develop tools to do so in range countries so as to reduce the level of illegal taking, illegal trapping and illegal trade of wild Saker Falcons (Point 4.4 of the STF 2012-2014 WorkPlan)

According to the UNEP Guidelines on Compliance with and Enforcement of Multilateral Environmental Agreements, compliance and enforcement are defined, as follows (UNEP, 2007):

Compliance means the state of conformity with obligations, imposed by a State, its competent authorities, and agencies on the regulated community, whether directly or through conditions and requirements in permits, licences and authorizations, in implementing multilateral environmental agreements; and,

Enforcement means the range of procedures and actions employed by a State, its competent authorities, and agencies to ensure that organizations or persons, potentially failing to comply with environmental laws or regulations implementing multilateral environmental agreements, can be brought or returned into compliance and/or punished through civil, administrative, or criminal action.

In general, then, compliance is brought into play in the international framework while enforcement is a concept to be used in national perspectives.

Harvesting for illegal trade can have a significant impact on species populations - with declining populations sometimes simply increasing the market value of the animals, plants, parts and products in demand.

The covert and often sophisticated nature of illegal wildlife trade operations spanning several countries and regions across the globe makes such networks difficult to detect by national authorities (TRAFFIC, 2010).

While law enforcement operations will vary tactically from place to place, the fundamental strategy for dealing with criminal activities relating to wildlife will not vary significantly. In every situation, the prime objective is to detect the activities of the criminal as early as possible. The key to effective deterrence remains simple in principle – it requires a law enforcement body that is well-manned, well-equipped and enjoys effective logistical support (Du Bois, 1997).

Even though national courts appreciate the CITES objective of preserving endangered species, fines imposed upon offenders are often not proportional to the income potentially generated by illegal trade and an offense committed for non-commercial purposes rarely carries grave consequences. Accordingly, the penalties are sometimes not a deterrent, especially for major illegal traders. Such offenders, if ever caught, are hardly ever imprisoned and can pay the fine and continue their activities. Such traders are hardly ever involved directly, as they get small-time traders or carriers to do their dirty work (Sharma, 2003).

Identification of species poses yet another problem for law enforcement agencies. As the volume of trade increases, it becomes difficult for Customs Officers to identify illegal shipments when one illegal specimen may be hidden among thousands of similar looking legal specimens. Despite strict enforcement and high criminal penalties for one particular species, illegal traders deal in different species or change their smuggling routes to countries where controls are less effective or absent. Hence, illegal traders can continue to evade capture (Sharma, 2003).

Illegal trading will continue, despite the implementation of legislative prohibitions, if a large enough market exists to demand the supply of such a product. Both domestic and international legislation cannot be effective unless combined with a grassroots programme of education and awareness-raising designed to alter the perceptions, attitude and behaviour of the consumer (Du Bois, 1997).

In the case of the Saker Falcon, illegal trapping and trade can potentially be converted into controlled and sustainable use. However, this will require law enforcement efforts and grassroots education to be supplemented with a set of pragmatic tools through which existing demands are partly satisfied and reasonable legal income can be generated for local people and for those who are already involved in businesses associated with the trapping, trade and use of Saker Falcons.

One of the potential tools to reduce the level of illegal taking, illegal trapping and illegal trade of wild Saker Falcons and also to increase habitat quality in favour of the species may be community-based natural resource management (CBNRM Net, 2012; USAID, 2009; WWF, 2006).

Community-based natural resource management (CBNRM) is an approach under which communities become responsible for managing natural resources (forests, land, water, biodiversity) within a designated area. The community, often assisted and monitored by outside technical specialists, utilizes and protects natural resources within established guidelines or according to a detailed,

mutually agreed plan. The active participation of stakeholders in natural resource decision making and use increases economic and environmental benefits. Critical investment areas include the introduction of viable management systems, securing legal control over resources and resource utilization, improving environmental governance, and information management (WB, 2004).

Human population growth and economic development are increasing pressure on land, water, forests, and biodiversity resources. Government attempts to conserve natural resources through top-down regulatory systems have often failed. Limited government capacity to enforce laws and regulations compounds management problems, particularly when regulations are inappropriate to the social, cultural, or ecological context. In seeking an alternative, natural resource managers have found that increasing the role of local people in managing their natural resources is often the most appropriate and effective solution.

CBNRM gives communities full or partial control over decisions regarding natural resources, such as water, forests, pastures, communal lands, protected areas, and fisheries. The extent of CBNRM control can range from community consultations to joint management or to full responsibility for decision making and benefit collection, using tools such as joint management plans, community management plans, stakeholder consultations and workshops, and communal land tenure rights.

CBNRM is both a conservation and rural development strategy, involving community mobilisation and organisation, institutional development, comprehensive training, enterprise development, and monitoring of the natural resource base.

The premise of CBNRM is that communities will manage local resources in a sustainable manner if: (1) they are assured of their ownership of the natural resources; (2) they are allowed to use the resources and/or benefit directly from others' use of them; and (3) given a reasonable level of control over management of the resources (USAID, 2009).

Such a community-based approach often leads to more equitable and more sustainable natural resource management solution for the following reasons (Brown, 2002):

- *Proximity to resources.* Those in closest contact with, and whose livelihoods are impacted by, natural resources are best placed to ensure effective stewardship.

- *Equity. Natural* resources should be managed to ensure equitable benefits for the diverse interest groups within a population.

- *Capacity*. Communities often have better knowledge and expertise in the management of the natural resources than government agencies/private industry.

- *Biodiversity*. Multiple-purpose management of natural resources by communities generally provides more varied land use, with greater species diversity than private/industrial management systems.

- *Cost-effectiveness.* Local management may help reduce government costs.

- *Development philosophy*. Local participation, decentralization, and subsidiarity may, in themselves, be considered important development objectives.

I.6 Investigate the possibilities of improving law enforcement and develop ways to incorporate sustainable use into national and international law (Point 4.5 of the STF 2012-2014 WorkPlan)

Achieving full compliance with laws is rarely possible, at least at reasonable cost, and governing bodies will almost always have to be satisfied with a "reasonable extent" of (non)-compliance. There is no general definition of the "acceptable" level of compliance, because each policy field has its own specifications, differences, and sensitivities. To define an acceptable level of compliance depends in part on the nature of the risks arising from non-compliance (OECD, 2002).

In the case of the Saker Falcon an "acceptable" level of compliance of users should be compatible with improving the present conservation status of the species, and maintaining a viable, widespread and self-sustaining population of wild falcons in the medium and long term.

(Non)-compliance may have a low probability of detection and enforcement if the resources of the regulatory agency are inadequate or if a monitoring and enforcement strategy is lacking. In such circumstances, the "sanction-based" dimension of compliance will fail. It has explicit requirements that regulations must be backed by sufficient budgetary and administrative resources to ensure their effective implementation and enforcement (OECD, 2002).

The most comprehensive attempt to date to improve the compliance-friendliness of regulatory design is that implemented in the Netherlands. Compliance activity is based on the "Table of Eleven" key determinants of compliance, reproduced below (**Box 2,** OECD, 2002).

These determinants have very important links to other STF objectives (O5: Stakeholder Analysis, O6: Knowledge Gap Analysis, O7: Sustainable Use, O10: Awareness Raising) and should carefully be considered one-by-one during the preparation of a sustainable Saker Falcon management strategy. An effective management of these determinants can considerably reduce the effects of threats on Saker Falcon populations.

Box 2 The Netherlands Table of Eleven (T11) key determinants of compliance:

Spontaneous compliance dimensions (factors that affect the incidence of voluntary compliance – that is, compliance that would occur in the absence of enforcement):

T1. Knowledge of rules: Target group familiarity with laws and regulation, clarity (quality) of laws and regulations.

T2. Cost-benefit considerations: Material and non-material advantages and disadvantages resulting from violating or observing regulation.

T3. Level of acceptance: The extent to which the target group (generally) accepts policy, laws, and regulations.

T4. Normative commitment: Innate willingness or habit of target group to comply with laws and regulations.

T5. Informal control: The possibility that non-compliant behaviour of the target group will be detected and disapproved of by third parties (i.e. non-government authorities), and the possibility and severity of sanctions that might be imposed by third parties (e.g. loss of customers/contractors, loss of reputation).

Control dimensions (the influence of enforcement on compliance):

T6. Informal report probability: The possibility that an offence may come to light other than during an official investigation and may be officially reported (whistle blowing).

T7. Control probability: Likelihood of being subject to an administrative (paper) or substantive (physical) audit/inspection by official authorities.

T8. Detection probability: Possibility of detection of an offence during an administrative audit or substantive investigation by official authorities. (The probability of uncovering non-compliance behaviour when some kind of control is applied).

T9. Selectivity: The (increased) chance of control and detection as a result of risk analysis and targeting firms, persons or areas (i.e. extent to which inspectors succeed in checking offenders more often than those who abide by the law).

Sanctions dimensions (the influence of sanctions on compliance):

T10. Sanction probability: Possibility of a sanction being imposed if an offence has been detected through controls and criminal investigation.

T11. Sanction severity: Severity and type of sanction and associated adverse effects caused by imposing sanctions e.g. loss of respect and reputation.

Original source:
Dick Ruimschotel, Compliance Methodology Consultants, Amsterdam and But Klaasen, Ministry of Justice, the Hague. *In:* OECD, 2002.

Awareness raising and partnership development of Stakeholders

Awareness-raising of key players, could have a crucial role in enhancing spontaneous compliance dimensions.

There is a need to raise awareness among falconers of the provisions of CITES, the seriously low levels of Saker Falcon populations and the significant impact that illicit trade exerts on wild falcon populations, in order to encourage compliance with CITES (CITES, 2004b).

Awareness-raising and training for law enforcement officials who are involved in implementing the CITES provisions, enforcing national legislation and combating the illegal capture and trade of falcons from the wild, would also be beneficial.

Training should be held regularly in all countries of import, export, re-export and transit of falcons to ensure that airport security, airline company and all border control staff are aware of CITES and of the potential role that they might play in detecting the smuggling of falcons, e.g. during the examination of vehicles, vessels and passenger baggage.

The successful implementation of the SakerGAP will need the possible widest and earliest engagement of Stakeholders (see more in the Objective 5 Stakeholder Analysis) in order to build trust and a cooperative environment for the adaptive management of the Saker Falcon and its habitats, especially healthy steppe land ecosystems that support many other important species.

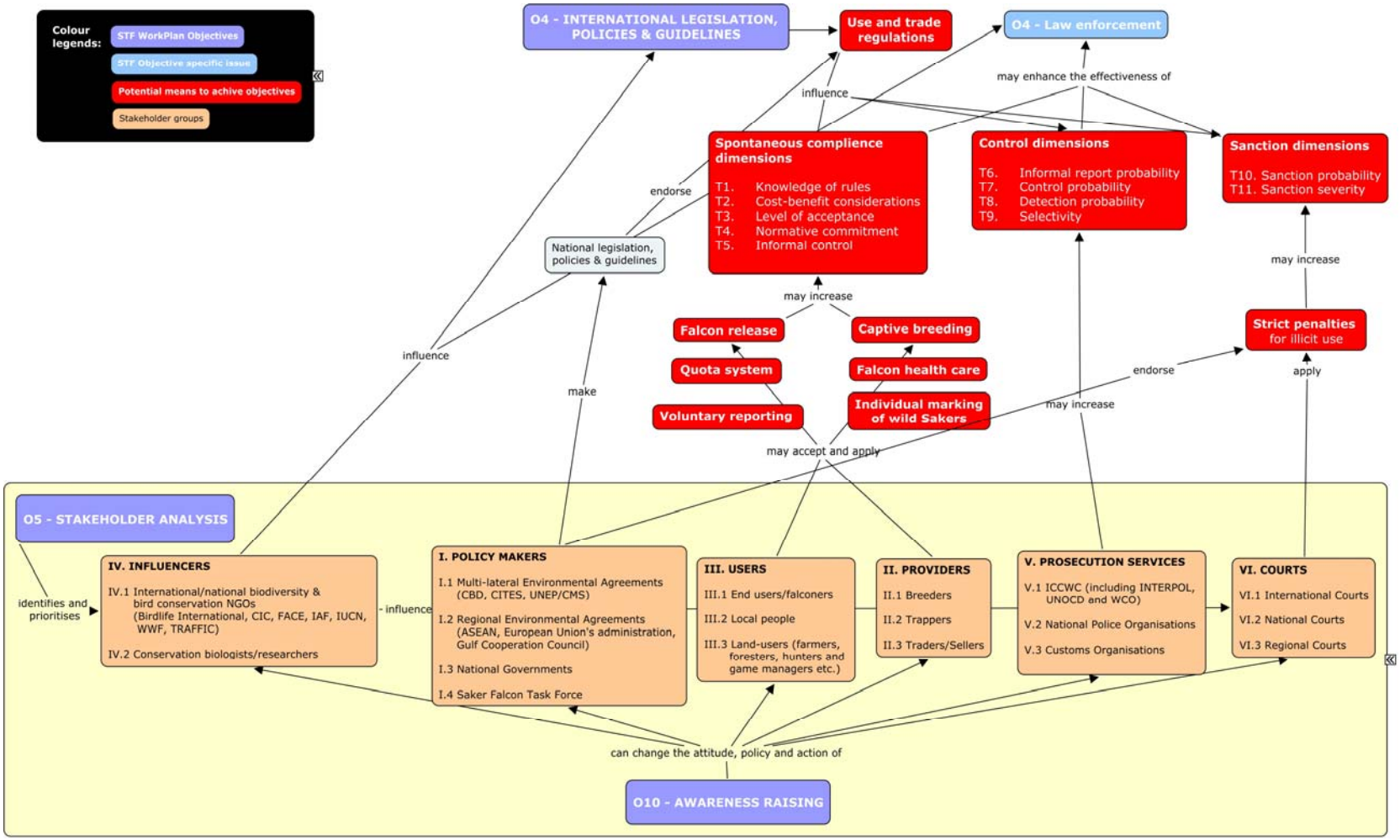
Besides the current cooperation with CITES, STF should explore the possibilities of networking with other ICCWC (International Consortium on Combating Wildlife Crime) IGOs including the INTERPOL, the United Nations Office on Drugs and Crime (UNOCD), the World Bank and the World Customs Organisation (WCO).

UNEP and CITES are conducting a feasibility study to establish a WEN (Wildlife Enforcement Network) for the management of wildlife trade and to promote cooperation, information sharing and capacity building. This effort should be flagged and harmonized within the SakerGAP.

Strengthening the cooperation with the Arab Working Group on the implementation of biodiversity and desertification related Multilateral Environmental Agreements (MEAs), the ASEAN Wildlife Enforcement Network (ASEAN-WEN), the Gulf Cooperation Council, the UNEP Division of Environmental Law and Conventions (UNEP DELC) and national environment agencies would also be beneficial for facilitating a harmonized approach to the regulation of trapping and trade in the Saker Falcon.

The Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) can also be involved in the implementation of the SakerGAP to enhance the science-policy interface to fill knowledge gaps, enhance information sharing and capacity building. This platform can support for the STF and visa versa.

Figure 3 Potential tools for improving law compliance and ultimately for enhancing the effectiveness of law enforcement



IV. Conclusions and recommendations for the Saker Falcon Task Force

In this report we have reviewed existing international policies and legislation in relation to the Saker Falcon, focusing mainly on the provisions of the relevant Multi-lateral Environmental Agreements. We did not aim to analyse relevant national policies and guidelines since national data are currently being gathered through a questionnaire survey and responses will feed the SakerGAP at a later stage of its development. Nevertheless, after summarizing Saker Falcon-related legislation at the national level based on the SakerGAP questionnaire responses, a further analysis will be needed to identify weaknesses of existing legislation, policies and guidelines, and to propose means to address them.

Some MEAs (specifically CITES, CBD and CMS) contain provisions that are particularly relevant to the conservation of the Saker Falcon. Most Range States of the species are members of these MEAs and have enacted legislation that allows them to implement these provisions. However, it is already recognised that there could be inconsistencies between MEAs which may hinder the application of potential conservation tools such as the sustainable use.

One of the priority actions of a Saker Falcon conservation strategy should be to work towards the synergies of existing international and national laws in order to ensure that the whole range of tools are used for the benefit of the species.

A principal recommendation of the report is to involve international and national policy makers in the development of such a synergistic and pragmatic legal and policy system that can potentially improve the present conservation status of the Saker Falcon in the long term through, *inter alia,* the controlled, legal and sustainable use of the species.

Reducing omissions and potential contradictions between MEAs and national laws, policies and guidelines, while enhancing synergistic inter-linkages between them, is the way forward towards the reform of international environmental governance regarding the Saker Falcon (see Table 5 for details).

Other priority issues that need to be addressed together with policy makers within the Saker Falcon range countries may be to improve the compliance-friendliness of regulatory design through the key determinants of compliance, and the reduction of the assumed high level of illegal use by enhancing the effectiveness of law enforcement.

Several determinants of compliance are dependent upon deeply rooted underlying socio-economic needs and cultural traditions of key stakeholders. Achieving full compliance of existing laws is unlikely and the actions regarding law enforcement should be designed on the basis of a complex socio-economic modelling and the engagement of stakeholders.

Both the key determinants of compliance and the effective law enforcement have very important links to other STF objectives (O5: Stakeholder Analysis, O6: Knowledge Gap Analysis and modelling, O7: Sustainable Use, O10: Awareness Raising) and should be carefully considered one-by-one during the preparation of a sustainable Saker Falcon management strategy.

The STF can play a coordinating role and raise capacity for scientific assessment and monitoring, and for the provision of early warnings to governments of priority range countries about their rapidly declining Saker Falcon populations.

The STF can act in a coordinating role to identify joint solutions for common issues (e.g. in making non-detriment findings or for mitigating specific threats) and shared concerns regarding the Saker Falcon within a mechanism underpinned by the relevant MEAs.

The STF can promote the integration of the principles of sustainable use in national laws and policies relevant to the conservation of the Saker Falcon, especially in those range countries where the species is trapped and used extensively. One example is the joint project between the United Arab Emirates and Mongolia to develop best practice guidelines on Saker Falcon management for countries in which the species is known to be trapped and/or used for falconry purposes. See more about sustainable use in the Objective 7 Sustainable Use report.

The STF can provide cooperative assistance to range countries which do not currently allow or are prohibited from exporting wild specimens of Saker Falcons, but who may wish to re-open legal trade on a sustainable basis, for improvement of capacity to make non-detriment findings for the Saker Falcon, based on nationally identified needs. Such cooperative assistance could take multiple forms, including financial and technical support.

The STF should examine and, were possible, offer support for the development of National Biodiversity Strategies and Action Plans and other means to integrate SakerGAP into national policies.

Communication and awareness about the value of the Saker Falcon and its associated ecosystem services, including promoting the involvement of local communities (possibly through a Community-Based Natural Research Management Scheme) in the sustainable use of the species is one of the areas that needs to be addressed by the SakerGAP.

The successful implementation of the SakerGAP will need the extensive awareness raising and the widest and earliest possible engagement of stakeholders (see more in III.6 and in the Objective 5 Stakeholder Analysis) in order to build trust and a cooperative environment for the adaptive management of the Saker Falcon and its habitats, especially healthy steppe lands that support many other unique and important species.

V. References

(Internet documents were last visited on 05/05/2013)

BirdLife International (2013) Species factsheet: *Falco cherrug*. Available at: http://www.birdlife.org on 05/05/2013.

Brown, K. (2002). Innovations for conservation and development. The Geographical Journal, 168(1), 6-17.

Du Bois, K. E. (1997) The Illegal Trade in Endangered Species. African Security Review.Vol.6, No.1. Available at: http://www.iss.org.za/Pubs/ASR/6No1/DuBois.html

Brandenburg University of Technology (2011) Feasibility Study - Implementation of the UNESCO - Convention for the Safeguarding of Intangible Cultural Heritage (2003) in Germany. Available at: http://www-docs.tu-cottbus.de/gradschool/public/Fachklasse_5/feasibility_study_igs_heritage_studies.pdf

Brown Weiss, E. (1995) International Environmental Law: Contemporary Issues and the Emergence of a New World Order. Georgetown Law Journal 81 (1): 675-693.

CBD (2013) Liaison Group of Biodiversity-related Conventions. Available at: https://www.cbd.int/blg/

CBD (1992) Convention on Biological Diversity. Available at: http://www.cbd.int/doc/legal/cbd-en.pdf

Chambers, W. B. (2008) Interlinkages and the Effectiveness of Multilateral Environmental Agreements. United Nations University.

CITES (2013) The CITES Appendices. Available at: http://www.cites.org/eng/app/

CITES (2013a) Resolution Conf. 16.7 Non-detrimental findings. Available at: http://www.cites.org/eng/res/16/16-07.php

CITES (2004) Resolution Conf. 13.2 (Rev. CoP14) Sustainable use of biodiversity: Addis Ababa Principles and Guidelines. Available at: http://www.cites.org/eng/res/13/13-02R14.php

CITES (2004a) Conf. 9.24 (Rev. CoP13). Criteria for amendment of Appendices I and II. Available at: http://www.cites.org/eng/res/all/09/E09-24R13.pdf

CITES (2004b) Summary Record. Consultative meeting on trade in falcons for falconry. Abu Dhabi, 16-19 May 2004. Available at: http://www.cites.org/common/prog/falcon_sum.pdf

CITES (1979) Convention on International Trade in Endangered Species of Wild Fauna and Flora. Available at: http://www.cites.org/eng/disc/E-Text.pdf

CMS (2003) Convention on the Conservation of Migratory Species of Wild Animals. Available at: http://www.cms.int/documents/convtxt/cms_convtxt_english.pdf

CMS (2002) Annex IX to ScC11Report. Report on the Implementations of the IUCN Listing Criteria for CMS. Available at: http://www.cms.int/bodies/ScC/ScC_Subset_Meeting/Inf_05_Annex_IX_to_ScC11_Rpt_E.pdf

Community-Based Natural Resource Management Network (2012) Introduction. Available at: http://www.cbnrm.net/about/overview/introduction.html

Cooperation Council of the Arab States of Gulf (2009) Convention on the Conservation of Wildlife and their Natural Habitats in the Countries of the Gulf Cooperation Council. Available at: http://sites.gcc-sg.org/DLibrary/index-eng.php?action=ShowOne&BID=335

Cooney, R. (2004). The Precautionary Principle in Biodiversity Conservation and Natural Resource Management: An issues paper for policy-makers, researchers and practitioners. IUCN, Gland, Switzerland and Cambridge, UK. xi + 51pp.

Council of Europe (1979) Convention on the Conservation of European Wildlife and Natural Habitats. CETS No.: 104 Available at: http://conventions.coe.int/Treaty/Commun/QueVoulezVous.asp?NT=104&CM=8&DF=&CL=ENG

Dixon, A. (2012) International policy in relation to Saker conservation: a review of developments over the last decade. Falco 39: 12-15. Available at: http://www.mefrg.org/images/falco/falco39.pdf

European Community (2009) DIRECTIVE 2009/147/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 November 2009 on the conservation of wild birds. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF

European Community (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1992:206:0007:0050:EN:PDF

Fox, N. 2002. The conservation of the Saker Falcon (Falcon cherrug) and the role of CITES in UAE 2002. Environmental Research and Wildlife Development Agency, Abu Dhabi, UAE.

Ivanova, M. and Jennifer, R. (2007) "The Architecture of Global Environmental Governance: Pros and Cons of Multiplicity," (PDF) in Global Environmental Governance: Perspectives on the Current Debate, (Lydia Swart and Estelle Perry, eds.), New York: Center for UN Reform Education. Available at: http://www.centerforunreform.org/system/files/GEG_Ivanova-Roy.pdf

Kanie, N. (2007) Governance with Multilateral Environmental Agreements: A healthy or ill-equipped fragmentation? In: Global Environmental Governance: Perspectives on the Current Debate, (Lydia Swart and Estelle Perry, eds.), New York: Center for UN Reform Education. Available at: http://www.centerforunreform.org/system/files/GEG_Kanie.pdf

Nagy, S. & Demeter, I. (2006). Saker Falcon: European Single Species Action Plan. Bern Convention: T-PVS/Inf (2006) 2 revised

OECD (2002) Chapter 5: Tools to Improve Implementation of Regulations. *In:* OECD Reviews of Regulatory Reform: Regulatory Policies in OECD Countries From Interventionism to Regulatory Governance. Available at: https://www.wbginvestmentclimate.org/uploads/7.RegulatoryPoliciesOECDCountries.pdf

Rosser, A.R. and Haywood, M.J. (Compilers) (2002) Guidance For CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports. IUCN, Gland, Switzerland and Cambridge, UK. xi + 146pp. Available at: http://data.iucn.org/dbtw-wpd/edocs/SSC-OP-027.pdf

Secretariat of the Convention on Biological Diversity (2004) Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity (CBD Guidelines) Montreal: Secretariat of the Convention on Biological Diversity 21 p. Available at: http://www.cites.org/eng/res/13/addis-gdl-en.pdf

Secretariat of the Convention on Biological Diversity (2004) The Ecosystem Approach, (CBD Guidelines) Montreal: Secretariat of the Convention on Biological Diversity 50 p. Available at: http://www.cbd.int/doc/publications/ea-text-en.pdf

Sharma, C. (2003) Enforcement mechanisms for endangered species protection in Hong Kong: a legal perspective. Vermont Journal of Environmental Law. Vol. 5. 2003-2004. Available at: http://www.vjel.org/journal/pdf/VJEL10014.pdf

START (2012) Current Approached to Biodiversity Conservation. Module 5. Available at: http://start.org/download/2012/biodiv/elearn/4-3_conservation-approaches.pdf

TRAFFIC (2010) Enforcement and CITES - A TRAFFIC briefing document. Available at: http://www.traffic.org/cites-cop-papers/enforcement.pdf

UNEP-WCMC (2012) Promoting synergies within the cluster of biodiversity-related multilateral environmental agreements. Available at: http://www.unep-wcmc.org/medialibrary/2012/04/27/8b832e8c/Final_MEA_synergies_27April2012_cover.pdf

UNEP (2007) Negotiating and Implementing Multilateral Environmental Agreements (MEAs): A Manual for NGOs. Available at: http://www.cbd.int/doc/guidelines/MEAs-negotiation-manual-ngo-en.pdf

UNESCO (2012) Inscription *Falconry, a living human heritage* on the Representative List of the Intangible Cultural Heritage of Humanity. Intergovernmental Committee for the Safeguarding of the Intangible Cultural Heritage. Decision 7. COM. 11.33.

University of Joensuu (2007) Multilateral Environmental Agreement Negotiator's Handbook. UNEP Course Series 5. Secon edition. Available at: http://unfccc.int/resource/docs/publications/negotiators_handbook.pdf

USAID (2009) Environmental Guidelines for Small-Scale Activities in Africa (EGSSAA). Chapter 2: Community-Based Natural Resource Management (CBNRM). Available at: http://www.encapafrica.org/EGSSAA/cbnrm.pdf

World Bank (2004) Module 5 - Community-Based Natural Resources Management. *In:* Agriculture Investment Sourcebook. Available at: http://go.worldbank.org/1U8MK1UZC1

WWF (2013) Polar bears, WWF and CITES trade bans. Available at: http://wwf.panda.org/who_we_are/wwf_offices/thailand/?207907/Polar-bears-WWF-and-CITES-trade-bans

WWF (2006) Community-based Natural Resource Management Manual. Wildlife Management Series. Available at: http://assets.wwf.no/downloads/cbnrm_manual.pdf

VI. Annexes

Annex 1 Multi-lateral Environmental Agreements directly affecting Saker Falcon conservation

Convention on Biological Diversity (CBD)

The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives:

1. The conservation of biological diversity.
2. The sustainable use of the components of biological diversity.
3. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

Each Contracting Party shall, as far as possible and as appropriate:

(a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;

(b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;

(c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;

(d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;

(e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas;

(f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies;

(g) Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health;

(h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species;

(i) Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components;

(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;

(k) Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations;

(l) Where a significant adverse effect on biological diversity has been determined pursuant to Article 7, regulate or manage the relevant processes and categories of activities; and

(m)Cooperate in providing financial and other support for in-situ conservation outlined in subparagraphs (a) to (l) above, particularly to developing countries (CBD, 1992).

Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES)

The Saker Falcon is listed on Appendix II of CITES. Therefore, the regulation of trade in Saker Falcon specimens requires the prior grant and presentation of an export permit (or re-export certificate). An export permit shall only be granted when the following conditions have been met:

a) a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species;

b) a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora; and

c) a Management Authority of the State of export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment.

No import permit is necessary for these species under CITES (although a permit is needed in some countries that have taken stricter measures than CITES requires). Permits or certificates should only be granted if the relevant authorities are satisfied that certain conditions are met, above all that trade will not be detrimental to the survival of the species in the wild (CITES, 1979, CITES, 2013).

Convention on the Conservation of Migratory Species of Wild Animals (CMS)

The Saker Falcon is listed on Appendix I of the Bonn Convention as a migratory species that have been categorized as being in danger of extinction throughout all or a significant proportion of their range.

States strive towards strictly protecting these animals, conserving or restoring the habitats in which they live, mitigating obstacles to migration and controlling other factors that might endanger them. They shall also prohibit the taking of such species, with very restricted scope for making exceptions.

Therefore, Range States should endeavour:

a) to conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction;

b) to prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species; and

c) to the extent feasible and appropriate, to prevent, reduce or control factors that are endangering or are likely to further endanger the species, including strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species.

Parties that are Range States of a migratory species listed in Appendix I shall prohibit the taking of animals belonging to such species. Exceptions may be made to this prohibition only if:

a) the taking is for scientific purposes;

b) the taking is for the purpose of enhancing the propagation or survival of the affected species;

c) the taking is to accommodate the needs of traditional subsistence users of such species; or

d) extraordinary circumstances so require; provided that such exceptions are precise as to content and limited in space and time. Such taking should not operate to the disadvantage of the species.

Migratory species can be removed from Appendix I when the Conference of the Parties (COP) determines that there is either reliable evidence, including the best scientific evidence available, that the species is no longer endangered and that it is not likely to become endangered again (CMS, 2003).

UNESCO, Intangible Cultural Heritage - Falconry, a living human heritage

Fallowing the nomination made by the United Arab Emirates, Austria, Belgium, the Czech Republic, France, Hungary, the Republic of Korea, Mongolia, Morocco, Qatar, Saudi Arabia, Spain and the Syrian Arab Republic, the Intergovernmental Committee for the Safeguarding of the Intangible Cultural Heritage, UNESCO, inscribed **Falconry, a living human heritage** on the Representative List of the Intangible Cultural Heritage of Humanity (UNESCO, 2012).
No binding multilateral instrument as yet exists for the safeguarding of the intangible cultural heritage.
Since the majority of the articles pertaining to the UNESCO Convention have been kept very general and nonbinding, the States Parties have a large amount of leeway in the practical implementation of the Convention. Even the legally binding obligation to inventory intangible heritage within sovereign territory has been formulated in such a manner that the implementation is rendered very flexibly (BUT, 2011).

Table 6 Signatories of Multi-lateral Environmental Agreements relevant to the conservation of the Saker Falcon

Full name	Convention on the International Trade in Endangered Species of Wild Flora and Fauna	Convention on the Conservation of Migratory Species of Wild Animals		Convention on Biological Diversity
Short name Range countries	CITES	UNEP/CMS – Bonn Convention	UNEP/CMS Raptors MoU	CBD
Afghanistan	+			+
Armenia	+	+	+	Acceptance
Austria	+	+	(+ as EU)	+
Azerbaijan	+			Approval
Bahrain	+			+
Belarus	+	+		+
Bulgaria	+	+	(+ as EU)	+
China	+			+
Croatia	+	+		+
Cyprus	+	+	(+ as EU)	+
Czech Republic	+	+	(+ as EU)	Approval
Egypt	+	+		+
Ethiopia	+	+		+
Georgia	+	+		Accession
Hungary	+	+	+	+
India	+	+		+
Iran	+	+		+
Iraq				Accession
Israel	+	+		+
Italy	+	+	+	+
Jordan	+	+		+
Kazakhstan	+	+		+
Kenya	+	+	+	+
Kuwait	+			+
Kyrgyzstan	+			Accession
Libya	+			+
Macedonia				
Malta	+		(+ as EU)	+
Mongolia	+		+	+
Montenegro	+			Succession
Nepal	+		+	+
Oman	+			+
Pakistan	+	+	+	+
Qatar	+			+
Republic of Moldova	+	+		+
Romania	+	+	+	+
Russian	+			+

Federation				
Saudi Arabia	+	+		Accession
Serbia	+	+		+
Slovakia	+	+	+	Approval
Sudan	+		+	+
Syrian Arab Republic	+	+		+
Tajikistan		+		Accession
Tunisia	+	+		+
Turkey	+			+
Turkmenistan				Accession
Ukraine	+	+		+
United Arabian Emirates	+		+	+
Uzbekistan	+	+		Accession
Yemen	+	+	+	+

Annex 2 Regional Environmental Agreements directly affecting Saker Falcon conservation

Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)

The Saker Falcon is listed on Appendix II of the Bern Convention. Therefore, Contracting Parties should take appropriate and necessary legislative and administrative measures to ensure the special protection of the species. The following will in particular be prohibited for these species:

a) all forms of deliberate capture and keeping and deliberate killing;

b) the deliberate damage to or destruction of breeding or resting sites;

c) the deliberate disturbance of wild fauna, particularly during the period of breeding, rearing and wintering, insofar as disturbance would be significant in relation to the objectives of this Convention; d) the deliberate destruction or taking of eggs from the wild or keeping these eggs even if empty;

e) the possession of and internal trade in these animals, alive or dead, including stuffed animals and any readily recognisable part or derivative thereof (CE,1979).

Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds (EU Bird Directive)

The Saker Falcon is listed on Annex I of the Birds Directive. Therefore, the species should be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in
their area of distribution in the EU. Member States should classify in particular the most suitable territories in number and size as special protection areas for the conservation of these species.
In addition, they should protect the species in particular against

a) deliberate killing or capture by any method;

b) deliberate destruction of, or damage to, their nests and eggs or removal of their nests;

c) taking their eggs in the wild and keeping these eggs even if empty;

d) deliberate disturbance of these birds particularly during the period of breeding and rearing, in so far as disturbance would be significant having regard to the objectives of this Directive;

e) keeping birds of species the hunting and capture of which is prohibited.

Derogation from this general protection can be only permitted in the interests of public health and safety, in the interests of air safety, to prevent serious damage to crops, livestock, forests, fisheries and water, for the protection of flora and fauna if there is no other satisfactory solution; or for the purposes of research and teaching, of re-population, of reintroduction and for the breeding necessary for these purposes; or for judicious use of certain birds in small numbers. However, this cannot undermine maintaining the species' population at a satisfactory level.

Member States shall also see that any introduction of species of bird which do not occur naturally in the wild state in the European territory of the Member States does not prejudice the local flora and fauna. In this connection they shall consult the Commission (EC, 2009).

Table 7 Saker Falcon range state signatories of European environmental agreements

Full name	Convention on the Conservation of European Wildlife and Natural Habitats	Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds
Short name Range countries	Bern Convention	EU Bird Directive
Armenia	+	
Austria	+	+
Azerbaijan	+	
Belarus	+	
Bulgaria	+	+
Croatia	+	
Cyprus	+	+
Czech Republic	+	+
Georgia	+	
Hungary	+	+
Italy	+	+
Macedonia	+	
Malta	+	+
Montenegro	+	
Republic of Moldavia	+	
Romania	+	+
Russian Federation		
Serbia	+	
Slovakia	+	+
Tunisia	+	
Turkey	+	
Ukraine	+	

Saker Falcon Task Force, Objective 5 Report

SakerGAP Stakeholder Analysis

Compilers: András Kovács, Specialist Technical Advisor, Nick P. Williams, Programme Officer (UNEP/CMS Raptors MoU), Colin Galbraith (Chair of the Saker Falcon Task Force)

Draft: Final Draft

Date: 13 August, 2013

Recommended citation:

Kovács, A., Williams, N.P. and Galbraith, C. (2013) SakerGAP Stakeholder Analysis. *In:* Williams, N.P., Galbraith, C. and Kovács, A. (eds.) Compilation Report on WorkPlan Objectives 4 – 8, including a modelling framework for sustainable use of the Saker Falcon *Falco cherrug.* UNEP/CMS Raptors MoU Coordinating Unit, Saker Falcon Task Force, Abu Dhabi.

Table of contents

List of abbreviations

ASEAN	Association of South East Asian Nations
CBD	Convention on Biological Diversity
CIC	International Council for Game and Wildlife Conservation
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
ENRTP	Thematic Programme for Environment and Sustainable Management of Natural Resources Including Energy
FACE	European Federation of Associations for Hunting and Conservation
GCC	Gulf Cooperation Council
IAF	International Association for Falconry and Conservation of Birds of Prey
ICCWC	International Consortium on Combating Wildlife Crime
CU	Coordinating Unit
IUCN	International Union for Conservation of Nature
KSA	Kingdom of Saudi Arabia
LAS	League of Arab States
MEA	Multi-national Environmental Treaty
MoU	Memorandum of Understanding
NGO	Non-governmental Organisation
Raptors MoU	UNEP/CMS MoU on the Conservation of Migratory Birds of Prey in Africa and Eurasia
ROWA	(UNEP) Regional Office for West Asia
SakerGAP	Saker Falcon Global Action Plan
STF	Saker Falcon Task Force
TRAFFIC	Wildlife Trade Monitoring Network
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNOCD	United Nations Office on Drugs and Crime
WCO	World Customs Organization
WB	World Bank
WWF	Word Wide Fund for Nature

I. Introduction - Stakeholder analysis and management as critical success factors

At the 1st Meeting of the Saker Falcon Task Force (STF) in March 2012, members adopted a set of Guiding Principles to promote frank and open debate, to generate mutual trust and respect amongst representatives and to ultimately establish a positive and constructive atmosphere in which satisfactory resolutions can be achieved by the consensus of all stakeholders.

According to past experience of action planning for species conservation and management, the success of the Saker Falcon Global Action Plan will be dependent upon three key elements: a) the degree of engagement by the Range States of the species; b) the level of trust and credibility that that is established and maintained among key stakeholders, particularly those with potentially competing interests; and, 3) the level of funding support that can be secured to implement the Action Plan.

II. Specific Opportunity of the SakerGAP

A specific opportunity of the SakerGAP is to bring together an unusually wide spectrum of international stakeholders to develop a co-ordinated and collaborative approach to reaching and realising creative and effective outcomes to a long-standing challenge; the conservation of the Saker Falcon.

III. STF's WorkPlan 2012-2014

Objective 5 of the STF WorkPlan is: to carry out a Stakeholder Analysis and develop a Stakeholders' network - Identify and establish a network of main stakeholders to be involved in the implementation of the 2012-2014 Work Plan (including the SakerGAP Stakeholder's workshop) and identify their needs.
Lead contributor: CMS, CU of the Raptors MoU
Partners: Mohammed Sulayem (KSA), Janusz Sielicki (IAF), Diane Klaimi (ROWA)

1.1. Identify stakeholder groups, their underlying needs and interests and the underlying conditions (socio-economic, political, institutional, religious and cultural) of their involvement.
   a) Prioritize stakeholders.
   b) Identify key stakeholders.
   Deliverables: List of Stakeholders. Stakeholder Table. Influence/Interest Grid.

1.2. Establish a network of key stakeholders and seek their participation in the planning and implementation of the STF Work Plan.
   Deliverables: List of Stakeholders' contacts.

1.3. Map relevant international, national and private sector organizations and their interests in developing joint actions in order to enhance Task Force capacity and effectiveness
   Deliverables: List of potentially cooperating organizations and their contacts.

IV. Stakeholder Table – Identification of stakeholder groups, their underlying needs and interests and the conditions (socio-economic, political, institutional, religious and cultural) of their involvement.

ID	Group/Sub-group	Interest in conserving the Saker Falcon	Knowledge on Saker Falcon status	Position	Conditions	Interest in Saker conservation	Influence
I.	**Governance/Policy makers**						
I.1	Multi-lateral Environmental Agreements (CBD, CITES, UNEP/CMS)	Forms a part of their respective overall missions. SakerGAP is a good case example of a multi-national co-operation in conservation, sustainable use and trade of a globally threatened raptor species.	3 (Int)	Key Stakeholder	Conservation policy	High	High
I.2	Regional bodies (ASEAN, European Union, Gulf Cooperation Council, League of Arab States)	Conserving an endangered bird species which forms a vital component of regional biodiversity. The species commands deep cultural significance in many regions and requires an effective management system set within a sustainable framework in order to conserve it for future generations.	3 (Int)	Key Stakeholder	Conservation policy	High	High
I.3	National Governments	Legal obligation under CBD (if Party to the Convention) to conserve one of the most threatened assets of their national biodiversity and cultural heritage.	2 (3-1, N)	Key Stakeholder	Conservation policy	High	Medium (High-Low)
I.4	Saker Falcon Task Force (STF) under the auspices of the CU, UNEP/CMS Raptors MoU	Implement underlying aim and mission to halt the decline of the global population of the Saker Falcon; restore and/or maintain its Favourable Conservation Status via an Adaptive Conservation Management framework.	3 (IN)	Key Stakeholder	Conservation policy	High	Medium

ID	Group/Sub-group	Interest in conserving the Saker Falcon	Knowledge on Saker Falcon status	Position	Conditions	Interest in Saker conservation	Influence
II.	**Providers**						
II.1	Breeders	Occasional refreshing of breeding stock with high quality, genetically pure wild falcons.	2	Primary Stakeholder	Economic	High	Low
II.2	Trappers	Ensuring family livelihoods in the long term through controlled, legal and sustainable trapping and trade.	3(L)	Primary Stakeholder	Economic	High	Low
II.3	Traders	Ensuring family livelihoods in the long term through controlled, legal and sustainable trapping and trade.	2	Secondary Stakeholder	Economic	High	Low
III.	**Users/Direct Beneficiaries**						
III.1	End Users/Falconers	Conserving one of the most prestigious falconry species for use by future generations through conservation and sustainable use.	2 (2-1)	Key Stakeholder	Cultural	High	High
III.2	Local people (e.g. land owners, land users), often in less developed Range States	Ensuring family livelihoods through relevant stewardship systems, potentially including monitoring and eco-tourism.	2 (3-1, L)	Primary Stakeholder	Socio-economic	Medium (High-Low)	Low
IV.	**Influencers/Conservationists & Researchers**						
IV.1	International and national biodiversity conservation related NGOs (BirdLife International, CIC, FACE, IAF, IUCN, WWF, TRAFFIC)	Restore and maintain the Favourable Conservation Status of the Saker Falcon throughout its range, downlist its international conservation threat status. Science-based decision making.	3 (Int-N)	Key Stakeholder	Institutional	High	High
IV.2	Conservation Biologists/Researchers	Contributing to the conservation of the Saker Falcon through conservation biology studies and international/national data collection.	2 (3-1, Int)	Secondary Stakeholder	Institutional	Medium	Low

ID	Group/Sub-group	Interest in conserving the Saker Falcon	Knowledge on Saker Falcon status	Position	Conditions	Interest in Saker conservation	Influence
V.	**Enforcement and Prosecution Agencies**						
V.1	ICCWC (including INTERPOL, UNOCD, WB and WCO)	Enhance the effectiveness of international law enforcement.	2 (Int)	Key Stakeholder	Socio-economic	High	High
V.2	National Police Organisations	Enhance the effectiveness of national law enforcement.	1 (N)	Secondary Stakeholder	Socio-economic	Low	High
V.3	National Customs Organisations	Enhance the effectiveness of national law enforcement.	2 (N)	Secondary Stakeholder	Socio-economic	Low	High
VI.	**Courts**						
VI.1	International Courts	Enhance the effectiveness of international law enforcement.	2 (Int)	Secondary Stakeholder	Socio-economic	Low	High
VI.2	National Courts	Enhance the effectiveness of national law enforcement.	1 (N)	Secondary Stakeholder	Socio-economic	Low	High
VI.3	Regional Courts	Enhance the effectiveness of national law enforcement at regional level.	1 (N-L)	Secondary Stakeholder	Socio-economic	Low	High

Notes:

Knowledge: 3 = high; 2 = medium; 1 = low (or none); Int =International, N=National, L=Local

Rank: **Key Stakeholders:** The organizations and authorities that can devise, pass, and develop policies to enforce laws and regulations that may either fulfill the goals of conservation efforts or directly cancel it out.

Primary Stakeholders: Beneficiaries are those who stand to gain something – services, skills, money, goods, social connection, etc. – as a direct result of the effort. Targets are those who may or may not stand to gain personally, or whose actions represent a benefit to a particular (usually disadvantaged) population or to the community as a whole.

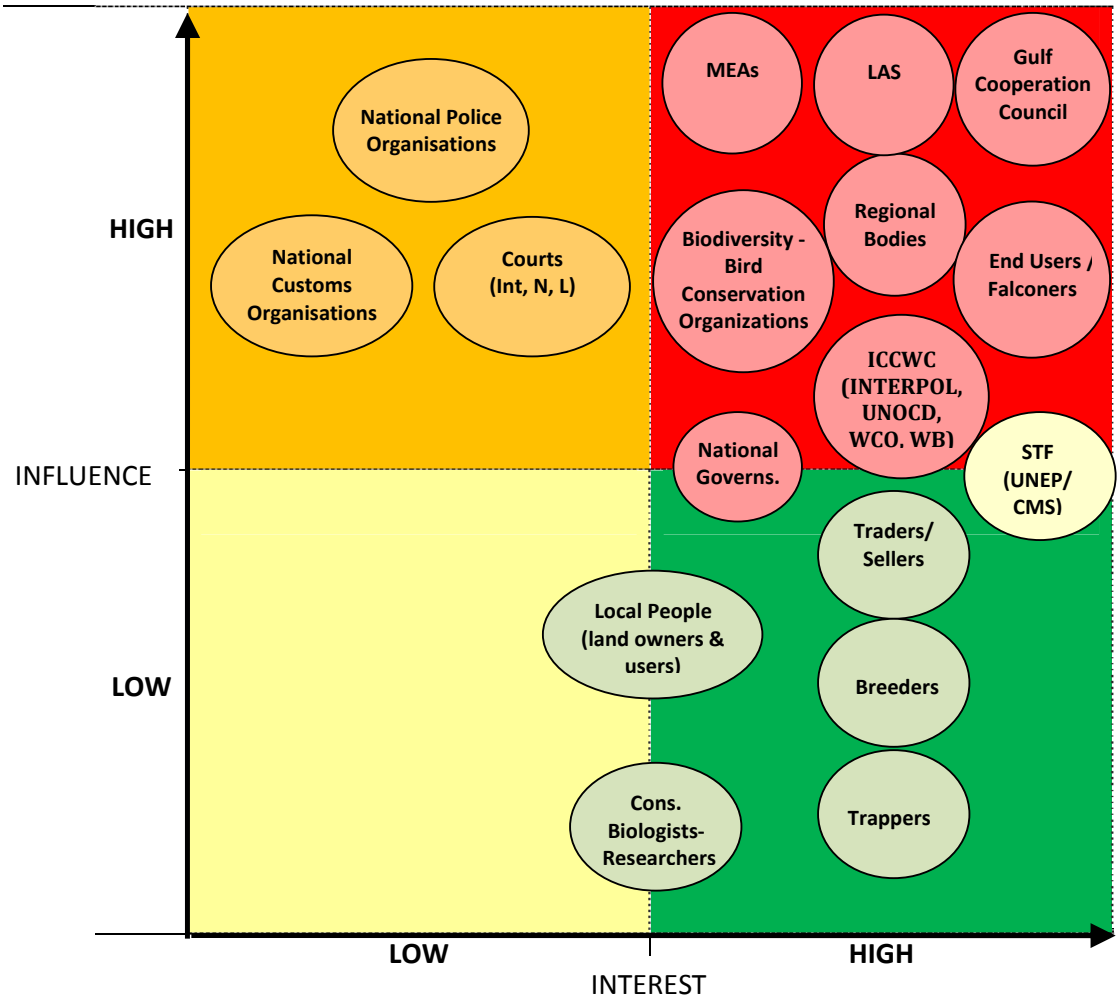
Secondary Stakeholders: Those directly involved with or responsible for beneficiaries or targets of the effort. Those whose jobs or lives might be affected by the process or results of the effort.

Influence: Refers to the ability of the stakeholder to affect the implementation of the Saker Falcon conservation policy due to the strength or force they possess (3 = high, 2 = medium, and 1 = low)

Interest: The level of interest in the success or otherwise of efforts to conserve the Saker Falcon (3 = high, 2 = medium, and 1 = low)

Sources: The community tool box, http://ctb.ku.edu/en/tablecontents/chapter7_section8_main.aspx, http://www.mindtools.com/pages/article/newPPM_07.htm

V. Stakeholder Grid (see the categories below)



Categories and necessary actions:

- ***High influencer, interested people:*** these are the people you must fully engage and make the greatest efforts to satisfy. They have both great interest in the effort and the influence to help make it successful (or to derail it).
- ***High influencer, less interested people:*** put enough work in with these people to keep them satisfied, but not so much that they become bored with your message. They have no particular interest or involvement in the effort, but have the power to influence it greatly if they become interested.
- ***Low influencer, interested people:*** keep these people adequately informed, and talk to them to ensure that no major issues are arising. These people can often be very helpful with the detail of your project. They have a vested interest and can voice their support in the community, but have little actual power to influence the effort in any way.
- ***Low influencer, less interested people:*** monitor these people, but do not bore them with excessive communication. They have little interest and little influence, and may not even know the effort exists.

Saker Falcon Task Force, Objective 6 Working Group Report

A review of key knowledge gaps concerning the biology and ecology of the Saker Falcon *Falco cherrug* and the socio-economic factors affecting its use

Lead: Nigel Collar (BirdLife International)

Contributors: Andy Symes (BirdLife International), Andrew Dixon (IWC), Mátyás Prommer (Hungary), Mohammed Shobrak (Saudi Arabia) and Janusz Sielicki (IAF)

Date: 29 July, 2013

RAPTORS MOU

CMS UNEP

Recommended citation:

Collar, N., Symes, A., Dixon, A., Prommer, M., Shobrak and M., Sielicki (2013) A review of key knowledge gaps concerning the biology and ecology of the Saker Falcon *Falco cherrug* and the socio-economic factors affecting its use. *In:* Williams, N.P., Galbraith, C. and Kovács, A. (eds.) Compilation Report on WorkPlan Objectives 4 – 8, including a modelling framework for sustainable use of the Saker Falcon *Falco cherrug.* UNEP/CMS Raptors MoU Coordinating Unit, Saker Falcon Task Force, Abu Dhabi.

Table of contents

I. Executive summary

The CMS Saker Falcon Task Force (STF) is committed to producing and implementing a Global Action Plan for the species. Among the issues the plan must address are the knowledge gaps that prevent consumers and conservationists from being able to manage Saker populations. STF appointed a working group from within its ranks to identify and describe these knowledge gaps, and (owing to its previous involvement in reviewing the IUCN conservation status of the Saker) asked BirdLife International to take the lead in this group. The working group corresponded electronically in pooling the judgements and expertise of its membership, recognising from the outset that, despite the Saker's huge cultural significance in falconry, there are many gaps in our knowledge, concerning (1) distribution; (2) population sizes and trends; (3) ecological issues; (4) trade effects; and (5) anthropogenic impacts (positive and negative) other than trade.

Apart from drawing on the first-hand knowledge of the working group members, the review was conducted by reference to the considerable body of literature on the Saker that has built up particularly in the past 15 years. Unfortunately much of this is difficult to interpret owing to its contradictory evidence and absence of rigorous scientific standards of method and/or reporting. However, this problem was itself seen and incorporated as a component of the 'knowledge gaps' that exist in the case of the Saker. The resulting draft document was circulated four or five times to members of the working group and incrementally completed through their various input.

The review of information on range and numbers indicated the need for improved breeding distribution data for Turkey, Russian Federation, Kazakhstan, Kyrgyzstan and China, for improved breeding population data for Turkey, Ukraine, Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan, Mongolia and China, and for information on the size of the migrant population in Iran and Afghanistan. This will require a significant investment in field teams in these countries, working as far as possible with the same or compatible methodologies (whether attempting to determine absolute numbers or to achieve a statistically robust sample).

Scientific fieldwork was also deemed to be needed to determine a long series of biological questions: (a) the proportion of the sexes and age-classes affected by trapping in wintering areas, (b) the effects on breeding performance of trapping, (c) any long-term effects on dispersal of trapping the longer-distance migrants, (d) the migration routes and wintering grounds of different populations and the boundaries between them, (e) age-specific survival rates and the causes of their variation, (f) the vulnerability (and its prevention) of habitats to food declines, (g) the seriousness of the impacts of grassland conversion, undergrazing, overgrazing, rodent eradication, afforestation, tree-felling, infrastructure development and mining on breeding populations (h) the impact (and its mitigation) of powerlines on Saker numbers, (i) the measures to mitigate climate change effects on lowland grasslands, (j) the risk level posed by wild Sakers hybridising with escaped hybrid falcons, (k) the identity of populations that can be subject to marker-recording techniques to indicate population sizes and trends, (l) the funding needed to improve the future Saker monitoring and conservation technologies, (m) the socio-economic costs and benefits of maintaining traditional landscapes for Sakers, and (n) the relationships of Saker performance variables with nest availability and food supply. Although the working group did not directly consider the means by which the answers to these questions might be obtained, the research required is perhaps best conducted through a series of doctoral theses under the supervision of the appropriately qualified expert academic(s) and through the publication of the results in respected peer-reviewed journals.

The working group also identified the management and policy knowledge gaps that will need to be addressed in the Saker Action Plan. These include: (o) the population levels appropriate for Range States to seek to achieve, (p) the scale and extent of trapping of wild Sakers in countries not holding breeding populations, (q) harvest levels from different Saker populations and the contribution of falconers to sustainable supplies, (r) appropriate measures to optimise the contribution and effectiveness of protected areas to Saker security, (s) the conditions, practices and protocols for successfully establishing new Saker populations with artificial nests, for sustainably harvesting new populations from such nests, and for successfully reintroducing Sakers to parts of the former range, (t) the level and type of state and NGO activity to prevent poaching, (u) the means by which falconers will persuaded to require a legal supply chain, and (v) the level and source of funding for a system of education, monitoring, regulation and conservation based on training wild Sakers. Again, the working group did not directly consider how these knowledge gaps might be filled, but strongly supervised doctoral research (with appropriate committee) is of course a sensible and cost-effective approach that would supply some of the answers, while other questions might be addressed by an investigative working group with a several-year remit and members representing various regions and interests, academic, economic, social and conservation.

The knowledge gaps identified in this review are of many types and many dimensions, and answers will not come easily or cheaply. A key issue is coordination: the Saker Action Plan will presumably supply this, but action plans tend to fail if they do not include, as components, a plan for both the leadership and the funding of the actions identified. With so many and so varied an array of knowledge gaps, the need for such leadership and funding is particularly stark. Perhaps a solution would be the formation of a working group with links and responsibilities to CMS and BirdLife International that would have the remit to promote and coordinate research of the types needed, on basic distributional and population information, key biological questions, and critical policy decision-making.

II. Introduction

The Saker Falcon *Falco cherrug* is a bird of prey adapted to relatively arid, open landscapes, wooded steppe and foothills in the Palearctic region (from eastern Europe to western China), where it hunts ground-haunting mammals supplemented with birds and other prey. Its large size for a falcon and its widespread use of drier environments have led over centuries to its use as the foremost bird of prey by Arabian falconers, particularly with regard to the hunting of (in particular) the Houbara Bustard *Chlamydotis undulata*. The immense cultural importance of falconry in Arabian countries and the increasing wealth of some Arab falconers have been suggested to be among the key factors that have led in recent decades to pressures being placed on both Saker and Houbara populations. The global population of the Saker is estimated to be c.12,800–30,800 mature individuals, based on national breeding population estimates that total c.6,400–15,400 pairs (median c.10,900) (BirdLife International 2013). However, compared to estimates from 20 years ago, this reflects an overall decline of c.50%, representing a serious and alarming circumstance whose causes and cures require the most urgent attention. Consequently the Saker is now listed as Endangered and the Houbara as Vulnerable on the IUCN Red List. It is also listed on Appendix II of CITES (under a blanket covering of Falconiformes) while the Houbara is listed under Appendix I. In Europe the Saker has been the subject of an action plan (Nagy & Demeter 2006).

The Saker Falcon shows migratory movements in parts of its range (moving south in the post-breeding period, with some birds in the west crossing the Mediterranean and wintering in Afrotropical Africa), and was therefore included in Appendix II of the Convention on Migratory Species (CMS). In 2011, following its placement also on Appendix I, CMS adopted a resolution calling for the establishment of a Saker Falcon Task Force under the auspices of the Interim Coordinating Unit of the UNEP/CMS MoU on the conservation of migratory birds of prey in Africa and Eurasia ('Raptors MoU').

Appendix II of CMS provides for 'migratory species which have an unfavourable conservation status and which require international agreements for their conservation and management, as well as those which have a conservation status which would significantly benefit from the international cooperation that could be achieved by an international agreement.' Parties that are range states for Appendix II species are required to conclude agreements to benefit the species. However, Parties to CMS that are range states of species listed on Appendix I are further required

(a) to conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction;

(b) to prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species; and

(c) to the extent feasible and appropriate, to prevent, reduce or control factors that are endangering or are likely to further endanger the species, including strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species.

Moreover, Parties that are range states 'shall prohibit the taking of animals belonging to such species', with exceptions permitted only if:

(a) the taking is for scientific purposes;

(b) the taking is for the purpose of enhancing the propagation or survival of the affected species;

(c) the taking is to accommodate the needs of traditional subsistence users of such species; or

(d) extraordinary circumstances so require [as long as] precise as to content and limited in space and time [and] not to the disadvantage of the species.

Finally, Parties may be invited to 'take further measures considered appropriate to benefit the species'.

So large is the range of the Saker, so little is known about its population status and trends, and so great is the pressure believed to be on it from falconry-related trapping that the fulfilment of the legal

requirements under the CMS agreement is highly problematic. CMS's Saker Task Force (STF) convened in March 2012 to review the needs of the Parties in order to fulfil their obligations through the implementation of an action plan for the species. The STF aims to develop a coordinated Global Action Plan ('SakerGAP'). Among the most important dimensions of the STF's work has been to identify knowledge gaps that affect the ability of Parties to manage Saker populations in a manner compatible with their obligations under international law and with their implementation of the SakerGAP. This is set as Objective 6 of the STF's 2012–2014 workplan.

III. Key knowledge gaps

Despite its high cultural, economic and conservation value, there has been surprisingly little significant scientific research on the Saker: thus in Google Scholar, where in 2011 the first 10 pages listed 96 papers on the Saker from the last 20 years, 31 were not peer-reviewed and could not count as replicable science, 49 were concerned with disease in captive birds, genetics and physiology, 4 with the species's general environment, 2 with techniques, 2 with trade, 1 with local status and only 7 with the biology of wild birds. Consequently, the evidence base for the conservation of the Saker as a threatened species, and for its sustainable utilisation an economic resource, is virtually non-existent.

Gaps in our knowledge of the Saker Falcon have long been a problem in assessing the species's global extinction risk for the IUCN Red List. The great majority of species require the assessment to extrapolate from relatively incomplete datasets, allowing various degrees of probability to inform the process. Among the most difficult species to assess are those that live at low densities but occupy very large ranges encompassing very remote regions. The typical circumstance of such species is that they have been studied by a few surveys over several time periods, almost always covering different areas and using different methods, so that comparisons are fundamentally very problematic.

The Saker Falcon presents this kind of problem. It has a massive range (something over 7,000 km from west to east), and the countries in which its largest populations are (or were) thought to occur—China, Kazakhstan, Mongolia, Russia (i.e. Asian Russia) and Uzbekistan, as well as countries with potentially large populations such as Ukraine and Turkmenistan—are all large, with significant areas of relatively inaccessible terrain where a biological research presence is either very small or non-existent. A very significant degree of uncertainty and speculation therefore accompanies population estimates for range states in Asia. The gaps in knowledge are in fact so great that they can only here be outlined in generality. They fall into five different types, concerning: (1) distribution; (2) population sizes and trends; (3) ecological issues; (4) trade effects; and (5) anthropogenic impacts (positive and negative) other than trade. Each of these is considered in turn below.

A further issue concerns taxonomy. The 'Altai Falcon', which is regarded variously as a species, *Falco altaicus* (e.g. Ferguson-Lees & Christie 2001), a subspecies *F. cherrug altaicus*, a morph of Saker Falcon or simply a synonym of it, appears to be limited to the Altai-Sayan Mountains in Russia and Kazakhstan (Moseikin 2000); it may be derived from a certain amount of interbreeding with Gyr Falcons *Falco rusticolus* (Potapov *et al.* 2002). The general assumption appears to be the Altai-Sayan Mountains are part of the range of the Saker, but agreement is not unanimous. Recently, a review of geographical variation in the Saker concluded that the Altai Falcon has no taxonomic status, but that as many as seven phenotypes and subspecies may be distinguishable by the analysis of the colour pattern of adult Saker plumages (nominotypical *cherrug*, *progressus*, *milvipes*, *coatsi*, *aralocaspius / korelovi*, *hendersoni* and *anatolicus*) (Karyakin 2011). In addition to this, there is a problem of intergradation with Lanner Falcon *Falco biarmicus* and a remarkable genetic homogeneity which could be taken to imply that Gyr Falcon is conspecific within the subgenus *Hierofalco* (Nittinger *et al.* 2007), although this interpretation has gained no traction.

Distribution

The most fundamental items of information in conservation assessment concern range and numbers. These two parameters are crucial elements in determining both Red List status and appropriate measures of management. In the case of the Saker Falcon, the distribution of the species in each of the key countries listed below remains insufficiently clear. For example, the true breeding ranges in Uzbekistan and China are still very far from being understood; in other major countries the situation is only marginally better. Unless and until this clarification happens across all countries, population estimates will remain very uncertain.

A second issue concerns migratory patterns and winter quarters. Some limited work, using satellite transmitters, has been undertaken on this in Hungary, Kazakhstan and Mongolia, indicating that Saker Falcons exhibit complex patterns of movement outside the breeding season, occupying many areas at least briefly that were completely unknown for the species before and possibly therefore encountering threats that were previously undocumented.

Inevitably, knowledge gaps in distributions always exist. However, in this review it is accepted that inaccuracies and needs will exist even where the knowledge is good, but we here concentrate on the most obvious and significant deficiencies.

European range (except Ukraine)

Range states in which the Saker is known to breed (or to have bred) in Europe include Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Moldova, Poland, Romania, Serbia and Slovakia (no evidence for Slovenia, Bosnia-Herzegovina, Macedonia, Montenegro, Albania, Kosovo). However, precisely because the countries are relatively small, with relatively well developed nature conservation interests, this information must be judged relatively accurate. Therefore in terms of significant knowledge gaps this portion of the Saker's range is considered to have none.

Turkey

Recent initial survey work and assessment suggests that a small breeding population exists in Central and Eastern Anatolia, but also that 'much apparently suitable habitat with a plentiful food supply' is available for the species in this area (Dixon *et al.* 2009). Given the size of the area in question it is appropriate to ask:

- What is the present distribution of the species in Turkey?

Ukraine

The range of the Saker in Ukraine appears to be restricted to the south and east of the country, south of 49°N and 28°E, very approximately 25% of the national territory (Akimov 2009; updated map in Myloboh 2012). No significant knowledge gaps therefore apply.

Russian Federation

The Russian range of the Saker Falcon covers an area totalling 1,084,000 km² (Karyakin *et al.* 2004a) and divides into two main areas, European Russia (west of the Urals) and Asiatic Russia (east of the Urals). Many details of historical records are in Karyakin *et al.* (2004a). The range of the Saker in Asiatic Russia is described as 'a relatively large enclave south of the Ural mountains with a chain of small fragments or isolated nesting areas along the state border with Kazakhstan up to… the Altay-Sayan mountains and… Baikal Lake' (Galushin 2004). However, this assessment omitted the populations that extend over the north and east of Mongolia, chiefly in 'Chita district' and fragmentarily in Amur, Evreyskaya and Primorskiy regions (documented in Karyakin 2008).

There seems to be no recent, accurate map of the distribution of the Saker in the Russian Federation. Given the central significance of Russian populations of the species, it is clearly important to synthesise the latest information from across the range into a cross-referenced map as a baseline for future monitoring of trends. Thus the key knowledge gap is:

- What is the past and present distribution of the species in the Russian Federation?

Kazakhstan

The species does not breed throughout the country, but in the north, central, south and east (where suitable rocky areas for nesting exist, including the Zailiysky and Dzhungarsky Alatau and Altai ranges), with a range gap that isolates the northern birds from the rest (Kenward *et al.* 1998, Levin *et al.* 2000). Sakers

breeding in northern Kazakhstan appear to migrate south-west at least as far as the Middle East; those from southern and eastern regions appear to be far more sedentary, and some overwinter locally (Kenward *et al.* 1998, Levin *et al.* 2000). The range of the species in the country is thus fairly well defined, although at least in the late 1990s new areas with breeding birds were being discovered (Levin *et al.* 2000, Bragin 2001). However, as with the Russian Federation it is important to synthesise the latest information into a cross-referenced map as a baseline for monitoring, so it is worth asking:

- What is the past and present distribution of the species in Kazakhstan?

Kyrgyzstan

Prior to recent research initiatives the only specific area mentioned appears to be the (Lake) Issyk-kul area; but in 1998 the species was found in the western part (called Balykchy) of Issyk-kul and in the 'Ak-Say study area' (Gott *et al.* 2000). The only other area cited for the country is 'near Nyrin', where a small population of Sakers was reported to have been wiped out by trapping (Gott *et al.* 2000). This information, now 13 years old, suggests the need for a fresh and full assessment of the range of the species, hence:

- What is the past and present distribution of the species in Kyrgyzstan?

Turkmenistan

Dixon (2009) reports that a study (Saparmuradov 1999—unseen) found Sakers widely distributed in the country, with the main breeding areas being the mountains and foothills of the Kopet Dag bordering Iran, hills in the central Karakum Desert, the Usturt Plateau, the Badhyz region close to the Afghanistan border and the mountain foothills of the far east.

Uzbekistan

The species nests in suitable habitats between the Amudarya and Sirdarya Rivers, mainly in the low mountains and foothills of the Kyzylkum Desert and in the southern foothills of the Pamiro-Alai mountain system (Kreuzberg-Mukhina *et al.* 2001). In winter, breeding birds move south but are replaced by individuals from northern Kazakhstan and Siberia, but most birds leave and only a small number of birds are resident (Kreuzberg-Mukhina *et al.* 2001).

Mongolia

An outline of records and studies of the species in Mongolia is provided in Shagdarsuren (2000), who reported that fieldwork to determine its range in 1959–1964 recorded it in most forest-steppe and steppe zones of the Mongolian and Gobi Altai, Khangai, Khuvsgul and Kentii Mountains; in the north it was known from around 'Sangiin-Dalai-Nuur' lake and the Selenge river, while in the Trans-Altai Gobi it was recorded in 'Segs-Tsaagan Bogd, Naran-Sevesteyn-nuruu, Aj-Bogd, Seruun-Khairhan, Noyon-Bogd, Gurvan-Saikhan and Khurh-uul'. Further notes on range are in Bold & Boldbataar (2001). An expansion of range and presumably of numbers occurred in the 1990s when birds began nesting on disused man-made structures following the withdrawal of the Soviet military and an economic depression (Potapov *et al.* 1999a). In winter a good number of Sakers remain in Mongolia, at least in the central and southern parts (Shagdarsuren 2000, Sumya *et al.* 2001); only adult birds remain in central Mongolia (Gombobaatar *et al.* 2004).

China

The species occurs in the provinces of Xinjiang, Qinghai, Sichuan, Gansu, Tibet, Inner Mongolia, Ningxia, Heilongjiang, Liaoning and Hebei (Cheng 1987, Zheng 1994 in Li *et al.* 2000). An important map in Ye *et al.* (2001) shows a patchwork of records ('sightings', distinguished from 'wintering areas') from the west and centre of the country, in the Altai Mountains, Tien Shan, Kunlun Shan, Altun Shan, Qilian Shan, Tanggula Shan and Bayan Har Shan, plus the Da Hinggan Ling and Xiao Hinggan Ling in the far north-east in Inner Mongolia and Heilongjiang. Studies in 2001 resulted in the judgement that the species 'might breed in small

numbers in Alashan mountains, along the Mongolian border, in Altay foothills and in Quinhai [*sic*] province' (Ye & Ma 2002). Clearly there is little certainty relating to the range of the species in China and this represents an extremely challenging knowledge gap:

- What is the present distribution of the species in China?

Other (Central) Asian countries

Saker Falcons are known to breed also in Iran, Afghanistan, Tajikistan and possibly Pakistan, but there is insufficient evidence at least at present to determine the true (former) breeding distribution of the species in these countries, given the degree of population reduction in them; thus these countries now appear to be more important as migration and wintering areas (see Dixon 2009). The range of the species in these countries is clearly a knowledge gap, but perhaps not a significant one for conservation purposes. A similar situation applies to Armenia, Azerbaijan and Georgia, none of which is large enough to play a significant role in the conservation of the Saker.

Wintering areas

Evidence from satellite telemetry is revealing fairly complex patterns of movements by Sakers in the non-breeding period. It is likely that Sakers leave breeding areas which experience the most severe winters, but as a general rule the majority of the breeding population is sedentary, while a smaller part is migratory, regardless of geographic situation (M. Prommer). Most individuals in the first-year cohort (from Central Europe to western Asia) show parallel migration uniformly to south-west, and a cone-shaped pattern of distribution east of the Altai, whereby a wide breeding population focuses down into a smaller winter range on the Tibetan Plateau and neighbouring areas (M. Prommer). European males travel shorter distances, while females may reach Africa; however, there are significant individual differences in migration distance. Those individuals migrating in subsequent years keep returning to their first wintering area; non-breeding adults (floaters) and immatures, as well as failed breeding adults (when prey availability is poor), show nomadic movements (Prommer *et al.* 2012). Immatures migrate earlier than adults, according to trappers in Saudi Arabia (AlRashidi 2004).

Some birds from western populations winter in arid areas either side of the Mediterranean Sea, ranging from Sicily (Italy) and Tunisia east to Turkey and Egypt, with some birds penetrating south in the Nile Valley to Sudan, Ethiopia and Kenya, and a few crossing the Sahara to the Sahelian zone. Birds are also found in apparently only small numbers in parts of the Middle East in Syria and Iraq, and in Pakistan and Gujarat (western India). Numbers of birds stay in or pass through Iran and the Arabian/Persian Gulf, and possibly reach Africa via the Arabian Peninsula. Generally, Chinese and eastern Mongolian birds winter south and east of their breeding ranges, but within China itself. For example, the Qinghai-Tibetan plateau has been identified as an important wintering region for Mongolian Sakers, and while ring/microchip recoveries indicate that birds from northern Kazakhstan migrate south-west (Kenward *et al.* 1996, 1998), juveniles dispersing from eastern Kazakhstan have been recovered in China and Mongolia (A. Dixon).

There appear to be no significant knowledge gaps concerning the distribution of birds in winter, although there are major issues relating to proportions of the population in the wintering range and their fate (see below).

Population estimates and trends in key countries

Robust information on population sizes and trends is essential for dependable global status assessment and good conservation practice. Information on population *sizes* can be generated through targeted surveys and extrapolation, but its accuracy increases with increased area covered and time invested by fieldwork; mark/recapture estimates have also proved valuable in generating population sizes for low-density, elusive species (Kenward 2006). Once a robust set of population values has been established through rigorous

fieldwork and analysis, information on population *trends* can be generated through standardised monitoring protocols that sample areas across the range within each country, without involving the same degree of geographic coverage as the population size surveys. By means of the population size surveys a baseline is established; by means of the population trends surveys a monitoring programme develops.

Despite (a) its extraordinary economic value and (b) the very considerable endeavours of some excellent fieldworkers, outside of Hungary the Saker Falcon has never been subject to scientific survey and monitoring of this type. Consequently the quality of the data available for analysis is low. Dixon (2009) classified the data quality of national population figures he assembled for 13 countries in Asia into five classes (excellent, good, medium, poor, guess) and found 1 was medium, 6 were poor and 6 were guesses. This has serious implications for the robustness of the Red List assessment. When data quality is poor, Red List assessments are inherently unstable, since (a) they require the exercise of judgement in applying the precautionary principle, and (b) new data can have a disproportionate impact on such judgement. Moreover, poor-quality data give little indication of the most appropriate conservation measures. There is therefore a pressing need to institute a rigorous and comprehensive programme of population evaluation and monitoring across the Asian range of the species.

European range (except Ukraine)

At present 360–400 pairs, representing only 2–4% of the global population, are judged to breed in Europe (M. Prommer). National populations have been assessed by repeated surveys in many of Europe's countries and it is improbable that significant numbers have been missed. Moreover, it appears that population monitoring is well developed and population trends are consequently known.

Turkey

The total population in the first decade of this century was estimated at 50 pairs (Dixon *et al.* 2009). This was the first concerted attempt at a thorough survey, and while it largely fills a knowledge gap it also establishes a real need for further surveys that can, in due course, be turned into a monitoring programme.

- What is the population size and population trend in Turkey?

Ukraine

Barton (2002) remarked that 'East Ukraine… populations have disappeared or are severely overexploited', which implies a significant decline in numbers from some unknown earlier baseline. The population of Sakers in the whole country was most recently estimated at 270–345 pairs (Dixon 2007). The development of a network of powerlines in previously treeless agricultural areas may have led to an expansion in numbers, but illegal trapping, agricultural intensification and the concomitant collapse of the suslik (ground squirrel) population has probably outweighed any gains (M. Prommer). Thus although the population is reasonably well known, the trends in numbers is less certain and in need of clarification.

- What is the population trend in Ukraine?

Russian Federation

In the 1970s the population 'decreased significantly' inside what was then the Soviet Union (Baumgart 1991). At the beginning of the 1980s the national population was judged unlikely to be fewer than 1,000 pairs (Red Data Book 1983 in Galushin & Moseikin 2000); at that time the Saker was thought to have disappeared from several areas including Tula, Voronesh, Riasan (Baumgart 1991). Moreover, in its submission to the CITES Animals Committee, ERWDA (2003) indicated that the population of the entire Russian Federation (by implication around the year 2000) was 550–700 pairs, basing this on a conflation of two published papers (Galushin *et al.* 2001, Ryabtsev 2001) and one internal report (with Galushin and Karyakin included in the authorship). By contrast, Karyakin (2008) postulated that the population in the 1970s was 9,000 pairs, with 3,000 in European Russia (1,000 in the south, 2,000 in the south-east), 500 in

south-west Siberia, 1,500 in Altai, 2,800 in Tuva, 600 in the Baikal region, and 600 in the Chita region. He estimated a population of 1,854–2,542 (mean 2,183) pairs for Russia in 2007 and concluded there had been 76% decline over 30 years across the country.

Writing of all of European Russia, Baumgart (1994) noted there were roughly 80–150 pairs in recent years (up to around 1990), with a small decrease in numbers; this was re-set as 110 pairs for the year 2000 (Galushin *et al.* 2001). However, Galushin (2004) referred to 'an almost total crash in… European Russia in 1990s' and to the fact that the species 'has almost disappeared there'. In 2000 the range of the species in European Russia was regarded as only around 50,000 km², i.e. '20 times less than its former range of 30–50 years ago' (Galushin *et al.* 2001), which indicates a truly massive decline rate since the 1960s. The entire Saker population in European Russia was judged to be 110–140 pairs (or 100–150 pairs: Galushin 2004), or, as a single value, 120 pairs (Galushin & Moseikin 2000), and by the 2000s this number was 30–50 pairs or merely 25 pairs or even 'already extinct' (Galushin 2004). The population was judged to be in steep decline and 'on the brink of extinction', although suslik population recovery (from what problem or population level is not specified) suggested that a Saker comeback might also be possible (Galushin *et al.* 2001), but since 2004 there has been no record of Saker breeding anywhere in European Russia (I. Karyakin to M. Prommer).

In Asiatic Russia around the year 2000 the Altay-Tuva-Sayan area (450,000 km²) held 1,600–2,100 pairs, the Lake Baikal area (400,000 km²) 300–500 pairs and the Ural–south-western Siberia enclave (250,000 km²) 200–300 pairs, yielding a total of 2,100–2,900 pairs although numbers 'continue to decline almost everywhere', with less than half the pairs breeding successfully in some areas (Galushin 2004). Karyakin *et al.* (2004a), by contrast, considered the number of Sakers east of the Urals to be 'more or less stable', but Karyakin *et al.* (2006) referred both to a decline in numbers in Irkutsk by half ('decrease in about 2 times') over the previous ten years, and to a decrease in part of Buryatia 'especially around Ulan-Ude'. Then, in a revision of the Altai-Sayan region (which includes Tuva) Karyakin & Nikolenko (2008) documented an overall decline of 18% in Sakers in a five-year period, from 1,600–2,096 pairs (consistent with those in Galushin 2004) to 1,372–1,646 pairs, down to 1,196–1,440 pairs in 2011 (Karyakin & Nikolenko 2011b). An earlier decline in Altai numbers was inferred from the registration of 44 records, 1986–1990, as against 16 records, 1991–1997 (Kuchin & Zubakina 2001). Likewise, tabulation of three successive surveys in the Krasnoyarsk District and Tuva Republic revealed that the number of occupied territories declined from 53 in 1999 to 31 in 2001 (Karyakin 2002).

The evidence assembled by Russian biologists clearly indicates a catastrophic decline in European Russia and a significant one in Asiatic Russia. The methods by which population sizes were derived are not stated in the sources cited, but there is a general convergence which suggests that the continued application of similar methods would at least reveal dependable trends. Pending the production of a detailed map of the range of the species in the Russian Federation, the only requisite may be for continued monitoring.

Kazakhstan

There has been some confusion about the status of the Saker in Kazakhstan. In one recent review of the evidence, the population in 1990 was 4,808–5,628 (median 5,218) pairs, and in 2010 1,882–2,179 (median 2,031) pairs (Moshkin 2010). Elsewhere the population was judged to be 2,000–5,000 birds up to 1985, and c.1,900 in the early 1990s (Kenward *et al.* 1996), but in the next few years to have plunged to 'the brink of extinction', although still numbering 300–400 pairs (Levin 2000). The following year the same author, after saying that there were 'until recently… 1000–3000 pairs in the republic', estimated the national population at only 150–200 pairs (Levin 2001; also in Barton 2001). Levin *et al.* (2000) indicated the decline to have been 'especially marked in the more accessible southeast of the Republic', but that overall 'the current situation appears to be threatening the status of the Saker as a breeding bird in Kazakstan'. In pointing out that Levin's (2001) estimate was 'based on studies conducted within a fraction of the Saker Falcon's breeding range' Dixon (2005) remarked that based on new work in 2004 'the population is believed to be in excess of 1500 breeding pairs'. Subsequently, in reviewing recent project publications which yielded a number of estimates for various parts of each of the main regions, Dixon (2009) concluded: 'Given that no

data exists for an enormous area of suitable habitat in Kazakhstan, the current breeding population of the country undoubtedly exceeds 2000 breeding pairs', and tabulated the population as 2,000–3,000 breeding pairs, indicating a 'stable/declining' trend. By contrast, Levin (2011) proposed that the Saker population in Kazakhstan declined 5–6 times since 1990 and in 2010 stood at around 1,000 pairs (actually tabulated as 980).

Meanwhile, in 2003–2004 a large, apparently previously unsuspected population was discovered in the 'north-west' of the country; in one part of the resulting paper this is given as an extrapolation of 1,204–1,427 (median 1,316) pairs, of which 145–165 pairs are in the northern sector and the rest (i.e. 1,059–1,262 pairs) in the western sector (c.1,119 pairs on the Ustyurt Plateau), while in another part of the paper the population for all Kazakhstan was 'projected' as 1,165 pairs (Karyakin *et al.* 2004b, 2005a). The comment was then made that 'the newly discovered population is the largest in Middle Asia, and the Saker's survival depends on its state' (Karyakin *et al.* 2004b, 2005a). In 2005 the area around the Aral Sea was further investigated, 21 breeding territories found, 130–245 pairs estimated for the region and a total of 1,306–1,638 (median 1,482) pairs given as the total for 'Western Kazakhstan' (Karyakin *et al.* 2005b).

Levin (2001) referred to 'the complete devastation of the southern regions of the country' by trappers, leaving only the east as the species's last refuge, where, however, 'according to the most optimistic estimations the number of Sakers does not exceed 50 pairs'. Two years later Levin (2003) indicated that numbers and densities had improved somewhat, owing to the recovery of suslik populations. Levin (2008a) estimated 400–450 pairs as the original population of the eastern region, this dropping to 120–145 pairs 'for last 15 years', yet Levin (2008b) and Levin & Dixon (2008) maintained that data on numbers of territories showed a 65% decline in the breeding population between 2000 and 2008. In compensation, investigations in the central areas of the country in 2005 and 2007 led to a total of 171–215 pairs in the Ulytau Mountains, the Sarysu River basin and the Betpak-Dala desert (which had lost all its Sakers to trappers but birds had come back when powerlines were erected across it) (Levin & Karpov 2005, Karyakin & Barabashin 2006, Karyakin *et al.* 2008).

All this evidence indicates several things. First, not all populations had been found by the end of the twentieth century, which raises questions as to whether there are areas of the country which still await investigation—Dixon's (2009) point about no data existing 'for an enormous area of suitable habitat' carries the implication that many more areas might be expected to hold the species. Second, estimates have varied significantly, not only between decades and observers but also from the same observer. Third, the confidence limits for the population (2,000–3,000 pairs, or this *vs* the 1,000 pairs of Levin 2011) are wide, and the trends in numbers ('stable/declining' in one account, 'catastrophic decline' in another) obscure. Thus, inevitably:

- What is the population size and population trend in Kazakhstan?

Kyrgyzstan

At the start of the twentieth century the species was described as 'abundant' but in the 1970s and 1980s it was considered to be in decline (sources in Gott *et al.* 2000), and it was placed on the national red list in 1986 (Shukurov & Davletbakov 2001). Dixon (2009) produced evidence from the 1980s which also suggested a serious decline in the 1970s and only a small breeding population in the 1980s. In one account, 'before 1990s' there were 150–200 pairs in the main breeding areas but from the 1990s numbers steadily declined, with 'up to 20% of nests… robbed for quick profit' (Turganbaev 2001). In another account, at the start of the twenty-first century the national population was estimated (with no reinforcing evidence) at 100–120 pairs, but 'the number is declining very fast' (Shukurov & Davletbakov 2001). A recent comment on the Saker in Kyrgyzstan is that it is 'nowhere common… but a very questionable estimate is *ca*. 50 breeding pairs' (Andersen 2006).

- What is the population size and population trend in Kyrgyzstan?

Turkmenistan

Dixon (2009) reported a study (Saparmuradov 1999—unseen) that estimated a population of 150 breeding pairs for the country, and which claimed that uncontrolled trapping for the falconry trade and habitat loss were factors affecting the Saker population in Turkmenistan. No other information appears to be available.

- What is the population size and population trend in Turkmenistan?

Uzbekistan

The population in around 2000 was estimated at 100–150 pairs, in decline in the more accessible areas owing to poaching for commercial gain, a phenomenon noted since the early 1990s, but offset to some extent by the species's adoption of pylons for nesting, which has allowed it to 'spread across the steppes' (Abdunazarov & Atadjanov 2002). The decline has elsewhere (by the same authors) been described as a 'drastic decrease' which is 'in some regions by 10 times and more' (e.g. near Termez, which had 20 pairs '10 years ago' and now has 2–4 pairs), but the numbers 'now' (also given as 100–150 pairs) are 'relatively stable' and (as a result of pole use) 'on the increase in several areas' (Kreuzberg-Mukhina *et al.* 2001). There appears to be no subsequent information on the Saker's status in the country (none in Dixon 2009), although a National Action Plan has been prepared by R. D. Kashkarov (available in English later this year).

- What is the population size and population trend in Uzbekistan?

Mongolia

Baumgart (1991), reviewing publications from the years 1930–1981, judged that throughout that period Mongolia probably harboured around 5,000 breeding pairs. Using Dixon's (2009) present-day estimates and decline rate data from adjacent Altai and Tyva republics Moshkin (2010) back-calculated that the country harboured 2,792–6,980 pairs in 1990 (median 3,884). By extrapolating an observed average of 2.7 pairs per 1,000 km² to the size of the country, after making allowances for areas of unsuitable habitat, Shijirmaa *et al.* (2000) projected 2,823 pairs as the national total by the end of the 1990s. Using this value of 2,823 pairs, combined with the observed average of 3.2 nestlings per brood and a 70.6% participation annually in nesting by available pairs, a total annual output of 6,382 (strictly on these figures: 6,377) young were then estimated to be produced per year (Shijirmaa *et al.* 2000). Meanwhile Shagdarsuren (2000) reported that some 3,000 pairs were present in the country, producing around 10,000 young. Shagdarsuren *et al.* (2001) calculated the national population of breeding pairs was 2,961 in 1999 (9,834 young produced) and 2,220 in 2000 (4,450 young produced). Gombobaatar *et al.* (2004) referred to a 'swift decline' in Mongolia's Saker population, yet Gombobaatar *et al.* (2007) reported that 'according to our studies of 1998–2005, there was no significant decline of numbers of breeding pairs in Central Mongolian study areas'. Dixon *et al.* (2008) pointed out that the take-up of artificial nest-sites suggested a surplus population in Mongolia which would not exist if the population there was in decline. However, Suhchuluun (2008) cited a report ('Fox *et al.* 2003') which put the number of pairs breeding in Mongolia in 2003 at 1,000–1,200, which certainly implies a significant decline.

Dixon (2009) considered the situation in Mongolia at length, arriving at a wide range of 2,000–5,000 pairs for the current population. His used a 'conservative' density value that yielded 2,000 breeding pairs for the entire country, but for the steppe zone used higher values that yielded 1,400–4,100 breeding pairs. To this he added 400–500 pairs breeding on electricity pylons and thus rounded figures (1,800–4,600) up to 2,000–5,000; he regarded the population as stable.

Such wide confidence limits represent a very weak baseline against which to measure trends. Given this and the particular interest in Mongolia generated by its nest-box scheme across treeless steppe, it is important to refine the evidence on both total numbers and trends.

- What is the population size and population trend in Mongolia?

China

Several highly contradictory accounts of the situation in China have been produced. Baumgart (1991) reported the Saker as breeding at remarkably high densities in Tibet, and estimated a total national population of 15,000–20,000 pairs. However, Ye *et al.* (2001) wrote that 'The numbers of Sakers in China according to the preliminary estimates is 64,000–102,000 individuals' and that 'Xingjiang [*sic*] and Qinghai are the important breeding areas'.

In 2001, new surveys were conducted in Xinjiang, and the population of Sakers there was revised down from 30,000–50,000 individuals to 350 pairs, while no birds were found in Nei Monggol (Inner Mongolia), leading to the conclusion that the population might not exceed 500 pairs for the entire country (Ye & Ma 2002). [Xiaodi=] Ye & Fox (2003) gave even lower values, calculating that only 14 breeding pairs might be present in all Inner Mongolia and judging that 'there might be as few as 200 breeding pairs across the entire country'. Barton (2002) remarked that 'Chinese populations have disappeared or are severely overexploited', indicating that the change in estimates for China was not merely a matter of improved knowledge but also and perhaps largely or entirely a result of a genuine change in numbers (which incidentally he gave as 'about 300 pairs'). ERWDA (2003) offered two assessments, one again of 300 pairs, based on three sources (none of which mentions this figure), and one of 1,000–1,200 pairs, based on 'Ming and Potapov in press' (never published). In the years 2005–2006 Ma *et al.* (2006) found 1.1–1.5 breeding pairs per 1,000 km² (in 5,400 km² of study area), yet Ma & Chen (2007) claimed that 'China possibly has the largest breeding Saker Falcon population of any country in the world'. By contrast, Wu *et al.* (2007)—whose authors included Ma—reported that the Saker in China 'will be on the edge of extinction for next years', its population having 'collapsed'. Dixon (2009), viewing the Qinghai-Tibetan Plateau as the most important area in China, 'with a large breeding and wintering population', estimated 3,000–5,000 pairs of Sakers for the country, but felt that, given various threats, the trend in numbers is likely to be downward. However, Moshkin (2010) argued that the number of pairs in China was just 1,500, basing this figure on an estimate of 1,000–2,000 pairs in 2007 as published in a report summary by the Xinjiang Conservation Fund (2007), which gave no indication of how the estimate was derived.
Little can be done with these oscillating figures. There is a clear need for hard data.

- What is the population size and population trend in China?

Peripheral other countries

Iran and Afghanistan are large countries and they possibly hosted large breeding populations of Sakers in the past and possibly still host large migrant populations today. The vulnerability of Sakers to trapping in these countries is evidently high.

- What is the size of the migrant population in Iran and Afghanistan?

Wintering areas

As noted under Distribution, it is largely juvenile birds that undertake the longest journeys in winter and travel the furthest from the breeding grounds (only 6 out of 23 Sakers trapped in western Saudi Arabia in autumn 2002 were adults: AlRashidi 2004). This raises the possibility that trapping at any distance outside the breeding range will depress recruitment into the breeding population. In Lybia, for instance, 15–50 Sakers are trapped annually, which, given the species's south-west migratory pattern, originate from Central Europe, and this number may represent 5–10% of the annual cohort (M. Prommer). Moreover, focus on larger females may also result in depressing recruitment if it creates a floating bachelor population.

- What proportions of the sexes and age-classes of Sakers are affected by winter trapping outside the breeding areas?
- What are the short-term effects on breeding performance of any biases produced by this exploitation?
- What are the long-term effects on the dispersive and restocking ability of the species (if longer-distance wanderers nest further from the natal area)?

Ecological issues

Habitat and prey

The basic ecology of the Saker Falcon, a large arid-country falcon requiring secure nest-sites and a food supply consisting mainly of rodents, is moderately well known. It breeds in forest-steppes, grasslands, agricultural areas, hills or open mountain ranges, and hunts over open grassland, wetlands, and even cultivated land where more or less dense populations of diurnally active small and medium-sized rodents or birds provide ample prey biomass for rearing young; outside the breeding season it hunts over a wider range of open habitats including coasts and deserts (Nagy & Demeter 2006). However, there has been little peer-reviewed in-depth scientific work on the ecology of the species, at least in the main parts of its range. This means that there is no real information on

- the relationship between presence/abundance of Sakers, habitat characteristics (including nest-site availability) and prey availability (this is, e.g., relevant to the situation in Turkey where apparently suitable habitat is available but unoccupied);
- how this relationship changes with cycles in rodent abundance;
- how breeding success and juvenile survival in Sakers vary with fluctuations in rodent numbers;
- rodent plagues, human endeavours at controlling them, and the responses of Saker populations either to the plagues or to the controls;
- how anthropogenic habitat change within its range affects the species's prey-base and influences its numbers and survival rates;
- its winter habitat selection, food choice, spatial distribution and movements.

Not all these knowledge gaps affect human use. In theory, Saker populations with high productivity could be harvested safely and sustainably, provided productivity and survival are monitored. However, these are all gaps that are better filled if conservationists and other stakeholders are to be able to direct the long-term, sustainable management of the species with real confidence.

- What are the relationships of performance variables (e.g. survival, productivity), for Sakers, especially productivity, with nest availability and food supply, including direct and indirect impacts of human on those resources?

Migration and dispersal

Sakers show different migration patterns in different parts of their range. Western populations are relatively sedentary. Northerly populations in Russia and across the Asian range have been considered largely or wholly migratory, leaving the breeding grounds in September or October and returning in March or April. Juveniles tend to undertake much longer, nomadic journeys than adults. However, work using satellite transmitters in Hungary, Kazakhstan and Mongolia reveals that Saker Falcons exhibit complex patterns of movement outside the breeding season, occupying many areas at least briefly that were completely unknown for the species before and possibly therefore encountering threats that were previously undocumented. Moreover, telemetry has established that Mongolian Sakers can be sedentary, short-distance migrants and long-distance migrants, with individuals varying their migratory behaviour across years, while observational data (of living and electrocuted birds) indicate that the Mongolian population is male-biased in winter, suggesting females are more likely to be long-range migrants (A. Dixon).

One study has suggested that Sakers (at least in Mongolia) are nomadic breeders responding to temporal and spatial variation in food supply (Ellis *et al.* 2011), but other work (led by A. Dixon) has found that Sakers (i) are generalist predators that can switch between prey depending on availability, (ii) exhibit high 'territory tenacity', occupying the same breeding ranges year after year, and (iii) show little breeding dispersal, returning to the home range they occupied the previous year. Although detecting long-range breeding dispersal is problematic, evidence suggests that it is not a major population phenomenon in

Mongolian Sakers (A. Dixon). It should be noted, however, that a female Saker that fledged in western Romania in 2012 was tracked by satellite to her nest 1,200 km west in the Crimean Peninsula in May 2013 (Prommer *et al.* 2012).

A study of sites used for migratory routes and wintering grounds would produce a new map that could be subject to analysis in terms of threats and habitat utilisation, and thus provide key information for the long-term conservation of populations.

- What are the main migration routes and wintering grounds for different Saker populations, and effective boundaries (geophysical, genetic) between these populations?

Demographic parameters

Sakers breed on cliffs, in trees, on pylons and even on the ground, readily accepting artificial nests (Nagy & Demeter 2006). Annual survival rate of adults is estimated to vary between 78% in Hungary and 82% in Kazakhstan, with minimum first-year survival estimate of 23% in Kazakhstan (Nagy & Demeter 2006, Kenward *et al.* 2007) but a more realistic minimum estimate from recent tracking by satellite of 36% (Kenward *et al.* 2013). Generation length is calculated at five years, and birds start breeding in their second calendar year. Clutch size varies from two to six, with means from 3.2 to 3.9 in different circumstances. Breeding success varies with year (especially in areas where rodents cycle) (Nagy & Demeter 2006).

The most important aspects relate to productivity, survival rates and the resulting non-breeding rate which indicates population resilience to pressures (Kenward *et al.* 1996, 2007). We do not know the demographic mechanisms driving declines. Rapid rates of decline suggest there is a problem with persistence of adults (Kenward *et al.* 2007). Where adult persistence seems to be a problem, knowledge of attrition patterns in terms of timing and sex could provide information on relative importance of causal factors (A. Dixon). It could be useful to apply radio tracking to this question. Raptors of several species, including Sakers, have carried long-life tags without detectable reductions in survival compared with other markers (Kenward *et al.* 2001, 2007), although mortality due to satellite tagging may be more of a problem (Dixon 2011b) perhaps because parts exposed for solar power create drag. Tags with lithium cells and infrequent transmission to satellites could be a solution (Kenward *et al.* 2013).

Data on productivity (young per pair that lay) are available for many countries (Kenward *et al.* 2013). Where independent estimates of breeding rates (proportion of adults in pairs that lay) have been available for other species, they have matched those estimated by modelling from survival and productivity (Kenward *et al.* 2007). Estimating survival, especially for the pre-breeding population, appears to be the main problem and hence greatest knowledge gap (Kenward *et al.* 2013).

- What are the typical age-specific survival rates for Saker Falcons, especially in their first and second years, and what factors cause these to vary?

Key pressures on Saker populations

Certain pressures are common to all birds of prey, including direct persecution, pesticide contamination and mortality in nests caused by litter (rope, string, plastic). These are not considered to be key in their effects on Saker populations, although locally they may be important, e.g. pesticide pollution in Hungary and Bulgaria and persecution by pigeon-fanciers in the Balkans (M. Prommer, J. Sielicki) and it is clearly important that they are taken into consideration in future research.

Trade

Evidence suggests that Sakers are trapped in large numbers in Central Asia and on migration routes, especially in the Middle East and Pakistan for use in falconry. This centuries-old tradition has recently been considered an important threat (BirdLife International 2013) and international trade in wild falcons is now

largely illegal although trapping within many countries continues. The international market has reportedly been supplied by trappers (many from Pakistan and Syria) who catch birds on autumn migration and during post-breeding dispersal in (e.g.) Russia, Kazakhstan, China and Mongolia (Nagy & Demeter 2006).

The internal trapping for trade within Saudi Arabia, which is probably mainly of Sakers from north-central Asia, has continued at a level of 25–40 falcons annually for the last two decades without apparent change in effort (Kenward *et al.* 2013). Mark-recapture techniques have estimated an off-take of 8–20% of juveniles (Kenward *et al.* 2001), which lie within sustainable yield estimates for those populations (Kenward *et al.* 2013) and supports contentions that birds from those areas have not experienced marked declines.

However, the effects of international trade on populations of the Saker Falcon have not been quantified and are therefore poorly understood: virtually all that can be said is that large-scale trapping exists, significant declines have been reported, and a correlation between the two is assumed. This uncertainty is hardly surprising, as no systematic attempts have been made to survey it following the estimate of an annual harvest of 2,750 by those marking birds at falcon-hospitals two decades ago (Riddle & Remple 1994) and because once trade becomes illegal it becomes clandestine and harder to record. The lack of data, combined with speculation about poorly documented exports, has made it easy to assume that illegal trade has been instrumental in the presumed or evident declines of the species in the major countries among the range states. Thus:

- in Asiatic Russia illegal trapping has been claimed as the primary cause of decline, with speculation that 1,000 Altai-Sayan Sakers might be caught on migration annually for the falcon trade;
- in Kazakhstan exports of 1,000 falcons (presumably Sakers) a year in the years 1994–1996 were reported, with the trapping pressure moving eastwards in 1997 owing to depletion of exploited areas;
- indeed, the 'catastrophic decline' in the Saker in Kazakhstan 'has been generally caused by illegal catching of birds for falconry' (Levin 2011), and this decline is associated with the high level of Houbara hunting in the country, which creates a black market in Sakers (Nikolenko & Karyakin 2013);
- in China there was a report in 2001 that 'thousands of foreigners claiming to be tourists or businessmen came to China and caught Sakers illegally';
- in Kyrgyzstan 100–120 birds were reported to be trapped annually through the 1990s (i.e. 1,000 birds taken in this period) and 80% of all nests robbed;
- in Uzbekistan 'mass trapping' of adults (50 or more adults being trapped per year) and the removal of chicks from nests have been the main threats since 1990;
- in Mongolia almost 1,000 birds were reported to have been exported legally in the period 1993–2002, but that in the same period the same number or more were exported illegally.

These reports are obviously highly speculative. However, the fact that all countries have reports of illegal trade reinforces the impression that covert trapping and trading is a major and enduring issue in Saker conservation across its range. One of the central issues in the Saker trade, legal or illegal, is the reported preference of consumers for females; on this basis, populations experiencing an excess of unpaired adult males would appear to be suffering from excessive trapping.

Because international trade is now illegal, the levels and effects of Saker smuggling are not an easy subject for research workers to investigate; and without clearer understanding of the problem, policy responses will remain ineffective and probably unimplemented. However, research on Saker population sizes and dynamics (including trends and resilience) will set a baseline by which the impacts of legal and illegal activities can in future be assessed and quantified, allowing for an appropriate policy response. This research will also provide range states with sufficient evidence to gauge appropriate offtake levels for legal trade under CITES provisions. Moreover, if the countries in question devote part of the income from such sales to the policing and protection of wild populations, then the domestic management and circumstances of Saker Falcons will be likely to improve dramatically (as is the case in parts of Mongolia).

Indeed, it is becoming clear that falconers in several Gulf States are forming clubs, engaging readily in surveys and having their possession of birds recorded through falcon-hospitals (AlRashidi 2004, Kenward *et al.* 2013). Useful data are also being provided by trappers, who are mostly themselves falconers, in Saudi Arabia. Conditions therefore exist not only for effective estimation of procurement but also for falconer end-users to be guided in establishing legal chains of procurement. Finally, even smugglers are not necessarily immune from investigation, and inducements of various types might be expected to bring about conversions of smuggler networks to legal supply chains.

- What is the scale and extent of trapping of wild Sakers in countries outside of those hosting breeding populations?
- What are the harvest levels of Saker Falcons from different populations and how much can falconers contribute to ensuring sustainable future supplies of Sakers?

Habitat change

Habitat change involves a number of elements including conversion of grasslands to arable, agricultural intensification, undergrazing, overgrazing, rodent eradication, afforestation, deforestation, infrastructural development and mining. Even minor increases in vegetation height as a result of irrigation and fertilisation can reduce the hunting ability of the Saker, while practices which reduce the biomass of rodents also tend to depress Saker presence (Nagy & Demeter 2006). Thus new farming initiatives and increasing cattle-grazing in parts of Kazakhstan have greatly altered the ecologies of certain grassland areas, and diminished the prey-base and hence numbers of Sakers. Similarly, in Hungary, Bulgaria and Ukraine rodents (in particular ground squirrels) have been literally marginalised, being confined to narrow strips of habitat along banks and verges, suggesting that the Saker may only survive in the long term in areas where the land is too poor to cultivate. In Central Asia agricultural abandonment may benefit Sakers, but abandonment of sheep-grazing increases vegetation cover to the detriment of suslik populations.

- To what extent are habitats for different Saker populations vulnerable to declines in food availability and what steps can be taken to alleviate this?
- How serious are the various impacts of grassland conversion, undergrazing, overgrazing, rodent eradication, afforestation, tree-felling, infrastructure development and mining on breeding populations of Sakers?

Mortality at man-made structures

Although pylons can supply nest-sites and may compensate in some areas for the cutting of trees, electrocution and collisions at powerlines (and indeed collisions at wind turbines in Europe) may offset these gains, e.g. causing up to 100 deaths of Sakers per year in Dauria (Goroshko 2011, Karyakin & Nikolenko 2011c). Two of eight deaths of Hungarian Sakers tracked by satellite were caused by electrocution (Kenward *et al.* 2013), two powerlines in Mongolia killed 28 Sakers at a rate of 1.2 per 10 km per year (Dixon *et al.* in press). Clearly it is important and now timely to examine ways of minimising electrocutions and collisions of Sakers and other raptors across the range state steppelands and of maximising their safe use of transmission poles and pylons. Work has begun on these aspects but a synthesis of information and evidence remains to be achieved.

- How much do powerlines contribute to Saker losses and what are the most appropriate measures to reduce the level of electrocutions and collisions?

Climate change

Climate change may make lowland grasslands change in character and affect the abundance of mammal populations (Morgan *et al.* 2007).

- What steps can be taken to mitigate the anticipated effects of climate change on lowland grasslands in the western part of the Saker's range?

Genetic introgression

Many falconers prefer hybrid falcons owing to their enhanced performance. This has raised the concern that escaped hybrid falcons may interbreed with wild Sakers and affect the natural gene pool. However, it is also assumed that most escaped hybrids do not survive long in the wild, and that their offspring would also be at a selective disadvantage. Even so, more information is needed to evaluate the possible effect of escaping hybrids on wild falcon populations.

- How serious is the threat of genetic pollution of wild populations by escaped hybrids, and what measures can be taken to minimise it?

Indicators of population status, trends and sustainable use

The size and remoteness of Asian breeding areas together with lack of resources makes any population assessment difficult. One way round this problem is to develop standardised survey methods that will enable population estimates to be derived with confidence intervals. Instead of whole population surveys on a country-by-country basis (although in a number of cases these are clearly imperative) in the longer term it may be more economical and effective to conduct detailed, repeated studies in key areas so that population trends can be determined with high confidence. Such studies can also generate information on productivity, on breeding turnover rates (if adults are marked for easy identification or DNA sampled from them or their young), and on first breeding age (if young are similarly identifiable). If young are easily identifiable, other important demographic parameters can be estimated, including survival, harvest rates, migration routes and population trends.

Markers used for dispersive species include visual markings, microtransponders, rings and radio-tags, with tags for satellite-tracking potentially most informative but most costly, while reduction in cost of DNA analyses is leading to increasing use of genetics to study migration patterns. Marked Sakers from detailed studies in turn can be used to estimate sizes, dynamics, trends and sustainable harvests if combined with monitoring of Sakers on migration and in winter quarters. Monitoring of migrants can be done at bottlenecks. Where trapping is routine and trappers cooperative, as in Saudi Arabia, inexpensive markers can provide mark-capture estimates of population size and hence trends at low cost. Where there is little trapping, proportions of birds with visual or radio-tags among visual counts could provide comparable data for marker-recording estimates.

With reduction in size of tags tracked by satellites, long life has become practical without dependence on solar cells, which may impact flight performance and also cease transmission if covered when birds die. More reliable tags for tracking by satellite could do much to improve survival estimates and indicate important migration routes and wintering grounds, while providing data of great interest and hence funding-attractive to stakeholders.

Unless populations from particular areas can be shown to use relatively discrete migration routes and wintering areas, genetic studies are required to fine-tune marker-recording estimates of trapped Sakers. Origins of marked Sakers are known, but for estimates of population size it is important also to be able to estimate the number of unmarked birds being recorded at the same time from the same population. It is also worth noting that, given appropriate information technology and DNA banking (e.g. as feathers), DNA-fingerprinting (Jeffreys *et al.* 1985, Parkin 1987) could replace other markers for monitoring Saker populations and trade (Kenward *et al.* 2013). Genetic studies are also advisable to identify levels of genetic biodiversity remaining in the global Saker population.

The tradition of releasing falcons back into populations after hunting with them might help alleviate loss of genetic diversity and perhaps compensate to an extent for harvest. However, although the earliest satellite tagging of Sakers occurred when Abu Dhabi started work on techniques to enhance survival of deliberately

released falcons (Kenward & Pfeffer 1995), findings from subsequent work need to be collated and provided as recommendations.

- What suggested population levels might be appropriate for individual nations to aspire to achieve and maintain?
- Which populations migrate and winter in particular areas where marker-recording techniques can provide indicators of population sizes and hence trends?
- What funding is needed to improve the marking and tracking technologies that will permit the effective future monitoring and conservation of Saker Falcons?

Effectiveness of existing conservation management

In the case of the Saker conservation management consists of four partially related activities:

1. broad habitat management at the landscape level;
2. protected area management and wardening;
3. species-specific initiatives involving nest-box provision and reintroduction;
4. trade monitoring, regulation and law enforcement; and
5. developing socio-economic incentives for stakeholders to support these activities.

Each of these is considered briefly in turn.

Broad habitat management

Broad habitat management is needed to address the various problems outlined under 'Habitat change' above—preserving areas of grassland, practising extensive rather than intensive agriculture, achieving an appropriate grazing regime, maintaining rodent populations, zoning afforestation and mining schemes away from sensitive areas, averting the loss of nest trees.

- What are the socio-economic costs and benefits of managing landscapes for Saker Falcons in traditional landscapes?

Protected area management and wardening

Strict management of protected areas helps populations of species within them to serve as reservoirs to maintain numbers and connectivity across wide landscapes. Extending the network of protected areas to ensure that populations are sufficiently large within them to maintain good genetic diversity is crucial. When Karyakin & Nikolenko (2011a) urge the expansion of several protected areas in the Altai-Sayan region, it is not clear if they simply see an opportunity that should be taken or if they regard the step as crucial to the species's survival in the region (the difference between 'can' and 'must'). This raises a series of pertinent questions to which as yet there are no answers:

- How effective are protected areas in conserving the Saker, does effectiveness increase with size, what are the optimal conditions and most appropriate management measures under which protected areas could maintain Saker populations in a country?

Species-specific initiatives

Although artificial nests are unlikely to be helpful where populations are declining rapidly and nest-sites are not limited, they can be deployed to maintain or increase breeding populations where nest-sites are evidently the single limiting factor (to be gauged by the existence of a significant non-breeding surplus). In Mongolia artificial nests have been used to create a new, monitored breeding population in order to underpin a sustainable harvest (Dixon *et al.* 2011). In Hungary artificial nests have also helped create a new population of Sakers, with 91% of pairs using them (Bagyura *et al.* 2012). Nesting success and productivity

are higher at artificial nests than natural sites in Mongolia: in 2012 380 pairs of Sakers used artificial nests in Mongolia and fledged 1,298 chicks (Dixon 2012).

Many successful projects reintroducing Peregrines *Falco peregrinus* has proved to be effective in re-establishing extinct populations, once the factor causing the extinction has been eradicated. In Europe the potential of a reintroduction programme to re-establish the Saker in Bulgaria is being explored (Dixon 2012), and has recently been judged appropriate for areas of Kazakhstan from which Sakers have been trapped out (Nikolenko & Karyakin 2013). For reintroduction projects birds as much as possible of local origin are needed, if available; however, the issue of the validity of the various subspecies (listed above) needs to be reconsidered as part of the process of developing plans for reintroductions. If considered appropriate, falconers in some countries (especially in Europe) can provide falcons for release and to take part in the reintroduction projects.

- What are the necessary conditions, practices and protocols for successfully establishing new populations of Sakers using artificial nests?
- What are the necessary conditions, practices and protocols for sustainably harvesting new populations of Sakers from a network of artificial nests?
- What are the necessary conditions, practices and protocols for successfully reintroducing Sakers to parts of the former range?

Trade monitoring, regulation and law enforcement

Listing on Appendix II of CITES requires Parties to establish, enforce and report scientifically determined quotas for the number of birds that they export and import each year, to ensure the sustainability of the supply. However, with the exception of Mongolia, national laws already prohibit the trapping of Saker Falcons; and in any case, because the Saker is a very widely dispersed species that lives in remote regions that are expensive and problematic to survey, and because there have been no robust long-term studies of the productivity and survival of the Saker in the core of its range in Asia, the baseline data on population sizes, densities and reproductive rates have never been available to establish credible quotas. Range states are typically poor and preoccupied with more pressing political and economic issues, and have very limited capacity either to generate their own scientific evidence or to police their Saker populations against their own and external trappers. Moreover, as a result of possible collusion between trappers and authorities, 'the problem is not one of legislative deficiency but rather… of effective enforcement' (Dixon 2011a).

Nevertheless, effective regulation and enforcement are clearly essential in order to manage Saker populations sustainably. This requires not only monitoring of populations and harvests, as discussed above, but also regulation that adapts to the monitoring (adaptive management) and is respected by the stakeholders. Respect for regulations benefits from understanding them (Council of Europe 2007) and from socio-economic conditions which favour compliance, with poaching favoured where gains are high relative to costs (Knapp 2012). With falconers paying about US$8,000 for a Saker (Kenward *et al.* 2013), gains are potentially high compared with costs, which are a product of risk of detection and earnings lost through imprisonment or fines. However, with appropriate regulation, risk of detection can be high. Development in Britain of DNA fingerprinting proved a strong deterrent against 'laundering' of wild birds (Williams & Evans 2000). An effective regulatory system for Sakers would need to educate falconers and gain their trust so that they favour its use for legal procurement, while at the same time using techniques such as DNA-fingerprinting to detect and thereby deter criminality throughout international supply chains.

- What level and type of state and NGO activity is needed in order to police territory and trade routes sufficiently strongly to prevent poaching?
- How could falconers be encouraged to require a legal supply chain?

Developing socio-economic incentives for stakeholders to support these activities

The long-term aspiration must be to have falconers and falcon trappers not only complying with regulations that keep harvest of wild Sakers at safely sustainable levels, but also contributing to conservation by monitoring Saker populations and keeping them healthy. This requires capability at national or regional level (i) for commissioning and handling scientific data on populations and procurement to ensure sustainability of harvest, and (ii) for commissioning science on other population conservation processes.

Fortunately, there is already a science infrastructure for falconers in Gulf States in terms of falcon hospitals, which proved effective for preliminary harvest estimates in the 1990s and are now marking most birds obtained by falconers. Falconers and trappers have also shown themselves willing to provide useful information through surveys and to be aware of Saker conservation issues (Kenward *et al.* 2013). Clubs for falconers are present in at least four states in North Africa and the Arabian Gulf and are already federated to the global falconry community through the International Association for Falconry and Conservation of Birds of Prey (IAF), which is in turn a part of the international conservation and hunting communities through the International Union for Conservation of Nature (IUCN) and International Council for Game and Wildlife Conservation (CIC).

With Arabic as a *lingua franca* for most falconers and trappers involved with trade in Sakers, growing use of web-and-mobile technology provides opportunity for outreach to vets, falconers and trappers from an international level, as has already been pioneered for science and local society activities within the UAE. International outreach that attracts stakeholders—providing useful information (e.g. on care of birds, release back into the wild, and birds in the wild), as well as making a regulation system easy for all to use and attractive through payments to those marking Sakers and recording trapped falcons—would avoid constraints that operate between national and regional institutions. However, a system to support education, monitoring, regulation and conservation will require funding to set up and to operate long-term. Initial foundation would require a donation, but long-term sustainable funding could involve state (e.g. fees for administering marking as a form of licensing), private (e.g. hosting and taking commission for legal sales) and philanthropic (e.g. sponsoring marked wild birds) revenues. So:

- What level and source of funding is needed for sustaining a system for education, monitoring, regulation and conservation based on training wild Saker Falcons?

IV. Conclusions and recommendations

The following sections reconstitute the knowledge-gap questions formulated in the above review. These questions constitute the lines of inquiry which the Working Group feels are most appropriate to recommend for pursuit through the forthcoming Saker Action Plan.

Distribution and population surveys

While inevitably subjective in nature, the review of evidence concerning the past and present breeding distribution plus the breeding population levels and population trends of the Saker yields the need for clearer information in key countries as tabulated here (under Distribution, two asterisks = past and present, one = present only; under Population, two asterisks = population level and trend, one = trend only, sword = size of migrant population).

	Distribution	**Population**
Turkey	*	**
Iran		†
Afghanistan		†
Ukraine		*
Russian Federation	**	
Kazakhstan	**	**
Kyrgyzstan	**	**
Turkmenistan		**
Uzbekistan		**
Mongolia		**
China	*	**

Fieldwork science

- What is the scale and extent of trapping of wild Sakers in countries outside of those hosting breeding populations?
- What proportions of the sexes and age-classes of Sakers are affected by winter trapping outside the breeding areas?
- What are the short-term effects on breeding performance of any biases produced by this exploitation?
- What are the long-term effects on the dispersive and restocking ability of the species (if longer-distance wanderers nest further from the natal area)?
- What are the main migration routes and wintering grounds for different Saker populations, and effective boundaries (geophysical, genetic) between them?
- What are the typical age-specific survival rates for Saker Falcons, especially in their first and second years, and what factors cause these to vary?
- What are the relationships of performance variables (e.g. survival, productivity), for Sakers, especially productivity, with nest availability and food supply, including direct and indirect impacts of human on those resources?
- To what extent are habitats for different Saker populations vulnerable to declines in food availability and what steps can be taken to alleviate this?
- How serious are the various impacts of grassland conversion, undergrazing, overgrazing, rodent eradication, afforestation, tree-felling, infrastructure development and mining on breeding populations of Sakers?
- How much do powerlines contribute to Saker losses and what are the most appropriate measures to reduce the level of electrocutions and collisions?

- What steps can be taken to mitigate the anticipated effects of climate change on lowland grasslands in the western part of the Saker's range?
- How serious is the threat of genetic pollution of wild populations by escaped hybrids, and what measures can be taken to minimise it?
- Which populations migrate and winter in particular areas where marker-recording techniques can provide indicators of population sizes and hence trends?
- What funding is needed to improve the marking and tracking technologies that will permit the effective future monitoring and conservation of Saker Falcons?
- What are the socio-economic costs and benefits of managing landscapes for Saker Falcons in traditional landscapes?

Management and policy

- What suggested population levels might be appropriate for individual nations to aspire to achieve and maintain?
- What are the harvest levels of Saker Falcons from different populations and how much can falconers contribute to ensuring sustainable future supplies of Sakers?
- How effective are protected areas in conserving the Saker, does effectiveness increase with size, and what are the optimal conditions and most appropriate management measures under which protected areas could maintain Saker populations in a country?
- What are the necessary conditions, practices and protocols for successfully establishing new populations of Sakers using artificial nests?
- What are the necessary conditions, practices and protocols for sustainably harvesting new populations of Sakers from a network of artificial nests?
- What are the necessary conditions, practices and protocols for successfully reintroducing Sakers to parts of the former range?
- What level and type of state and NGO activity is needed in order to police territory and trade routes sufficiently strongly to prevent poaching?
- How could falconers be encouraged to require a legal supply chain?
- What level and source of funding is needed for sustaining a system for education, monitoring, regulation and conservation based on training wild Saker Falcons?

V. References

Abdunazarov, B. B. & Atadjanov, M. A. (2002) Problems of conservation of falcons in Uzbekistan. *Falco* 20: 3-4.

Akimov, I. A., ed. (2009) *Red Book of Ukraine*. Kiev: Globalconsulting. (In Ukrainian.)

AlRashidi, M. (2004) An ecological study on hunting falcon species and their protection in Saudi Arabia. Master Thesis (in Arabic), Biology Department, Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia.

Andersen, M. W. (2006) Occurrence of wintering Sakers in Kyrgyzstan. *Falco* 28: 7-9.

Bagyura, J., Fidlóczky, J., Szitta, T., Prommer, M., Tihanyi, G., Zalai, T., Balázs, I., Váczi, M., Viszló, L., Klébert, A., Haraszthy, L., Tóth, I., Török, H. A., Demeter, I., Serfőző, J., Pigniczki, Cs., Kazi, R. & Erdély, K. (2012) A Kerecsensólyom-védelmi Munkacsoport 2010 évi beszámolója (Report of the Saker Conservation Working Group, 2010). *Heliaca* 8: 22-30.

Barton, N. (2001) Second international conference of the Middle East Falcon Research Group, Ulan Baatar, Mongolia. *Falco* 17: 3-4.

Barton, N. W. H. (2002) Recent data on Saker trapping pressure. *Falco* 20: 5-8.

Baumgart, W. (1991) *Der Sakerfalke*. Second edition. Wittenberg Lutherstadt: A. Ziemsen Verlag (Neue Brehm-Bücherei 514).

Baumgart, W. (1994) Saker *Falco cherrug*. Pp.198-199 in G. M. Tucker & M. F. Heath, eds. *Birds in Europe: their conservation status*. Cambridge, U.K.: BirdLife International (Conservation Series 3).

BirdLife International (2013) Species factsheet: *Falco cherrug*. Downloaded from http://www.birdlife.org on 28/06/2013.

Bold, A. & Boldbataar, Sh. (2001) Range, seasonal distribution, peak and decline of the Saker Falcon in Mongolia. Pp.155-159 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000)*. Ulaanbaatar: Ministry of Nature and Environment.

Bragin, E. A. (2001) Recent status and studies of the Saker Falcon in the northern Kazakhstan. Pp.110-115 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000).* Ulaanbaatar: Ministry of Nature and Environment.

Cheng Tso-hsin (1987) *A synopsis of the avifauna of China.* Beijing: Science Press.

Council of Europe (2007). European Charter on Hunting and Biodiversity. Convention on the Conservation of European Wildlife and Natural habitats (Bern Convention), Strasbourg.

Dixon, A. (2005) Falcon population estimates: how necessary and accurate are they? *Falco* 25/26: 5-8.

Dixon, A. (2007) Saker Falcon breeding population estimates. Part 1: Europe. *Falco* 29: 4-12.

Dixon, A. (2009) Saker Falcon breeding population estimates. Part 2: Asia. *Falco* 33: 4-10.

Dixon, A. (2011a) Abu Dhabi sponsored research on falcons in 2011. *Falco* 38: 6-11.

Dixon, A. (2011b) Effects of attaching telemetry equipment to free-living birds. *Veterinary Record* 169: 308-309.

Dixon, A. (2012) International falcon research conducted on behalf of the Environment Agency–Abu Dhabi in 2012. *Falco* 40: 4-11.

Dixon, A., Batbayar, N., Etheridge, M., Purev-Ochir, G. & Gombobaatar, S. (2008) Development of the artificial nest project in Mongolia. *Falco* 32: 8-10.

Dixon, A., Ragyov, D., Ayas, Z., Deli, M., Demerdzhiev, D., Angelov, I, Kmetova, E. & Nedyalkov, N. (2009) Population status of breeding Saker Falcons (*Falco cherrug*) in Turkey. *Avian Biol. Res.* 2: 213-220.

Dixon, A., Batbayar, N., Purev-Ochir, G. & Fox, N. (2011) Developing a sustainable harvest of Saker Falcons (*Falco cherrug*) for falconry in Mongolia. Pp.363-372 in in R. T. Watson, T. J. Cade, M. Fuller, G. Hunt & E. Potapov, eds. *Gyrfalcons and Ptarmigan in a changing world*. Boise, Idaho: The Peregrine Fund.

Dixon, A., Ma Ming, Gunga, A., Purev-Ochir, G. & Batbayar, N. (in press) The problem of raptor electrocution in Asia: case studies from Mongolia and China. *Biological Conservation*.

Ellis, D. H., Kitowski, I. & Roundy, T. B. (2011) Nomadism in large falcons: lessons from the Saker Falcon in Mongolia. Pp.291-306 in R. T. Watson, T. J. Cade, M. Fuller, G. Hunt & E. Potapov, eds. *Gyrfalcons and Ptarmigan in a changing world*. Boise, Idaho: The Peregrine Fund.

ERWDA (2003) The status of the Saker Falcon (*Falco cherrug*) and assessment of trade. [Submission to] CITES Animals Committee, August 2003. Environmental Research and Wildlife Development Agency, Abu Dhabi, unpublished.

Ferguson-Lees, I. J. & Christie, D. A. (2001) *Raptors of the world*. London: Christopher Helm.

Galushin, V. (2004) Status of the Saker in Russia and eastern Europe. *Falco* 24: 3-8.

Galushin, V. & Moseikin, V. (2000) The Saker Falcon in European Russia. Pp.275-278 in R. D. Chancellor & B.-U. Meyburg, eds. *Raptors at risk*. World Working Group on Birds of Prey and Owls, & Hancock House, Surrey, British Columbia.

Galushin, V., Moseikin, V. & Sanin, N. (2001) Saker Falcon breeding range and populations in European Russia. Pp. 34-43 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000)*. Ulaanbaatar: Ministry of Nature and Environment.

Gombobaatar, S., Sumiya, D., Shagdarsuren, O., Potapov, E. & Fox, N. (2004) Saker Falcon (*Falco cherrug milvipes* Jerdon) mortality in central Mongolia and population threats. *Mongolian J. Biol. Sci.* 2(2): 13-21.

Gombobaatar, S., Sumiya, D., Potapov, E., Munkhzaya, B. & Odkhuu, B. (2007) Breeding biology of the Saker Falcon in Mongolia. *Raptors Conservation* 9: 17-26.

Goroshko, O. A. (2011) Bird electrocution in the Daurian Steppe (south-eastern Trans-Baikal Region), Russia. *Raptors Conservation* 21: 84-99.

Gott, E. J., Macdonald, H. J. & Fox, N. C. (2000) The Saker Falcon *Falco cherrug* in the Kyrgyz Republic. Pp.269-273 in R. D. Chancellor & B.-U. Meyburg, eds. *Raptors at risk*. World Working Group on Birds of Prey and Owls, & Hancock House, Surrey, British Columbia.

Jeffreys, A. J., Wilson, V. & Thein, S. L. (1985) Individual-specific 'finger-prints' of human DNA. *Nature* 316: 76–79.

Karyakin, I. V. (2002) Report on Tuva 2001. *Falco* 19: 10-11.

Karyakin, I. V. (2008) Saker Falcon in Russia. *Raptors Conservation* 12: 28-47.

Karyakin, I. V. (2011) Subspecies population structure of the Saker Falcon range. *Raptors Conservation* 21: 116-171.

Karyakin, I. V. & Barabashin, T. O. (2006) The birds of prey and owls of the Ulutau mountains. *Raptors Conservation* 5: 37-49.

Karyakin, I. V. & Nikolenko, E. G. (2008) Monitoring results on the Saker Falcon population in the Altai-Sayan region in 2008, Russia. *Raptors Conservation* 14: 63-73.

Karyakin, I. V. & Nikolenko, E. G. (2011a) Conservation of the Saker Falcon in the Altai-Sayan Ecoregion: what has been done and what should be done? *Raptors Conservation* 22: 24-59.

Karyakin, I. V. & Nikolenko, E. G. (2011b) Results of monitoring of the Saker Falcon population in the Altai-Sayan Region in 2011, Russia. *Raptors Conservation* 23: 152-167.

Karyakin, I. V. & Nikolenko, E. G. (2011c) The Saker Falcon in Dauria, Russia. *Raptors Conservation* 23: 168-181.

Karyakin, I., Konovalov, L., Moshkin, A., Pazhenkov, A., Smelyanskiy, I. & Rybenko, A. (2004a) Saker Falcon (*Falco cherrug*) in Russia. *Falco* 23: 3-9.

Karyakin, I., Levin, A., Novikova, L. & Pazhenkov, A. (2004b) Saker in the north-western Kazakhstan: results of the 2003–2004 surveys. *Falco* 24: 11-13.

Karyakin, I. V., Levin, A. S., Novikova, L. M., Novgorod, N. & Pazhenkov, A. S. (2005a) Saker in the north-western Kazakhstan: results of the 2003–2004 surveys. *Raptors Conservation* 2: 42-55.

Karyakin, I. V., Barabashin, T. O. & Moshkin, A. V. (2005b) The Saker Falcon in Aral Sea region. *Raptors Conservation* 4: 44-49.

Karyakin, I. V., Nikolenko, E. G. & Barashkova, A. (2006) Large birds of prey of steppe depressions in the Baikal region, Russia. *Raptors Conservation* 7: 21-45.

Karyakin, I. V., Kovalenko, A. V., Barabashin, T. O. & Korepov, M. V. (2008) The large birds of prey of the Sarysu River basin. *Raptors Conservation* 13: 48-87.

Kenward, R. E. (2006) *The Goshawk*. London: A. & C. Black (T. & A. D. Poyser).

Kenward, R., Katzner, T., Wink, M., Marcström, V., Walls, S., Karlbom, M., Pfeffer, R., Bragin, E., Hodder, K. & Levin, A. (2007) Rapid sustainability modelling for raptors with radio-tags and DNA-fingerprints. *Journal of Wildlife Management.* 71: 238-245.

Kenward, R.E. & Pfeffer, R.H. (1995) Saker Falcons in Central Asia: final report of the pilot study. Report for National Avian Research Centre, Abu Dhabi, by Institute of Terrestrial Ecology, Wareham, UK.

Kenward, R. E., Pfeffer, R. H., Bragin, E. A., Levin, A. & Kovshar, A. F. (1996) Kazakhstan. Pp.131-142 in J. Samour, ed. *Proceedings of the Specialist Workshop, Abu Dhabi, United Arab Emirates, November 14-16 1995*. Middle East Falcon Research Group.

Kenward, R. E., Pfeffer, R. H., Bragin, E. A., Levin, A. & Newton, I. (1998) Environmental contaminants and movements of Saker Falcons *Falco cherrug* in Central Asia. Pp.535-543 in R. D. Chancellor, B.-U. Meyburg & J. J. Ferrero, eds. *Holarctic birds of prey: proceedings of an international conference*. Berlin & Mérida: World Working Group on Birds of Prey and Owls, and Asociación para la Defensa de la Naturaleza y los Recursos de Extremadura.

Kenward, R. E., Pfeffer, R. H., Al-Bowardi, M. A., Fox, N. C., Riddle, K. E., Bragin, Y. A., Levin, A. S., Walls, S. S. & Hodder, K. H. (2001) Setting harness sizes and other marking techniques for a falcon with strong sexual dimorphism. *Journal of Field Ornithology* 72: 244-257.

Knapp, E. J. (2012) Why poaching pays: a summary of risks and benefits illegal hunters face in western Serengeti, Tanzania. *Tropical Conservation Science* 5: 434-445.

Kreuzberg-Mukhina, E. (2001) Large falcons and problems of their protection in Uzbekistan. Pp.101-109 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000)*. Ulaanbaatar: Ministry of Nature and Environment.

Kuchin, A. P. & Zubakina, N. A. (2001) Saker Falcon in Altay and adjoining plains. Pp.44-54 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000)*. Ulaanbaatar: Ministry of Nature and Environment.

Levin, A. S. (2000) Problems of Saker Falcon conservation in Kazakhstan. *Falco* 16: 8-9.

Levin, A. S. (2001) On the critical state of the Saker Falcon population in Kazakhstan. Pp.64-79 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000).* Ulaanbaatar: Ministry of Nature and Environment.

Levin, A. (2003) Sakers in Kazakhstan 2002. *Falco* 21: 8-9.

Levin, A. S. (2008a) Conservation problems of the Saker Falcon in Kazakhstan. *Raptors Conservation* 12: 48-55.

Levin, A. S. (2008b) Saker Falcon in eastern Kazakhstan. *Raptors Conservation* 14: 85-90.

Levin, A. S. (2011) Illegal trade and decrease in numbers of the Saker Falcon in Kazakhstan. *Raptors Conservation* 23: 64-73.

Levin, A. & Karpov, F. (2005) Notes of breeding the Saker Falcon in central Kazakhstan. *Raptors Conservation* 4: 52-57.

Levin, A. S. & Dixon, A. (2008) Long-term monitoring of breeding Saker Falcons in eastern Kazakhstan. *Falco* 32: 11-14.

Levin, A., Watson, M., Macdonald, H. & Fox, N. C. (2000) The Saker Falcon *Falco cherrug* in Kazakstan. Pp.259-262 in R. D. Chancellor & B.-U. Meyburg, eds. *Raptors at risk*. World Working Group on Birds of Prey and Owls, & Hancock House, Surrey, British Columbia.

Li Yi-ming, Gao Zenxiang, Li Xinhai, Wang Sung & Niemelä, J. (2000) Illegal wildlife trade in the Himalayan region of China. *Biodiversity & Conservation* 9: 901-918.

Ma M. & Chen Y. (2007) Saker Falcon trade and smuggling in China. *Falco* 30: 11-14.

Ma M., Mei Y., Tian L., Wu Y.-Q., Chen Y., Xu F., Dixon, A., Potapov, E., Angelov, I., Ragyov, D. & Balazs, I. (2006) The Saker Falcon in the desert of north Xinjiang, China. *Raptors Conservation* 6: 58-64.

Morgan J. A., Milchunas, D. G., LeCain, D. R., West, M. & Mosier, A. R. (2007) Carbon dioxide enrichment alters plant community structure and accelerates shrub growth in the shortgrass steppe. *Proc. Natn. Acad. Sci.* 104: 14724-14729.

Moseikin, V. (2000) Saker Falcons of the Russian Altai. *Falco* 16: 5-8.

Moshkin, A. V. (2010) Is there any scientific basis for decreasing the conservation status of the Saker Falcon? *Raptors Conservation* 19: 37-74.

Myloboh, Y. V. (2012) [Falconiformes in the Ukraine steppe: species composition, spatial distribution, dynamics, size and trends.] PhD dissertation, Kryvorizko National University. (In Ukrainian.)

Nagy, S. & Demeter, I. (2006) *Saker Falcon: European Single Species Action Plan*. Strasbourg: Convention on the Conservation of European Wildlife and Natural Habitats.

Nikolenko, E. & Karyakin, I. (2013) Outcomes of the round table discussion on the Saker Falcon at the Conference 'Conservation of Steppe and Semidesert Ecosystems of Eurasia', 13 March 2013. Unpublished.

Nittinger, F., Gamauf, A., Pinsker, W., Wink, M. & Haring, E. (2007) Phylogeography and population structure of the saker falcon (*Falco cherrug*) and the influence of hybridization: mitochondrial and microsatellite data. *Molec. Ecol.* 16: 1497-1517.

Parkin, D. T. (1987) The value of genetic fingerprinting to the breeding and conservation of birds of prey. Pp.81–86 in D. J. Hill, ed. *Breeding and management in birds of prey*. Bristol: University Press.

Potapov, E., Banzragch, S. & Shijirmaa, D. (1999a) The paradox of industrialisation in Mongolia: expansion of Sakers into flat areas is dependent of industrial activity. *Falco* 13: 10-12.

Potapov, E., Sumya, D., Gombobaatar, B., Fox, N. C. & Barton, N. W. H. (2002) Mongolian Altai Survey 2001. *Falco* 19: 7-8.

Prommer, M., Bagyura, J., Chavko, J. & Uhrin, M. (2012) Migratory movements of Central and Eastern European Saker Falcons *(Falco cherrug)* from juvenile dispersal to adulthood. *Aquila* 119: 111–134.

Riddle, K. E. & Remple, J. D. (1994) Use of the Saker and other large falcons in Middle East falconry. Pp.415-420 in B.-U. Meyburg & R. D. Chancellor, eds. *Raptor conservation today*. Berlin: World Working Group on Birds of Prey.

Ryabtsev, V. V. (2001) Saker Falcon in the Baikal region. Pp.58-63 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000).* Ulaanbaatar: Ministry of Nature and Environment.

Shagdarsuren, O. (2000) A short history of Saker Falcon (*Falco cherrug* Gray 1834) studies in Mongolia. *Falco* 16: 3-5.

Shagdarsuren, O., Sumya, D., Gombobaatar, S., Potapov, E. & Fox, N. (2001) Saker Falcon in Mongolia: numbers and distribution. Pp.25-33 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000).* Ulaanbaatar: Ministry of Nature and Environment.

Shijirmaa, D., Potapov, E., Banzragch, S. & Fox, N. C. (2000) The Saker Falcon *Falco cherrug* in Mongolia. Pp.263-268 in R. D. Chancellor & B.-U. Meyburg, eds. *Raptors at risk*. World Working Group on Birds of Prey and Owls, & Hancock House, Surrey, British Columbia.

Shukurov, E. & Davletbakov, A. (2001) Saker Falcon (*Falco cherrug*) in Kyrgistan. Pp.95-100 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000).* Ulaanbaatar: Ministry of Nature and Environment.

Suhchuluun, G. (2008) Conservation status and transboundary trade of the Saker Falcon in Mongolia. *Raptors Conservation* 12: 56-58.

Sumya [Sumiya in author credit], D., Gombobaatar, S., Shagdarsuren, O., Potapov, E. & Fox, N. (2001) Wintering of the Saker Falcon in Mongolia. Pp.138-143 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000).* Ulaanbaatar: Ministry of Nature and Environment.

Turganbaev, N. (2001) On the status and problems of conservation of Saker Falcon in Kyrgistan [*sic*]. Pp.209-211 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000).* Ulaanbaatar: Ministry of Nature and Environment.

Williams, N. P. & Evans, J. (2000) The application of DNA technology to enforce raptor conservation legislation within Great Britain. Pp.859-867 in R. D. Chancellor & B.-U. Meyburg, eds. *Raptors at risk*. Berlin: World Working Group on Birds of Prey and Owls.

Wink, M., Staudter, H., Bragin, Y. Pfeffer, R. & Kenward, R. 1999. The use of DNA fingerprinting to estimate survival rates in the Saker Falcon (*Falco cherrug*). Journal für Ornithologie 140:481-489.

Wu Y.-Q., Ma M., Liu X. F., Tian L. & Mei Y. (2007) Status of the Saker Falcon on the eastern fringe of the Junggar basin, China. *Raptors Conservation* 8: 42-47.

Xinjiang Conservation Fund (2007) *Summary version of report on illegal poaching and trade of Saker Falcon in Xinjiang*. http://www.greengrants.org.cn/file/pub/saker.pdf

Ye Xiaodi [given as 'Xiaodi Y.'] & Fox, N. C. (2003) China 2002. *Falco* 21: 7-8.

Ye Xiaodi & Ma Ming (2002) China 2001. *Falco* 19: 5-6.

Ye Xiaodi, Wan Ziming & Bai Yanxia (2001) The Saker Falcon in China is fighting for survival. Pp.80-94 in E. Potapov, S. Banzragch, N. Fox & N. Barton, eds. *Saker Falcon in Mongolia: research and conservation (Proceedings of II International Conference on Saker Falcon and Houbara Bustard, Ulaanbaatar, Mongolia, 1–4 July 2000).* Ulaanbaatar: Ministry of Nature and Environment.

Saker Falcon Task Force, Objective 7 Working Group Report

Progress report of the Working Group on sustainable use of the Saker Falcon *Falco cherrug*

Lead: Colin Galbraith (Chair of the Saker Falcon Task Force)

Contributors: Robert Kenward (IUCN), Borja Heredia (CMS), Tom De Meulenaer (CITES), Janusz Sielicki (IAF), Mátyás Prommer (Hungary), Mohammed Shobrak (Saudi Arabia), Umeed Khalid (Pakistan), Sadegh Zadegan (Islamic Republic of Iran), Diane Klaimi (UNEP/ROWA) and Michal Adamec (Slovakia), András Kovács (STA, UNEP/CMS Raptors MoU) and Nick P. Williams (UNEP/CMS Raptors MoU)

Date: 25 July, 2013

Recommended citation:

Galbraith, C., Kenward, R., Heredia, B., De Meulenaer, T., Shobrak, M., Klaimi, D., Kovács, A. and Williams, N. P. (2013) Progress report of the Working Group on sustainable use of the Saker Falcon *Falco cherrug*. *In:* Williams, N.P., Galbraith, C. and Kovács, A. (eds.) Compilation Report on WorkPlan Objectives 4 – 8, including a modelling framework for sustainable use of the Saker Falcon *Falco cherrug.* UNEP/CMS Raptors MoU Coordinating Unit, Saker Falcon Task Force, Abu Dhabi.

Table of contents

I. Executive summary

The Saker Falcon *Falco cherrug*, is an iconic species famed for its historic role in falconry. The conservation status of the Saker Falcon has attracted considerable attention, particularly as the population has declined over much of its traditional range, and as the traditional practice of taking some birds from the wild for falconry has been questioned.

This has led to what can be considered a classic conservation dilemma where the use of the species has become a core part of the culture for a number of countries in the species range, while active protection, with no taking from the wild, possession or use of the species, is the management norm in other range States.

The challenge for all those involved in the management of the species is to identify a clear way forward so that a holistic approach can be implemented for its conservation and management.

The Convention on the Conservation of Migratory Species of Wild Animals (CMS) has taken a leading role in the conservation of the species and *Falco cherrug* is included in both Appendix I and II of CMS. At the 10th meeting of the Conference of the Parties (COP10; Bergen, November 2011), the Parties adopted Resolution 10.28 which lists *Falco cherrug* in CMS Appendix I, excluding the population in Mongolia which remains in Appendix II. The Resolution also calls for the establishment of a Saker Falcon Task Force (STF) under the auspices of the UNEP/CMS Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MoU), and the implementation of a Concerted Action in cooperation with the Signatories of the Raptors MoU, range States and other interested parties.

In support of the Saker Falcon Task Force, CMS and the CITES Secretariat have concluded an Internal Cooperation Agreement to review relevant international policies and legislation relating to the sustainable use of the Saker Falcon for falconry and trade; and to develop a framework document for the controlled sustainable use of the Saker Falcon under an adaptive management framework that conforms to the needs of CITES and that incorporates robust monitoring and feedback mechanisms

The Working Group on sustainable use

The Saker Task Force has created a number of short-term working groups to take forward consideration of particular areas of work leading up to a Stakeholder's Workshop to be held in September.

The role of the Sustainable Use Working group is to:

i) Elaborate options for the sustainable use procedure, propose difference scenarios.

ii) Investigate the potential effects and possible conditions of legal trade and use of wild-origin Sakers by falconers and agree on the method of estimating the level of sustainable use in the light of identified knowledge gaps.

iii) Review potential means that aim toward delegating rights, responsibility, and accountability to those (e.g. indigenous and local communities, private landowners, conservation organizations and the trade sector) that manage and/or use Saker populations in a sustainable and controllable way.

In addition the STF have commissioned a short contract to address some of the key biological and socio-economic issues involved. The contract requires the consortium undertaking the work to:

i) Review existing population data, models and modelling techniques, including specifically any models that have already been developed for discrete Saker Falcon populations.

ii) Develop a series of related demographic models covering the range of Saker Falcon populations to create a modelling framework for the global Saker Falcon population.

The report from this contract will be circulated to members of the Working Group and should be read alongside the present report, as it addresses some of the key issues highlighted here as requiring substantive investigation.

Reporting to CMS

The STF will report to the next Conference of the Parties to CMS in late 2014.

Before the report to CMS can be concluded a number of key questions need to be answered, so that a holistic monitoring and management plan can be submitted for consideration by the CoP. These issues will be addressed in the forthcoming Stakeholders Workshop and through further work to be undertaken by the Saker Task Force in the lead up to the CoP.

These questions include:

i) What governance structures will be required and what will the composition of any management grouping established to ensure the delivery of the Global Action Plan be?

ii) Who will implement the management and monitoring plan?

iii) Who will fund the overall implementation of the management and monitoring plan?

iv) What reporting mechanisms are required in future years for CMS and CITES?

v) What monitoring methods are to be employed, both in relation to the population and to the level of off take from the wild?

In relation to point v) above, further consideration is required on the methods needed to monitor the taking of birds, including the use of micro-chipping, marking of trapped wild birds and other field techniques. The details of possible field monitoring techniques will be provided for further discussion as part of the outputs from the Working Group on planning and implementing fieldwork.

Similarly, a number of detailed and important questions remain about the nature and extent of any “take” from the wild that will need to be addressed in order to develop a system for the sustainable use of the species, including:

i) What number of birds can be taken from the wild each year?

ii) When can birds be taken?

iii) Where can birds be taken from?

iv) What age and sex ratio of birds can be taken? How might this vary across the species range and over different stages of their life cycle?

v) How can birds be taken (trapping methods) and what factors might influence this, both from a biological and socio-economic perspective?

vi) What variability in the level of “taking from the wild” over time might be appropriate and how could such variability, for example over a period of years, be incorporated into any management system?

vii) Could the variability covered in vi) above be linked to the relative productivity of the species over a number of years?

viii) Is a taking and export quota system a viable option as part of this approach?

Importantly, the modelling contract has addressed many of these issues, thereby enabling substantive discussions about the options for management.

A range of outcomes can be envisaged from the discussions at CMS COP11, and consideration is being given to the implementation of any monitoring and management system that might be required after that point.

II. Background

The Saker Falcon, *Falco cherrug*, is an iconic species famed for its historic role in falconry. Its conservation status has attracted considerable attention, particularly over recent times. It is a species that engenders strong opinions about its conservation and wider management, with these opinions becoming ever more strident over recent years as the population has declined over much of its traditional range, and as the traditional practice of taking some birds from the wild for falconry has been questioned.

This has led to what can be considered a classic conservation dilemma where the use of the species has become a core part of the culture for a number of countries in the species range, while active protection, with no taking from the wild, possession or use of the species, being the management norm in other range States.

The challenge for all those involved in the management of the species is to identify a clear way forward and ideally to do this by consensus, so that the a holistic approach can be implemented for its conservation and management. There are, however, also many positive aspects apparent. Firstly there are various stakeholder groups interested in the Saker Falcon, ranging from conservationists to falconers, as well as numerous governments across the species' range. These stakeholders are seeking to collaborate and jointly work towards the conservation of the species. Secondly, there has been considerable publicity and media attention on Saker Falcons in recent times, thereby raising wider awareness of the need for concerted action in favour of this species. This means that there is real engagement and considerable effort now being expended to aid its conservation overall.

This report outlines progress in relation to the development of a management and monitoring system for the sustainable use of Saker Falcon.

II.1. Convention on the Conservation of Migratory Species of Wild Animals (CMS)

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention) aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 119 Parties (as of 28 May 2013) from Africa, Central and South America, Asia, Europe and Oceania.

Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the range States of many of these species.

Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention. For this reason, the Convention encourages the range States to conclude global or regional Agreements.

The conservation status of species is a key determinant of how CMS regards management issues relevant to their population. Article I, paragraphs 1.c and 1.d of the Convention describes the conservation status of species as follows:

c) "Conservation status" will be taken as "favourable" when:

   (1) population dynamics data indicate that the migratory species is maintaining itself on a long-term basis as a viable component of its ecosystems;

   (2) the range of the migratory species is neither currently being reduced, nor is likely to be reduced, on a long-term basis;

(3) there is, and will be in the foreseeable future sufficient habitat to maintain the population of the migratory species on a long-term basis; and

(4) the distribution and abundance of the migratory species approach historic coverage and levels to the extent that potentially suitable ecosystems exist and to the extent consistent with wise wildlife management;

d) "Conservation status" will be taken as "unfavourable" if any of the conditions set out in sub-paragraph (c) of this paragraph is not met;

Falco cherrug is included in both Appendix I and II of CMS. At the 10th meeting of the Conference of the Parties (COP10; Bergen, November 2011), the Parties adopted Resolution 10.28 which lists *Falco cherrug* in CMS Appendix I, excluding the population in Mongolia which remains in Appendix II. The Resolution also calls for the establishment of a Saker Falcon Task Force (STF) under the auspices of the UNEP/CMS Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MoU), and the implementation of a Concerted Action in cooperation with the Signatories of the Raptors MoU, range States and other interested parties.

The descriptions in Article I, paragraphs 1c and 1d are relevant to the Saker Falcon where, given current information and the recent population declines of the species, the Saker Falcon Task Force would, in effect, be designing a management and monitoring system for a species whose status under CMS is deemed to be "unfavourable" in all of its range with the exception of Mongolia.

II.2. Sustainable use of Saker Falcons under CMS

Many major conservation initiatives have the sustainable use of species at their core. Alternatively, of course, many people involved in the conservation of species do not view sustainable use as a key part of the conservation effort in relation to many species, hence getting a balance between these views is challenging, and the issue of sustainable use has been a difficult one for CMS over many years. The CMS Convention text refers to the "taking" of species from the wild in Article III, paragraph 5-7 as follows:

"5. Parties that are Range States of a migratory species listed in Appendix I shall prohibit the taking of animals belonging to such species. Exceptions may be made to this prohibition only if:

a) the taking is for scientific purposes;

b the taking is for the purpose of enhancing the propagation or survival of the affected species;

c) the taking is to accommodate the needs of traditional subsistence users of such species; or

d) extraordinary circumstances so require; provided that such exceptions are precise as to content and limited in space and time. Such taking should not operate to the disadvantage of the species".

In addition, paragraphs 6 and 7 add a degree of context to how these issues should be handled:

"6. The Conference of the Parties may recommend to the Parties that are Range States of a migratory species listed in Appendix I that they take further measures considered appropriate to benefit the species.

7. The Parties shall as soon as possible inform the Secretariat of any exceptions made pursuant to paragraph 5 of this Article".

These paragraphs are important in relation to the work of the Saker Falcon Task Force, where any management and monitoring system to be proposed to the next Conference of the Parties to CMS will need to satisfy the terms outlined above.

Whilst the issue of the taking of species listed on Appendix 1 of the Convention is covered in the above paragraphs, the wider issue of sustainable use has been further considered in Resolution 8.1, adopted at the 8th meeting of the Conference of the Parties to CMS (Nairobi, November 2005). In the preamble, it is *acknowledged* that the Parties to the Convention on Biological Diversity (CBD) had adopted the Addis Ababa Principles and Guidelines (AAPGs) and that Parties to CITES have initiated studies of the potential roles of the AAPGs in contributing towards implementation of CITES requirements for species included in the CITES Appendices; and *recognised* that the implementation of the CBD AAPGs by Parties, where appropriate, could contribute to reducing many of the causes of loss of migratory species (e.g. by-catch, unsustainable harvesting, overexploitation or unsustainable hunting).

II.3. The Convention on International Trade in Endangered Species of fauna and flora (CITES)

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival (CITES Website 2013. http://www.cites.org/).

Commercial international trade in CITES Appendix-II listed species such *Falco cherrug* is allowed provided that (a) a national CITES Management Authority had determined that the animals to be exported had been obtained legally; and (b) a Scientific Authority had advised that the trade is sustainable and 'not detrimental to the survival of the species in the wild'. CITES has mechanisms in place to review authorized level of export, and take measures against countries where trade is found to be unsustainable.

Such a review, conducted in the second half of 2000, concluded that international trade in Saker Falcon was of no concern for the large majority of range States of the species (typically because the species was fully protected or because no exports of wild birds had been recorded for prolonged periods of time). However, trade from nine countries was 'of concern'. In 2009, the CITES Parties agreed that eight of these establish zero-export quotas for wild Saker Falcons, which can only be lifted when they comply with specific conditions prescribed by CITES, including the implementation of a series of conservation measures. The ninth country, Mongolia, implemented all conservation actions required by CITES, and was therefore allowed to export a limited and sustainable number of live, wild Saker Falcons under an annual quota system (a quota of 300 live birds for 2010 and 2011). Mongolia has not communicated export quotas in 2012 and 2013, and has now temporarily suspended the exportation of wild Saker Falcons.

It is noteworthy that the international trade in captive bred Saker Falcons is not affected by the trade suspensions and quotas indicated above, which pertain exclusively to birds of wild origins.

Concerning the sustainable use of Saker Falcons and other wild species of fauna and flora, CITES adopted in 1992 Resolution Conf. 8.3 (Rev. CoP13) on *Recognition of the benefits of trade in wildlife*, and in 2004 the standards concerning the sustainable use of wildlife recognized under the CBD through Resolution Conf. 13.2 (Rev. CoP14) on *Sustainable use of biodiversity: Addis Ababa Principles and Guidelines*. More recently, CITES Parties adopted at CoP16 (2013): Resolution Conf. 16.6 on *CITES and livelihoods*, which recognizes *inter alia* that the implementation of CITES is better achieved with the engagement of rural communities, especially those which are traditionally dependent on CITES-listed species for their livelihoods; and Resolution Conf. 16.7 on *Non-detriment findings*, containing general guidance for Scientific Authorities to determine that exports of wild species of fauna and flora will not be detrimental to the survival of the species concerned, i.e. are sustainable.

In support of the Saker Falcon Task Force, the CITES Secretariat concluded an Internal Cooperation Agreement with the CMS Secretariat, with the following key activities:

Activity 1: Develop a framework document for controlled sustainable use of the Saker Falcon under an adaptive management framework that conforms to the needs of CITES and incorporates robust monitoring and feedback mechanisms *(this action supports Objective 7 of the SFTF work plan for 2012-21014)*

Activity 2: Review relevant international policies and legislation relating to sustainable use of the Saker Falcon for falconry and trade *(this action supports Objective 4 of the SFTF work plan for 2012-21014)*

The objectives of this Agreement are fully in line with the outputs required to develop a management and monitoring system for the species, and should benefit the two Conventions.

II.4. Other legislation and policy

The sustainable use of species has been covered in a wide range of other legislation. This will be dealt with by STF Working Group 4 and will include the key pieces of legislation in relation to the Saker Falcon such as the EU Directive on the Conservation of Wild Birds (EU 79/409), the Bern Convention and UNESCO which identified traditional falconry as part of the intangible Human heritage.

II.5. Conservation status

At CMS COP 10, the Saker Falcon1 (*Falco cherrug*) was included in CMS Appendix I, with the exception of the popualtion in Mongolia which remained in Appendix II.

In March 2012, IUCN found the status of the species to be 'Endangered' as a consequence of a population trend analysis indicating that the species to be undergoing a very rapid decline.

In addition, the Saker Falcon was listed by CMS at COP 10 as one of the species designated for Concerted and Cooperative Actions in Annexes 1 of Resolution 10.23. Such Actions encourage Parties and other organizations to take steps to improve the conservation status of the species concerned, including the preparation of species action plans.

II.6. History of use in falconry

Falconry has been a key part of the tradition and culture of many Arab and other countries for at least 2000 years. This involves a range of falcon species, with the Saker Falcon being considered as the premier species by many falconers. Decline in some Saker populations has been observed in the last two decades, while some other populations appear to be stable or growing. There are a number of recognized threats, but their relative importance and impact is not fully clear. The main threats include electrocution and collisions with manmade structures, uncontrolled taking, poisoning and in some areas habitat changes.

Over the previous two decades captive breeding has become an important source of birds for falconry. Sakers trained in Europe come almost exclusively from domestic breeding, and in Arab countries the number of such birds is increasing.

[1] http://www.birdlife.org/datazone/speciesfactsheet.php?id=3619

The use of Saker Falcons for falconry involves the taking of birds at various stages of their life cycle, and in various locations across their range. Adult and juvenile birds are traditionally trapped during migration in several Middle-Eastern countries, as traditional use of Sakers was of birds that had already learned to fly. In the last two decades, birds have also been trapped in their breeding range or taken as young from nests. Obtaining a clearer picture of how many birds are trapped at the various stages of their life cycle and in the various parts of their range is important to understand the impact for populations. A questionnaire has been designed to be sent to trappers to help answer this question.

Related to the taking of wild falcons has been an active international trade, involving considerable sums of money for individual birds. Again it is important that the Task Force develops a clearer picture of the nature of this trade, in terms of the number of birds involved and timing of the activity. The involvement of CITES in the work is of importance here. As a consequence of the CITES review of international trade in Saker Falcons mentioned above, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Russian Federation, Saudi Arabia, Turkmenistan and Uzbekistan established zero-export quotas for wild Saker Falcon which can only be lifted when they comply with specific conditions prescribed by CITES, and Mongolia agreed to an annual export quota of maximum 300 live, wild birds in 2010 and 2011. These quotas have been adhered to. If that would not have been the case, CITES provisions include a number of measures to impose compliance.

A useful summary of the development of trade over recent years is presented in Dixon *et al.*

" ...there has always been a small falcon trade associated with Arabic falconry (bär 2006), but this has developed markedly in recent decades, driven by changing socio-economic factors in the Middle East, central Asia and beyond. Trade in falcons to the Arabian Peninsula initially came from countries of the Middle East, the Maghreb, and Pakistan, mainly involving passage birds (Platt 1983, Riddle and Remple 1994), but since the breakup of the Soviet Union, the falcon trade has moved into the breeding distribution range of the Saker Falcon (Falco cherrug) in central Asia, including Mongolia and China (Flint 1995, Zahler et al. 2004, yi-Ming et al. 2000). Uncontrolled and unregulated trapping of Saker Falcons is thought to be the main cause of rapid and extensive population declines in parts of Central Asia, particularly in the countries of the former Soviet Union (Birdlife International 2011)".

II.7. Recent conservation efforts

There has been a range of conservation action for the species across various parts of the species range. This is described in the reports from the other Working Groups, so will not be covered in great detail here. The work includes;

i) Conservation programme in Mongolia; including a large scale nest box scheme, monitoring and community action.

ii) European nest box schemes, studies on juvenile dispersal through satellite tracking. education and awareness – webcams.

iii) Countries in the Middle-east – Education programmes, monitoring and release of birds used in falconry.

iv) Conservation action in other countries including reintroduction programmes.

III. The Saker Falcon Task Force (STF)

CMS Resolution 10.28[2] establishes a Saker Falcon Task Force (STF) and states that the Parties agree to provide financial and other resources to the operation of the Task Force and the implementation of the Concerted Action in cooperation with the Signatories of the Raptors MoU, Range States and other interested parties.

The Task Force brings together range States of the Saker Falcon, co-operating Partners and other stakeholders to develop a coordinated Global Species Action Plan. Importantly, this Action Plan will include a management and monitoring system for the sustainable use of the species.

The Saker Falcon Task Force is expected to develop robust monitoring and management mechanisms to ensure that any use of the Saker Falcon is controlled and sustainable and is set within an adaptive management framework. This approach needs to be acceptable to the Parties potentially using and trading Saker Falcons, as well as to Parties not using this species but who have a keen interest in the overall implementation of the Convention. The viewpoints of the various stakeholders, including pro-use and conservation organisations, also need to be considered. The approach should, if possible, meet requirements from both CMS and CITES. The work requires clear, scientifically based evidence and a degree of practical knowledge to be effective.

The work on the Saker Falcon fits within wider initiatives on the conservation and management of birds of prey, and particularly within the framework of actions initiated under the UNEP/CMS Memorandum of Understanding on the Conservation of Migratory Birds of Prey in African and Eurasia (Raptor MoU).

Key parts of the work programme of the Task Force are being delivered by a number of time-limited working groups consisting of Task Force members. This is shown in a diagram and is below.

III.1. The STF Woking Groups

The first meeting of the STF identified a number of key actions required to develop the management and monitoring plan for the species. These actions were to be delivered by the individual members of the Task Force and by the wider range of organisations involved in the work. In addition, some of the key actions that were identified are being delivered via four Working Groups thereby allowing further focussed discussion between participants, and the adoption of a common view which will be further discussed as part of the Global Action Plan Workshop later in 2013.

The four Working Groups (WGs) are:

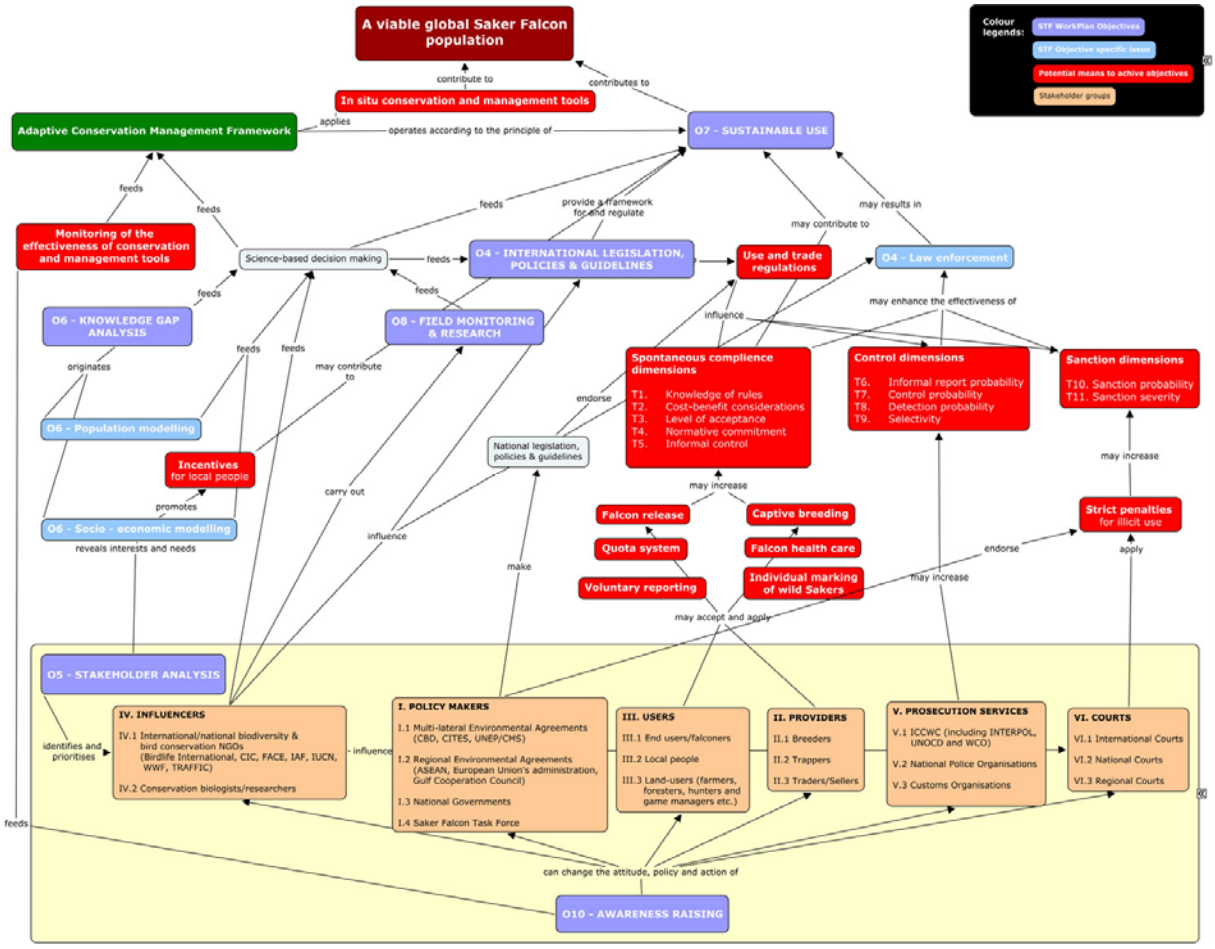
- WG 4 To review relevant international policies and legislation
- WG 6 To conduct a knowledge gap analysis
- WG 7 To examine the sustainable use of wild origin falcons
- WG 8 To plan and implement fieldwork

The actions being undertaken by the Working Groups are designed to explore the complexity and detail of the issues involved in the conservation and management of the Saker Falcon across the full extent of its range, throughout each of the stages of its annual cycle, including breeding, migration and wintering periods. This complexity and interdependence of issues has been described in Diagram 1 below.

[2] http://www.cms.int/bodies/COP/cop10/resolutions_adopted/10_28_saker_e.pdf

The remaining sections of this report will detail the work undertaken by WG 7 in relation to the sustainable use of wild origin falcons. Each of the other Working Groups will produce a similar report for further discussion at the GAP workshop scheduled for September 2013, and for subsequent incorporation into the Global Action Plan for the species.

Diagram 1 Key factors (v2, UNEP/CMS Raptors MoU CU, 2013)



IV. The Working Group on sustainable use

The following section outlines the work and outputs from the Working Group addressing Objective 7 of the overall STF work programme;, namely to examine the sustainable use of wild Saker Falcons. This is a key work area for the Task Force and linked to other work areas taken forward by parallel Working Groups that will, in turn, provide important context. For example, the conclusions from the Working Group addressing Objective 6 on "Knowledge Gaps" may be able to provide information on the present data and information available to inform decisions about the timing and extent of any use of the species. Providing an objective, scientific basis for the management of the population in this way is a key aspect of the work of the Group.

The Working Group has given early consideration to the nature of the outputs required from it. Importantly, this should not simply be an academic review of sustainable use for the species but, as mentioned above, needs to include realistic options for the implementation of a management and monitoring system under CMS that fits also with requirements under CITES. Additionally, it was agreed as being important to ensure the scientific rigour of any methods suggested and critical to ensure that the data and information used was as robust and defendable as possible.

IV.1. Membership and remit of the Working Group

Aim: To examine the sustainable use of Saker Falcons of wild-origin

i) Membership: Lead contributor: Colin Galbraith (CMS), CMS, Raptors MoU, ICU. Partners: Robert Kenward (IUCN), Borja Heredia (CMS), Tom De Meulenaer (CITES), Janusz Sielicki (IAF), Mátyás Prommer (MME), Mohammed Sobrak (KSA), Umeed Khalid (MoNDM, Pakistan), Sadegh Zadegan (DoE, Iran), Diane Klaimi (UNEP/ROWA), Michal Adamec (SNC, Slovak Republic), Fernando Spina (CMS Scientific Council).

ii) Key tasks: The following tasks have been drawn from the overarching work programme for the Saker Falcon Task Force for 2012-2014. The numbering is derived from the STF Work Programme document.

- *Action 7.1 Elaborate options for the sustainable use procedure, propose difference scenarios.*
- *Action 7.2 Investigate the potential effects and possible conditions of legal trade and use of wild-origin Sakers by falconers and agree on the method of estimating the level of sustainable use in the light of identified knowledge gaps.*
- *Action 7.3 Review potential means that aim toward delegating rights, responsibility, and accountability to those (e.g. indigenous and local communities, private landowners, conservation organizations and the trade sector) that manage and/or use Saker populations in a sustainable and controllable way.*

iii) Outputs: A report considering the issue of sustainable use for the species and presenting a range of scenarios for the sustainable use of the species under CMS.

iv) Timeframe: Draft report for discussion as part of the Global Action Plan workshop in September 2013.

v) Working methods: By e-mail and teleconference.

The following section reports on progress in addressing the work areas of the Working Group as outlined above. In each case, an update on progress is provided and a range of questions is included that will require to be answered over the coming months in the lead up to, and as part of, the Stakeholder Workshop to help develop the Global Action Plan.

IV.2. Implementing Action 7.1. "Elaborate options for sustainable use procedure and propose different scenarios".

This is a key work area for the Task Force covering a range of biological issues relating to the Saker Falcon population, and providing, in due course, a workable management and monitoring system in relation to the sustainable use of the species.

A contract has been let to a consortium of scientific experts and experienced population modellers to explore options in relation to the sustainable use of the species in more detail, and specifically to develop a modelling approach to investigate the biological options and socio-economic issues in relation to sustainable use.

The contract requires the consortium to undertake the following:

i) Review existing population data, models and modelling techniques, including specifically any models that have already been developed for discrete Saker Falcon populations.

ii) Develop a series of related demographic models covering the range of Saker Falcon populations to create a modelling framework for the global Saker Falcon population.

iii) Using the best available data and information, the modelling should:

- Investigate the population dynamics of Saker Falcon, including the effects of differing levels of productively, recruitment and mortality.
- Simulate the potential effects of harvesting from declining, stable as well as increasing Saker Falcon populations.
- Investigate the effects of harvesting female and male specimens at different stages in their lifecycles, i.e. nestlings, fledglings, dispersing juveniles and adults, and, breeding adults.
- Identify parameters which impose critically important pressures and therefore require the highest levels of data quality.

There are a number of questions that stem from this work to be considered as part of the Global Action Plan workshop, and in due course that will be included in the final report from the Sustainable Use Working Group. These will form part of the management and monitoring system to be presented to the CMS CoP in late 2014.

IV.3. Population related factors

There are biological factors that might influence the taking of birds from the wild. Some of these relate to the characteristics of the population to be "used", and some relate directly to the nature of the "taking" itself. The following considerations concerning populations remain to be answered:

i) Is the population to be used at "favourable conservation status" as defined by CMS?

ii) Is the local population to be used increasing, decreasing or stable; and is it considered large enough to sustain use at particular levels? Note that ideally having information on the population trend is likely to be particularly valuable in informing judgements on these aspects of the population status.

iii) Are other factors impacting on the population that need to be considered such as persecution or habitat loss?

iv) What role can captive breeding play in future to supply birds for falconry? Note there is a need to describe effectively issues relating to the "quality" and vigour of captive bred birds compared to those taken from the wild.

v) What role does the release of birds back to the wild have as part of any management scheme that might be proposed by the STF?

These questions remain to be answered, and will be informed by future discussions, the outputs from the other working groups and the products from the modelling contract.

IV.4. Taking from the wild

A number of questions can be posed about the nature and extent of any "take" from the wild in order to develop a system for the sustainable use of the species:

i) What number of birds can be taken from the wild each year?

ii) When can birds be taken?

iii) Where can birds be taken from?

iv) What age and sex ratio of birds can be taken? How might this vary across the species range and over different stages of their life cycle?

v) How can birds be taken (trapping methods) and what factors might influence this, both from a biological and socio-economic perspective?

vi) What variability in the level of "taking from the wild" over time might be appropriate and how could such variability, for example over a period of years, be incorporated into any management system?

vii) Could the variability covered in vi) above be linked to the relative productivity of the species over a number of years?

viii) Is a taking and export quota system a viable option as part of this approach?

IV.5. Implementing Action 7.2. "Investigate the potential effects and possible conditions of legal trade and use of wild-origin Sakers by falconers and agree on the method of estimating the level of sustainable use and on governance in the light of identified knowledge gaps".

The work required here can be considered in relation to the three questions contained in the above paragraph, namely:

i) Potential effects of legal trade

ii) Possible conditions of legal trade

iii) Agree a method of estimating the level of sustainable use in light of identified knowledge gaps

Note that the outputs from the modelling contract and from the other STF Working Groups are highly relevant in providing an evidence base to help answer these points. For example, the identification and quantification of knowledge gaps will be significant in defining the "risk" attached to the various options for population management. Further discussion between the various Working Groups would therefore be useful as the work progresses over the coming few months.

The following questions are relevant to usefully inform the CMS CoP of the suggested way ahead:

i) What governance structures will be required and what will the composition of any management grouping established to ensure the delivery of the Global Action Plan be?

ii) Who will implement the management and monitoring plan?

iii) Who will fund the overall implementation of the management and monitoring plan?

iv) What reporting mechanisms are required for CMS and CITES?

v) What monitoring methods are to be employed, both in relation to the population and to the level of off take from the wild?

In relation to point v) above, further consideration is required on the methods needed to monitor the taking of birds, including the use of micro-chipping, marking of trapped wild birds and other field techniques. The details of possible field monitoring techniques will be provided for further discussion as part of the outputs from the Working Group on planning and implementing fieldwork.

IV.6. Implementing Action 7.3: "Review potential means that aim toward delegating rights, responsibility, and accountability to those (e. g. indigenous and local communities, private landowners, conservation organizations and the trade sector) that manage and/or use Saker populations in a sustainable and controllable way"

The Stakeholder's workshop, scheduled to be held in September of this year, provides an important opportunity to explore socio-economic issues in greater detail and develop ways to achieve the effective buy-in from the various stakeholder groups. Such buy-in can contribute to the effectiveness of the initiative. Ways need to be developed to empower local stakeholders, whilst retaining the ability to monitor progress at the "global" level against particular targets that might be identified in relation to population status, levels of offtake, conservation actions or the transfer of benefits to local communities.

The views of those working "on the ground" in the management and conservation of the Saker Falcon need to be incorporated into any action plan. They should be part of the wider decision making process.

Again, the work being undertaken as part of the modelling contract will look at some of these issues and part of the work will:

Develop a socio economic model to elaborate sustainable use of the species for falconry purposes, which can be integrated with the population demographic modelling.

This is a particularly important aspect of the work as it will, ideally, bring together biological and socio-economic factors into one integrated approach. This will be difficult and will require further discussion by a range of stakeholders as part of the GAP workshop, to ensure wider acceptability and buy-in.

Particular issues to be examined and developed as part of the Workshop include:

i) Incentives for local communities and stakeholders to manage "their" populations

ii) Compliance and how this is monitored, measured and reported on

V. Reporting to CMS

V.1. Implementation

This section is included to highlight the importance of the coming period and to stress that action will be needed in the run up to the 11th meeting of the Conference of the Parties (CMS COP11; late 2014) in terms of completion of the Global Action Plan and to ensure that the Parties to CMS adopt the proposed management and monitoring system.

It is important to note also that the CMS Scientific Council will meet before the main Conference of the Parties and that the Council should have sight of the proposed Global Action Plan, and should receive a report of the work of the Task Force.

COP11 should be followed by the implementation of the various actions required under the Plan. This will require significant action and funding, and raises questions concerning the overall governance of the initiative in future. These are issues that can be discussed at the GAP workshop, and in the following meeting of the STF.

Detailed consideration will therefore be required for the following:

i) Timelines to CMS COP11 for the completion of the sustainable use components in the Global Action Plan.

ii) Implementation phase after COP11 - Management and implementation structures; funding and resources; monitoring and reporting.

V.2. Possible Outcomes at the next CMS Conference of the Parties

The following outcomes could be envisaged at COP11. It would be useful for the Working Group to elaborate and consider the implications of each of these options, and report these to COP11.

i) No use recommended by CMS.

ii) Recommends limited use after the implementation of an agreed management and monitoring system.

iii) Recommends use for a limited time period – possibly three years up until the following CoP.

iv) Recommends use based on an agreed management and monitoring system.

UNEP/CMS Office, Abu Dhabi (OBIS/CMSAD/1237/2013)

Elaboration of a modelling framework to integrate population dynamics and sustainable use of the Saker Falcon *Falco cherrug*

Lead: R.E. Kenward, European Vice Chair of IUCN Sustainable Use and Livelihoods Specialist Group

Contributors: M. AlRashidi (University of Hail, Saudi Arabia), M. Shobrak (University of Taif, Saudi Arabia), M.Prommer (MME/Birdlife Hungary), J. Sielicki (International Association for Falconry and Conservation of Birds of Prey, Poland), N. Casey (Anatrack Ltd, United Kingdom)

Draft: Final Draft

Date: 31 July, 2013

RAPTORS MOU

CMS UNEP

Acknowledgements

For help with obtaining data we thank Dr Mohammad Sulayem, Mohammed Al Kathlan and the 37 falconers who completed questionnaires in the Kingdom of Saudi Arabia, to Drs Gergő Halmos, Szabolcs Nagy and Ivan Demeter in Hungary and to Dr Andrew Dixon in Wildlife Consultants International for Mongolia. The work draws on unpublished material gathered with the help of many individuals over several decades, organised by János Bagyura, Birdlife Hungary (MME) and the Hungarian Bird Ringing Centre in the Panonian Region of Europe, and in several parts of Kazakhstan with help from British Trust for Ornithology. Funding was kindly provided by the National Avian Research Centre in Abu Dhabi (now part of Environment Agency – Abu Dhabi), the National Commission for Wildlife Conservation and Development in the Kingdom of Saudi Arabia (now the Saudi Wildlife Authority), Institute of Terrestrial Ecology in UK (now the Centre for Ecology & Hydrology), the European Union's LIFE+ programme and the International Association for Falconry and Conservation of Birds of Prey. We are also grateful to Nick Williams at the Coordinating Unit of the CMS Raptors MoU for patient supervision of the work in this contract, and to Dr Rosie Cooney for over-view within IUCN.

Recommended citation:

Kenward, R., AlRashidi, M., Shobrak, M., Prommer, M., Sielicki, J. & N. Casey (2013) Elaboration of a modelling framework to integrate population dynamics and sustainable use of the Saker Falcon *Falco cherrug*. *In:* Williams, N.P., Galbraith, C. and Kovács, A. (eds.) Compilation Report on WorkPlan Objectives 4 – 8, including a modelling framework for sustainable use of the Saker Falcon *Falco cherrug.* UNEP/CMS Raptors MoU Coordinating Unit, Saker Falcon Task Force, Abu Dhabi.

Table of contents

List of Tables

List of Figures

List of Boxes

I. Executive summary

1. We reviewed demographic modelling of raptors, built models for the Saker Falcon, surveyed falconers and trappers in Saudi Arabia, developed a conceptual socio-economic model for Saker Falcon management and produced a costing of the main software tool that it would need.
2. We noted that data and techniques for monitoring Saker Falcon populations need refinement for populations with different ecological conditions in terms of breeding, migration and wintering areas.
3. For harvesting, more data on productivity, survival and attrition factors are needed to enable precautionary estimates of population resilience and persistence in the face of natural variation.
4. Observed productivity, and survival estimates of 50% through the first nine months after fledging, 65% of the next year and 80% thereafter predicted resilience of compact European and central Asian Saker populations above 80 pairs if not subject to trapping of breeding adults.
5. The IAF population model in Microsoft Excel is simple, flexible and transparent as a basis for stakeholders to reach agreement on safe harvest quotas from unfragmented populations that comfortably exceed an 80-pair threshold.
6. Trapping on migration of juveniles marked while nest recording can estimate population sizes, for cross checking through modelling nest densities across breeding areas, and size trends.
7. By engaging stakeholders in breeding areas, as well as in the falconry-interest community, mark-recapture estimation of populations could build trust and cooperation for managing wild Sakers.
8. Survey in Saudi Arabia indicated that trappers and falcon-hospitals in the Gulf States are capable of providing data to model demography of Sakers and socio-economics of their use in falconry.
9. On this basis, we recommend engagement of the CMS Saker Falcon Task Force with falconers, falcon hospitals and trappers, as well as biologists to build networks of local land managers in breeding areas and governments plus international NGOs to support cooperative management.
10. We also recommend work on radios that can give reliable long-distance signals from pre-breeding Sakers, genetics to identify falcon origin areas, and ways to motivate and facilitate engagement of falconers and trappers in exchange of data and local knowledge.
11. We propose development of a portal in Arabic to attract trappers and falconers (by providing useful knowledge, sponsoring of birds marked in breeding areas, surveys and competitions), to promote the idea of not trapping adults in breeding areas, to host tools for monitoring populations and potentially also a system for regulating trade.

II. Introduction

The Saker Falcon (*Falcon cherrug*) is the world's second largest falcon, with breeding populations distributed across the breadth of Eurasia, with some migration to Africa for winter. Falcons have for many centuries been trapped sustainably for use in falconry, typically while on migration and with subsequent release of trained birds back to the wild at the end of the hunting season.

Breeding is mainly in steppe and semi-arid land, on cliffs in the south and in trees in northern areas, with some also on man-made structures and in artificial nests. In parts of its range with limited nesting opportunities and recent increased access for trappers, trapping of breeding adults has been associated with population declines. Healthy populations still occur in other parts of its range although there are concerns about electrocution on poorly designed power cables and secondary poisoning during control of rodent populations. As a result of these factors, as well as large scale anthropogenic changes in land use, Saker populations declined globally, leading to Red Listing of the species as threatened, and growing pressure for action through the Convention on the Conservation of Migratory Species (CMS 2003) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1979).

The Saker Falcon Task Force (STF) was formally established by CMS Resolution 10.28 adopted at the 10th Conference of the Parties (COP10) in November 2011. The STF aims to bring together Range States, Co-operating Partners and other interested parties to develop a coordinated Global Action Plan, including a management and monitoring system to conserve the species.

During 2012, four STF Working Groups were established to contribute to a 1st draft of the Saker Falcon Global Action Plan (SakerGAP) by July 2013, to inform a Stakeholders' Workshop in September 2013. One Working Group takes forward issues related to the sustainable use of the species, primarily for falconry. The issue of sustainable use may be a central element to the future conservation and management of the Saker Falcon. The Task Force is clear that any management plan for the species should be founded on an objective evidence base; including, where appropriate, information obtained from population modelling, using the best available data.
As well as population modelling to ensure that use is sustainable, fundamental principles for conservation through sustainable use follow from the Convention on Biological Diversity (CBD 1992), in which sustainable use is the second pillar and a focus of 13 substantive articles. Some relevant aspects of the convention were expanded in agreement by CBD parties on the Malawi Principles for the Ecosystem Approach (CBD 2004a) and the Addis Ababa Principles and Guidelines for Sustainable Use of Biodiversity (CBD 2004b). Relevant principles may be summarised as (CoE 2007):

- *Supportive and linked governance at all levels with harmonised regulations that promote societal benefits from conservation;*
- *Transparent and adaptive management based on interdisciplinary science, monitoring and timely feedbacks;*
- *Encouragement of economic/cultural incentives with sharing of benefits (and costs) especially at the local level;*
- *Education, awareness and inclusion of managers, resource users, and society at large.*

To apply these principles from CBD would require further conceptual modelling, and the linking of socio-economic models to the computations to predict development of Saker populations. With these considerations in mind, a tender to report on conservation modelling for the species was placed with European Sustainable Use Group to meet 5 objectives:

1. Review existing population data, models and modelling techniques, including specifically any models that have already been developed for discrete Saker Falcon populations.
2. Develop a series of related demographic models covering the range of Saker Falcon populations to create a modelling framework for the global Saker Falcon population.
3. Using the best available evidence, the modelling should:
    - Investigate the population dynamics of the Saker Falcon, including the effects of differing levels of productivity, recruitment and mortality.
    - Simulate the potential effects of harvesting from declining, stable as well as increasing Saker Falcon populations.
    - Investigate the effects of harvesting female and male specimens at different stages in their lifecycles, i.e. nestlings, fledglings, dispersing juveniles and adults, and breeding adults.
    - Identify parameters which impose critically important pressures and therefore require the highest levels of data quality.
4. Develop a socio economic model to elaborate sustainable use of the species for falconry purposes, which can be integrated with the population demographic modelling.
5. The results are presented as a series of options comprising electronic, textual and graphical outputs, outlining the level and nature of taking from the wild that could be sustained in the long-term and the key factors in the population dynamics of the species that might prove to be limiting factors in this regard.

III. A review of existing models and parameters for the Saker Falcon

In order to identify existing models and providing the most accurate input data for the recent model, a thorough review of literature was made. Population models and parameters for Saker Falcon were collected from the relevant – published and yet unpublished – articles and books, as well as from personal communication. Data cover most of the range from Central Europe to Mongolia. While there are some data from as early as the 1940s, most of them are from the end of the 20th and the beginning of 21st centuries.

III.1 Existing models for the Saker and other raptors

Although there are not many predictive population models for the Saker Falcon, models for other birds of prey species describing the dynamics of a given population and the importance of various factors determining the model's outputs can be found in the literature. The cited papers provide insights for our population modelling of the Saker Falcon, for carefully assessing the input data, as well as for evaluating and explaining the outcomes appropriately.

Data for population modelling can come from direct observations from regular counts of migratory populations (Farmer 2007) or monitoring the population of a certain geographic area (Sergio *et al.* 2011; Kauffman *et al.* 2004), they can be results of the classical capture-recapture method (Hiraldo *et al.* 1996) or if there is no other way to study a population of certain species in a given area, modern technologies like DNA sampling (Wink *et al.* 1999), as well as radio and satellite-tracking come into play to gather the necessary data (Kenward *et al.* 1988, 2007; Prommer *et al.* 2012). In the case of Sakers, in theory, all techniques except migration count data can be used (because relatively few migrating Sakers are counted); however there has been a tendency to prefer the latest technologies as they are more cost and time efficient.

Once the data are collected various mathematical methods are applied in order to conclude raw data. Although the methods are the same or very similar in many cases, conclusions in different articles may contradict depending on the species.

Sergio *et al.* (2011) argue that age-structured variation in multiple vital-rates (of survival and breeding parameters) is a fundamental determinant of population growth, with important implications for conservation management. However, for many long-lived vertebrates such as birds of prey, such variation has been usually examined in shorter-lived species. Their study on Black Kite (*Milvus migrans*) – a relatively long-living bird of prey – suggests that both survival and offspring production varies along the lifespan in conjunction with the sequence of major life history stages: they are lowest during the initial years of life, increase steeply during the period of progressive incorporation of non-breeders into the breeding sector of the population (age 2–6), level off between 7 and 11 years of life, decline with senescence after age 12, and increase again for the few high-quality individuals capable of reaching age 18–25. This pattern is more gradual, asymmetrical and protracted than in shorter-lived species. Matrix modelling estimates a stationary growth rate, which was more sensitive to changes in survival in early life rather than to survival in adult life, contrary to expectations for long-lived species. The results highlight: (1) a growing appreciation of the importance of juvenile survival for population dynamics, (2) the need for caution on the generalization that population-trends of long-lived species are primarily determined by adult survival, and (3) that the trajectory of the breeding populations of migratory

species may be determined by environmental variation experienced in early life in staging areas located far away from breeding areas.

Unlike Sergio *et al.*, working on the shorter-lived Lesser Kestrel (*Falco naumanni*), Hiraldo *et al.* (1996) found that population growth was most sensitive for changes in adult survival, followed by juvenile survival, productivity of fledglings, proportion of adults that attempt breeding and age at first breeding. More interestingly, Katzner *et al.* (2006) confirm that finding, based on results of their study of the Eastern Imperial Eagle (*Aquila heliaca*), which is a longer-lived species, similar to Black Kite. They used novel sensitivity analysis of stochastic simulation models to analyse the demography of the world's highest-density and longest-studied population of Eastern Imperial Eagles, at the Naurzum National Nature Reserve in Kazakhstan. Single variable perturbation (a simple elasticity-type analysis) showed that population growth was most sensitive to changes in adult survival, but provided no information on how interactions between parameters may influence population growth. Multiple-variable perturbations (a more comprehensive elasticity-type analysis) suggested that population growth is relatively more sensitive to adult survival than is indicated by single-variable perturbation but also that when adult survival is within a biologically reasonable range, other parameters are still highly consequential to model outputs. This finding suggests that also for other structured populations of vertebrates, effective conservation and management likely requires an approach that addresses the importance of simultaneous variation in multiple vital rates including both survivorship and reproductive output.

Factors like available safe nests can also have significant impact on population dynamics of some raptor species, including Saker Falcons. Natural nests – mostly built by corvids – may not last until the end of the nestling period and their collapse often leads to breeding failure. During 1980-2002, 14% of all breeding attempts in Hungary (n=1065) failed due to collapse of natural nests. If we project that number only to breeding attempts in natural nests, during a period with a majority of breeding attempts already in artificial nests, that ratio is considerably higher. The long-run Saker conservation project in Hungary showed that the provision of artificial nests was a very efficient way to increase the number of successfully breeding Saker pairs, in areas where prey was abundant (Bagyura *et al.* 2004). Population modelling supports that observation. As a 2005 Vortex model for the International Action Plan for the Saker Falcon (based on the Hungarian Saker population data) suggests, providing safe artificial nests as an alternative to vulnerable natural nests, can contribute to successful breeding and effectively compensate for higher adult and juvenile mortality, thus supporting the increase of the population (Nagy, unpubl.).

Kenward *et al.* (2007) noted the importance of removing adults from raptor populations, when they studied the impact of harvesting in three species including Saker. They used age-specific survival and breeding data to parameterize a demographic model for a harvested Kazakh Saker Falcon population by radio tagging juveniles and estimating adult turnover with DNA-fingerprinting during 1993–1997. Similar data had been gathered during 1980–1998 to model the Northern Goshawk (*Accipiter gentilis*) in Sweden (Kenward *et al.* 1991, 1999) and during 1990–1998 for a model of the Common Buzzard (*Buteo buteo*) in Britain (Kenward *et al.* 2000). Leg-bands and implanted microtransponders provided ways to test for bias and to estimate the harvest of Sakers for falconry. Despite an estimated minimum first-year survival of only 23%, the observed productivity of 3.14 young per clutch would sustain a saker population with a breeding rate (at laying) of only 0.63 for adults or with a residual juvenile yield of 37%, if all adults breed. Higher first-year survival rates for goshawks and buzzards correlated with juvenile yields of up to 71%, but no more than half as many individuals, if adults also were harvested. According to their model, an annual population decline of 40% for Sakers in southern Kazakhstan could be

explained by observed productivity of only 0.71 young per clutch, if there was also an estimated harvest of 55% of adults. Their study also suggests that demographic models can be built rapidly if nestlings are fitted with reliable and safe radio-tags and adult turnover is estimated from genetic analyses or other techniques.

Other models have studied the impacts of harvest. Saker population models in the feasibility study for Saker's re-introduction to Bulgaria (Ragyov *et al.* 2009) showed that harvesting juveniles at a safe rate from an increasing donor population (for reintroduction in Bulgaria) does not have a strong impact on population size and dynamics. However, it is not the same for a decreasing population with a growth rate below zero when low juvenile survival rate and a small number of offspring per breeding pair have been assumed. In those cases, harvesting could cause further decrease in population size. As for the recipient population, after testing several scenarios with different estimations of survival and breeding success parameters, positive population growth were observed in all cases, which indicates the establishment of a viable population and, therefore, a successful reintroduction. The rather optimistic model predicts that ten years after initiating the reintroduction project (involving the release of ten male and ten female juveniles each year for five years), an increasing breeding population will be established with a population of between eight to fifteen breeding pairs. Survival rate for juveniles and adults are estimated at least to 30% and 80% respectively. First breeding is expected in the third year after the first cohort was released.

Millsap *et al.* (2006) studied the impact of harvesting for falconry on some North American raptor species' populations. They used population data and a deterministic matrix model that accounted for important aspects of raptor population biology to evaluate the likely impact of falconry harvest (including take of different age classes) on wild raptor populations in the United States. The harvest rate at maximum sustainable yield (MSY) ranged from 3% to 41% for the species examined. At least for Peregrine Falcons (*Falco peregrinus*), harvest rate at MSY was greatest for nestlings and lowest for adults. One important conclusion of the study is that the quality of demographic data for the species influenced MSY. They argue that in case of most species the state of current knowledge probably underestimates the capacity for allowed harvest because estimates of vital rates, particularly survival, are biased low, because emigration is not distinguished from survival. This is offset somewhat by biases that might overestimate sustainability inherent in MSY-based analyses and deterministic models. Taking these factors into consideration and recognizing the impracticality of monitoring raptor populations to determine actual effects of harvest, they recommend that falconry harvest rates for juvenile raptors in the United States not exceed one-half of the estimated MSY up to a maximum of 5%, depending on species-specific estimates of capacity to sustain harvest. Under this guideline, harvest rates of up to 5% of annual production are supported for Northern Goshawks, Harris's Hawks (*Parabuteo unicinctus*), Peregrine Falcons, and Golden Eagles (*Aquila chrysaetos*); lower harvest rates were recommended for other species until better estimates of vital rates confirm greater harvest potential.

Clearly, it is not only harvest that removes individuals from populations. Mortality caused by illegal killing can have significant impact as well, that can considerably slow down ongoing population recovery processes, as Smart *et al.* (2010) suggest. Red Kites (*Milvus milvus*) have been re-introduced to England and Scotland, following extinction due to widespread human persecution during the 19th century. Considerable regional variation in population growth exists. Productivity in north Scotland was high compared to other Scottish and Welsh populations and equal to English populations with high population growth rates. In north Scotland, annual survival of wild-fledged birds was low for first-year birds compared to other Scottish populations and second-year survival declined over time. In north Scotland, 40% of 103 Red Kites found dead were killed illegally, mainly by direct poisoning. In the

absence of illegal killing, they estimate that annual survival rates in wild red kites might increase from 0.37 to 0.54, 0.72 to 0.78 and 0.87 to 0.92 for first, second-year and adult birds respectively. Models in which the additive illegal killing mortality is excluded, predict a population trajectory and size very similar to that found in the Chilterns, a rapidly growing population in south-east England re-introduced at the same time, but where rates of illegal killing are much lower. They concluded that illegal killing of Red Kites is the cause of poor population growth in north Scotland.

Similarly to the study above, there are studies suggesting that regional differences even within a relatively small area in populations must be strongly considered. This is certainly true also for the Saker Falcon, which has an enormous geographic distribution.

Kauffman *et al.* (2004) found that the recovery of the Peregrine Falcon (*Falco peregrinus anatum*) in California has taken place amid strong geographical differences in habitat quality, potentially creating a sink population in the southern coastal habitat and source populations in the northern interior and urban habitats. They analyzed long-term monitoring data to investigate the mechanisms and consequences of spatial structuring for the recovery of this set of non-stable subpopulations. Dispersal rates between habitats were asymmetric, with extremely limited dispersal out of the interior habitat and a strong tendency for birds in the southern coast to disperse to the urban habitats. They used dispersal estimates and habitat-specific productivity rates to build a set of regional population models that describe population growth within and dispersal between each subpopulation. They tested for the existence of habitat-specific survival and territory acquisition rates by comparing model projections with the number of breeding pairs counted annually in each subpopulation. Analyses indicated a high rate of survival for interior birds and suggested that both the interior and urban subpopulations were regulated by territory availability over the study period. The inherent spatial structure of this regional peregrine falcon population has had a considerable influence on its recovery and management

One of the first steps to build such spatially specific models is to understand the factors determining distribution. This was done for the Hungarian Saker population by Fehérvári *et al.* (2010). They collected the data of all active territories during 2007-2010 to serve as the countrywide distribution pattern on a 10x10 Universal Transverse Mercator (UTM) grid scale. To explain this pattern they used landscape variables (Corine Landcover database, OTAB), and estimated densities of potential prey species deriving from the Common Bird Census database, or other records for mammals. They used a multi-level and multi-scale approach to data analyses. Initially they reduced the number of potential explanatory variables with an ensemble classifier (random forest algorithm). As a second step they constructed Conditional Autoregressive (CAR) models in a Bayesian framework with the pre-selected variables. Bayesian CAR models give robust estimates on the global effects of explanatory variables on the probability of Saker territory presence in a given grid cell; however, they lack the power to reveal local deviances. In order to correct that they built Generalized Geographically Weighted Regressions (GGWR) to estimate the scale of local effects of the same variables. The results indicated that Sakers avoid UTM cells with high ratio of forests, but prefer areas with large open areas of large arable fields and grasslands. Surprisingly, the association of estimated densities of Skylarks (*Alauda arvensis*) and Kestrels had high overall explanatory powers. The large spatial scale of the analyses suggests that these associated variables may reflect both the openness and overall good biodiversity state of these areas.

A geographical model of the population based on data from satellite tracking of more than a dozen breeding adult males and females, and on the available proper habitat and prey items in a specific geographical region (Pannonian basin) is under construction in the frame of LIFE NAT/HU/000384 project. That model will be able to help refining regional population models (Prommer, pers. comm.).

III.2 Data for recent and current Saker population modelling

There are extensive data from studies of Saker Falcons nesting at sites across Eurasia. These are listed in Annex I and summarised in Table 1. The most consistent data are on brood sizes from successful nests, since these were available from occasional and sporadic observations during brood rearing. However, there are also data from regular monitoring programmes in which nests were visited during incubation so that the nest success, from laying to fledging, could also be estimated and hence the total productivity of young per clutch (using the conventions of Newton 1979). Some data sets represent information for a whole country, while others cover only regions. In some cases data were deficient, but missing details could be calculated (as shown between brackets in the table). Annex I also includes sources of information and links to the websites representing the data.

Hungary provided the longest and most detailed data set (from between 1980 and 2012), however, it relates to a relatively small part of the global population. At the same time, it neatly represents a recovery process from the population minimum to about the carrying capacity of the study area.

Sample size for the Mongolian data set is higher, but the studied time period is considerably shorter than in case of Hungary, while data from Russia cover a longer time period, but with a smaller sample size. Another important source of data is Kazakhstan, especially the eastern part of the country, where eight years of annual monitoring resulted in a good set of data and there are other data sets from other part of the country, as well as sporadic data from the mid-20th century. There are data sets from a number of other countries; however those cover shorter time period and/or have significantly lower sample sizes. Nevertheless, they are also considered for modelling.

Table 8 Average brood size, nest success and productivity in studies of Saker Falcons. The data are presented fully in Annex I.

Europe	**Years**	**Nests**	**Average brood size** (nestlings/ fledged brood)	**Nest success** (proportion of clutches that fledged young)	**Productivity** (nestlings per clutch)
BULGARIA	?	7	2.00		
CZECH	1976-2010	345	3.23	0.72	2.31
HUNGARY	1982-2012	2819	3.02	0.67	2.02
ROMANIA	2013	3	2.00	0.67	
SERBIA	1986,1994,2004	21	2.33		
SLOVAKIA	1976-2010	345	3.23	0.72	2.31
UKRAINE	1986-2004	22	2.33	0.41	
MEAN VALUES			2.59	0.64	2.21
C. Asia					
KAZAKHSTAN	1993-1996	63	3.59	0.86	3.08
MONGOLIA	2002-2006	330	3.70		
MONGOLIA grids	2005-2010	69	3.55	0.84	2.99
MEAN VALUES			**3.61**	**0.85**	**3.04**
RUSSIA (Altai)	1999-2011	436	2.67	0.71	1.90

Summarising, the extensive data on breeding, productivity in Europe and Asia appear to differ. The average sizes of successful broods did not exceed 3.25 in 7 European countries, while in Central Asia the average in 3 studies was above 3.5. Similarly, the proportion of nests with eggs that fledged at least one did not exceed 72% in Europe and was more than 80% in Central Asia. Russian (Altai) data were reduced appreciably by trapping of breeding adults and were therefore excluded from the estimates. Although nest success can be overestimated if many are found late (e.g. through single-visit surveys to mark young), brood sizes are straightforward to record.

III.3 Survival data from satellite tracking and population growth records

New survival data are available from 42 satellite-tracked individuals tagged as juveniles between 2007 and 2010 in Hungary and Slovakia (Prommer *et al.* 2012). In many cases when the satellite-received transmitters stopped, it was impossible to discern whether the tag had failed on a living bird, or ceased to transmit because its solar cells or antenna were covered when a bird died, or perhaps was destroyed when a bird was deliberately killed or captured. In these cases it was assumed that all birds had died, to estimate minimum survival rates of birds still moving and transmitting at a particular age, as is normal practice to obtain conservative survival estimates from radio-tagging (Kenward 2001: 238). Birds found dead with tags transmitting provided some information on causes of mortality. More juveniles have been tagged and tracked since 2010, in Hungary, Slovakia, Romania, Ukraine and Serbia, however those data have not yet been analysed, therefore those data are not considered here.

As it has been very difficult to calculate reliable survival rate to adulthood (first breeding) and rates from satellite-tracking appeared to be low, another approach was applied. Analysing the population data of the Hungarian pairs, correlation analysis shows strong correlation between a given year's juvenile cohort and the number of newly established pairs three years later, especially for the decade during which numbers increased from 30 to 80 pairs at natural sites. That suggests that most Sakers in Hungary during that period were starting to breed by age 3. Knowing the number of juveniles in the given year and the number of new pairs three years later, an estimation could be done for the survival rate until breeding age. Differences between sexes were ignored due to lack of detailed data, and this calculation could not consider

(1) immigration from other countries (although it is probably negligible);

(2) emigration from the study population (it may add 1-2% at least, but no accurate data exist);

(3) the number of non-breeding adults, which may be considerable (see later).

Although this analysis indicated majority first breeding at age three, in the first decade the strongest correlations had a two-year interval. Moreover, three of 16 pairs in a depressed southern Kazakh population had females at 9 months post-fledging, i.e. in first year plumage (Kenward *et al.* 2007). We therefore modelled first breeding at 21 months post-fledging.

III.4 Recent and current Saker population modelling

Recent modelling includes work for an action plan on the species in Europe (Nagy & Demeter 2006), in which population targets were set with the Vortex modelling suite (Lacy & Pollak 2013) that predicts population viability. Similar modelling was done within the LIFE+ project on Sakers in Hungary (MME & RPS 2010), and to estimate the growth in Saker production in Mongolia resulting from construction of artificial nests (Dixon *et al.* 2011). Vortex adds stochasticity (chance) to the matrix modelling used in other projects.

The principle of matrix-modelling is that the number of animals in age class x is the number produced x years ago multiplied by the product of survival rates (s) for each preceding age class. In year j, the number of adults in age class x (n_{xj}), of which an age-specific proportion (b_x) breed with a productivity of (y_x) young per pair, produces $\Sigma n_{xj}.b_x.y_x$ young. The total number of young produced that year is then the sum across all age classes from the first breeding year to the greatest breeding age ($\Sigma n_x.b_x.y_x$), from which cohort the total of surviving adults in each successive year can in turn be estimated. Partitioning the attrition rate (a) for each age class into k attrition classes (e.g. harvest, electrocution, natural) enables modelling of s as $1-\Sigma a_k$ if attrition rates are additive.

The process in Vortex is in principle the same, except that terms are added to investigate the sensitivity of variables, and small populations, to stochastic events. The effects of changing productivity and attrition rates can be investigated, separately for each sex, in matrix models first, and then evaluated for small populations with Vortex. It is preferable to examine these preliminary "what-if" questions first in a deterministic spreadsheet-based matrix model, not least because such a model is transparent to audit of the estimation processes.

IV. Modelling Saker Falcon populations across their Eurasian distribution

IV.1 The International Association for Falconry and Conservation of Birds of Prey model

Parameters in the previous section were used to populate a matrix model developed by Janusz Sielicki for the International Association for Falconry and Conservation of Birds of Prey (IAF). The model is similar to the "age and sex-specific survival and breeding" matrix models used by Millsap & Allen (2006) and Kenward *et al.* (1991, 2007) to predict sustainable yields for falconry from raptor populations. The advantage of the IAF model is its Microsoft Excel format, which can be used reasonably easily and transparently to investigate effects of harvest, pollutants and other additional mortality factors, as well as to investigate populate decline and growth, including changes in breeding rates during growth until breeding sites become saturated. The functioning of the model was checked mathematically, and then through its ability to produce the same results as in these models.

The principle of all these matrix models is to estimate survival in each year to the point at which adults in the population lay eggs, and then apply the observed productivity of young per clutch laid (i.e. nest success x brood size) to those birds that lay. This means that survival is estimated for the first nine-months after fledging, and subsequently for 12-month intervals. The model applies an age of first breeding and then applies to each older age class a similar proportion of adults breeding (the breeding rate). The breeding rate may not be the same for all age classes: it is quite possible that few or none will breed in the youngest age classes, and most will breed when older, producing an average for all adults of the predicted value. In buzzards, for example, only 14% bred at age 2 in a stable population but 40% in a population rebuilding with released birds (Walls *et al.* 2004).

For the first scenarios modelled, the approach was to estimate the breeding rate for population stability, i.e. neither increase for decrease. The lower the proportion of adults which need to breed to replace mortality, for a given productivity, the greater is the resilience of the population to perturbations. In the absence of evidence that survival differs between sexes, equal numbers of males and females were assumed for each age class.

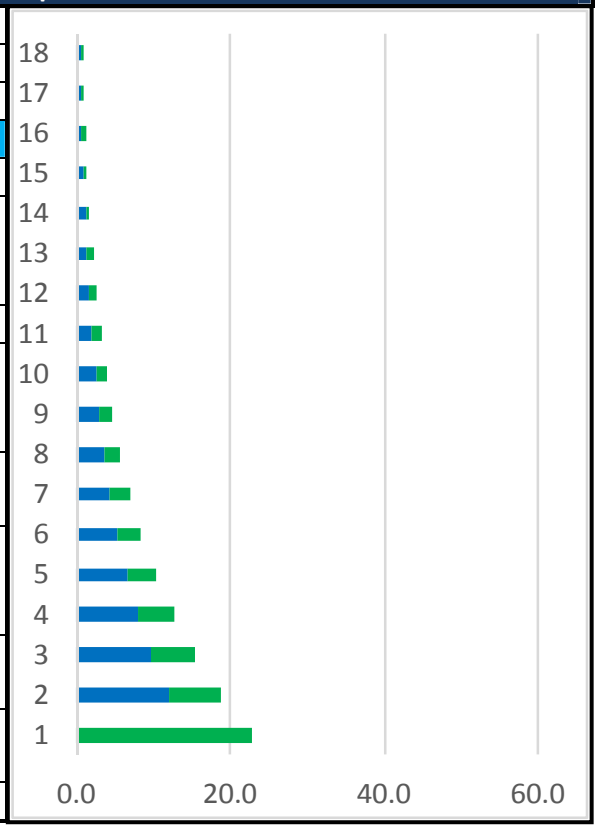
The IAF model was tested using Saker data from Northern Kazakhstan, where daily listening from a tower for VHF signals from 61 falcons tagged at fledging recorded the return of only 14 (23%) in their

following or second breeding season. Adult turnover, estimated by DNA from young in the same nest sites sampled at 1-3 year intervals (Wink *et al.* 2003), gave annual adult survival of 82%, which was used for all older years. Even with such a low rate for survival to 9 months, the high productivity of 3.1 young produced a stable population with just 64% of adults expected to be breeding in the IAF model (Table 1), as in Kenward *et al.* (2007).

The model was also tested by comparison with Vortex, using population sizes of more than 150 breeding pairs. Vortex uses similar age-specific survival and breeding rates as a deterministic matrix-based model of the IAF type, but can also vary breeding and survival parameters stochastically (at random) in order to investigate the risks of extinction in small populations from annual variations. Large Saker populations with parameters used in the IAF models persisted at the same average level. To avoid assumptions of stochasticity (which may in reality be offset by density-dependent effects not accommodated in Vortex), the IAF model was used to assess effects of variation in productivity, survival and harvest, and Vortex then used to investigate how large populations might need to be to avoid risk of extinction from stochastic events. Although the IAF model was set for stability in the following 3 tables of analyses, by allowing either breeding or harvest rates to reach equilibrium, it can also be used to simulate population growth, decline, or maximum harvest under conditions of limitation by breeding sites or additive impacts on mortality and/or survival.

Table 9 The IAF model can be used to predict breeding rates for stability at given age-specific survival and breeding parameters, or to show how populations develop with breeding-site limitation and changes based on additive impacts on survival and mortality. In this case the low juvenile survival is offset by high subsequent survival and productivity to that the population is stable with few of 100 fledglings surviving in each age class (on the right), and only 64% of adults breeding (blue) from all survivors (green) in their second year onward.

Original Kazakhstan parameters	
survival rate to 9 months	23%
survival rate 10-21 months	82%
survival rate 3+ year	82%
expected breeding rate for single adult	64%
young produced per pair that lay eggs	3.10
adjustment for proportion of each sex that breeds if survival differs between sexes (=0.5 for equality)	0.5
maximum capacity of breeding pairs	unused
negative impacts (additive mortality factors) for 1st year birds from (e.g. electrocution)	0% (i.e. no impacts)
additive positive impact on 1st year birds (e.g. feeding, protecting nests)	0% (none)
negative impacts (additive mortality factors) for older birds from (e.g. electrocution)	0% (none)
additive positive impact on older birds (e.g. feeding, protecting nests)	0% (none)
probability of harvested bird returning to wild to breed	0% (none)
harvest rate of juveniles	0%



The principles behind such modelling are simple. From 100 birds fledged, 77 die in their first year and 23 enter their second year; of the 23, there are 4 (18% of 23) that die in the next year and 19 that survive to the next breeding season, then 3 (18% of 19) with 16 survivors, and so on. If that continues for 18 years, a total of 100 birds have died. In a stable population, where that continues year after year, there are also 23+19+16+ ... (to 18 years) of birds in this population, a total 122 birds. Of those 122 birds which breed from their second year, 19+16+... (totalling 99) are deemed breeders. Those 99 breeders are producing 100 young with 3.1 young per pair, so there are 32 pairs, involving 64 birds, and only 65% of the adult population is breeding. If they were deemed only to breed from their third year of life, there would be 80 “breeders”, and 81% would be breeding. In fact, what happens in a healthy stable population is that age of first breeding advances and fewer young birds breed.

IV.2 Modelling with new parameters

However, improved survival data were used for further modelling. Of 42 Hungarian Sakers that wore tags for tracking by satellite (Prommer *et al.* 2012), 15 (36%) were known to survive 9 months (Prommer unpublished). Of the 15, only 6 had returned to their natal area, which indicated that estimates based on philopatry in Kazakhstan could have been substantially low: overall survival might have been more than double the 23% recorded in Kazakhstan. This was also likely because some radio tags used in Kazakhstan, and for tracking by satellite, may have failed or themselves contributed to deaths of long-distance migrants. However, the 36% survival gives a conservative estimate for the first 9 months (Box 1).

Box 1. Survival of juvenile and sub-adult Sakers

Returns of VHF-tagged Sakers were 23% at Naurzum from VHF radio-tagging; however, Hungarian PTT work gave only 40% philopatry of survivors, so this could represent 58% survival for Naurzum.
Hungarian PTT work gave 36% minimal survival to 9 months, but the attrition includes tag impacts, tag failures and trapping for falconry and is therefore a conservative survival estimate.
Only 15 Hungarian satellite-tagged birds were transmitting at 9 months, so interpolated survival is used for months 9-21 and a severe knowledge gap noted among the general data gap for survival.
Hungarian ringing data gave 55% survival to 9 months (46% to 1 year), and by analogy with other comparisons of ringing and radio-tag data may also be low because ring recoveries overestimate early deaths (Kenward *et al.* 2000); more ringing and better analyses of the data are needed too.

Too few data were available from both VHF tagging in Kazakhstan and the tracking by satellite in Europe to estimate survival from 9-23 months: however, when adequate data are available, raptor second year survival tends to be appreciably higher than survival to 9 months but somewhat less than for adults (Kenward *et al.* 2007). The original adult turnover estimate from Kazakhstan was revised to account for the possibility of double partner changes during two year recording intervals, and gave an estimate of 80% for breeding adults (Box B). Although Dixon (pers comm.) re-sighted only 7 survivors from 12 wing-tagged adults (58%), this is a small sample and trapped adults tend to be poorer birds. Moreover, adult survival of large falcons generally exceeds 80% (Cade 1988). Initial model scenarios therefore used survival of 36% for the first 9 months, 80% for adults and a value of 58% interpolated for sub-adults. Maximum breeding age was set at 18 years.

Box 2. Survival of adult Sakers

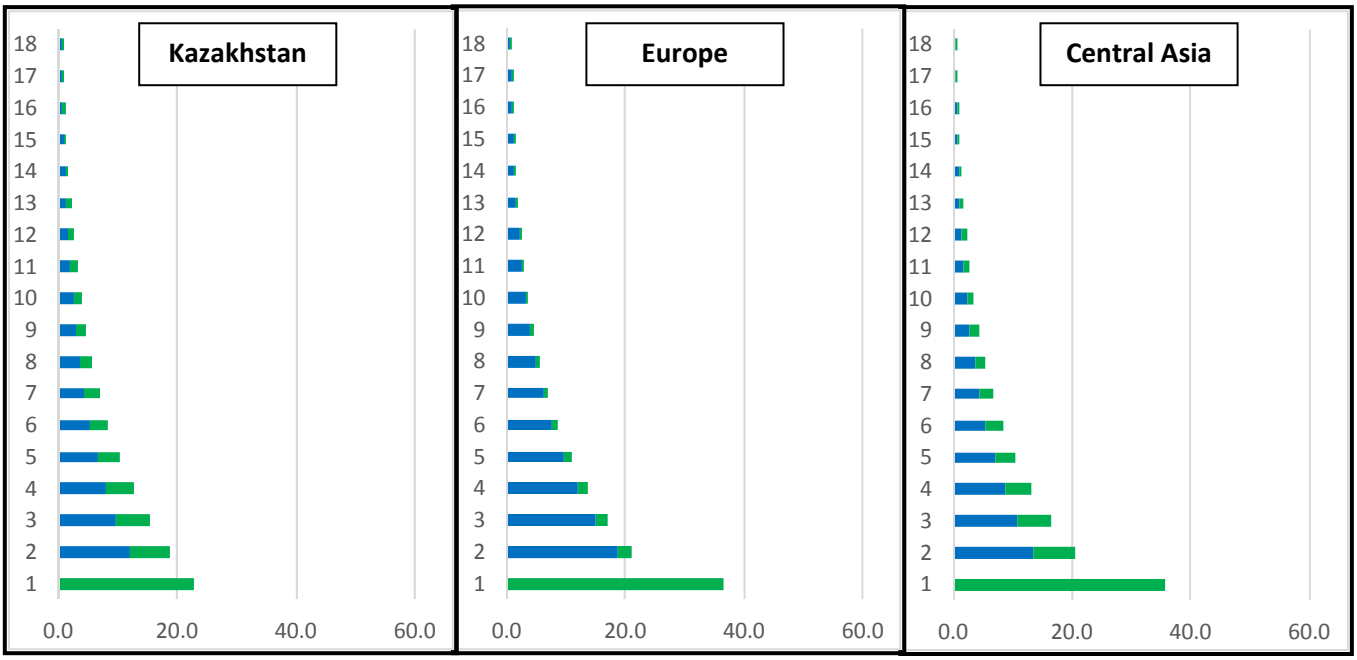
During 10 single-year intervals for 1993-1997 at Naurzum, Kazakhstan, turnover was 4 birds in 20 falcon-years (i.e. 20 birds across consecutive breeding years), giving 20% turnover and 80% survival.
There were also 3 double-year intervals; with a single turnover in 2 of them and 20% chance of two turnovers, this gives 2.4 turnovers in 12 falcon-years, again 80%.
Similarly, there were 4 three-year intervals, with two-bird turnovers in 2 of them, representing 4 definite and 0.8 further possible losses in 24 falcon years or again 80% survival.
Effectively, there were 10 observed and 1.2 estimated turnovers in 56 falcon-years, or 20% adult turnover, but this will be low because some birds may have changed partner without dying.
Thus the most reasonable survival estimate for 34 adult falcons is probably 80%, which is at the low end of many ringing studies of raptors with 1-2 kg body-mass and may therefore be conservative.

These survival data were used together with two productivity scenarios, because productivity in Europe and Asia appear to differ (Table 1). Brood size from three multi-decade studies in Europe averaged 3.1 chicks and 72% nest success, giving productivity of 2.2 chicks/pair. In Central Asia, broods can average 3.6, with 85% success, which suggests productivity above 3 chicks/pair in good conditions. Modelling was therefore based on 3 chicks/pair for Asia and 2.2 chicks/pair for Europe.

With survival rates of 36%, 58% and 80% in consecutive life-stages, this European scenario was stable only if 89% of adults were breeding from their second year of life in Europe (Table 3, column 3); a relative absence of resilience to factors reducing survival or productivity is indicated by a low proportion of non-breeders (in green) after the first year. However, productivity of 3 young per clutch, averaged across Asia, gave a stable scenario with breeding expected by 65% of adults (Table 3, column 4); the green portion of the estimated numbers for each age category shows the resilience.

Table 10 As in Table 2, breeding rates for stability are estimated for productivities observed in Europe and Asia. Parameters not used in further analyses are not shown. The non-breeding proportion of each year class, shown with green bars, indicates low resilience in Europe.

	Original Kazakhstan data	Europe (conservative survival)	Asia (conservative survival)
survival rate to 9 months	23%	36%	36%
survival rate 10-21 months	82%	58%	58%
survival rate 3+ year	82%	80%	80%
expected breeding rate for single adult	**64%**	**89%**	**65%**
young produced per pair that lay eggs	3.10	2.20	3.00
harvest rate of juveniles	0%	0%	0%



IV.3 Testing resilience to random and consistent changes

Higher productivity gives the Asian scenario greater resilience, as shown in two ways. Vortex has the ability to vary parameters stochastically (at random) in order to investigate the risks of extinction from annual variations, and this capability was used to investigate the population sizes that would be needed to avoid risk of extinction from stochastic events. We used the variability applied in previous modelling of Saker Falcons (Nagy & Demeter 2006). Although the Vortex model operates stochastic rules that are considered realistic, it takes no account of density dependent feedback effects that may compensate with increased survival or productivity at low population levels. It therefore over-estimates risk of extinction from chance events and provides a precautionary approach for modelling "safe" population sizes. Vortex modelling suggested that a compact Asian Saker population could be considered safe at 200 birds, equivalent to a compact (non-fragmented) breeding population of at least 50 pairs, while a European population would need 325 birds (at least 80 pairs) for the extinction risk to become negligible

(Figure 1), because of the lower productivity. There is also a need to consider how large fragmented populations need to be to withstand harvest at the same level as more cohesive populations, such as have re-established in Europe.

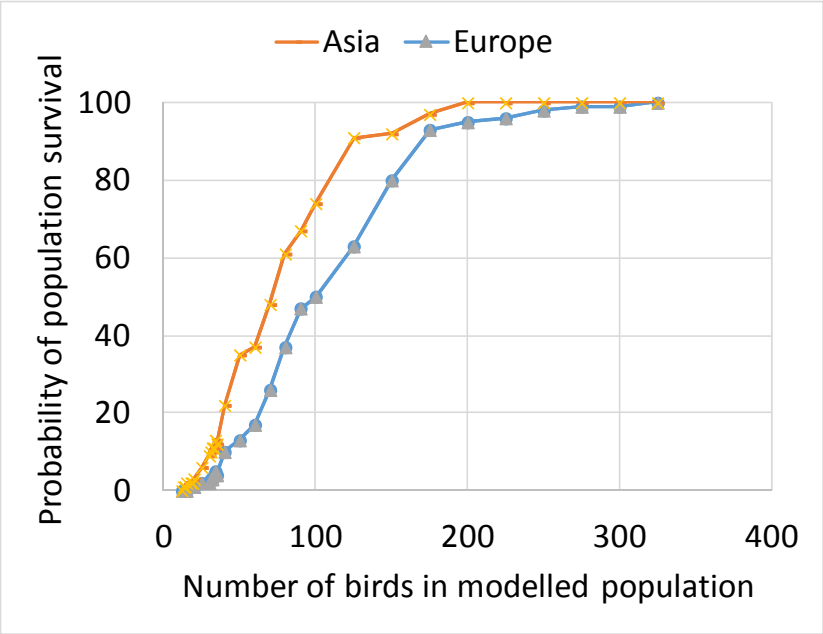


Figure 4 The population sizes that Vortex models estimate to persist with the survival and breeding parameters shown in Table 3; the Asian populations would be stable at 200 birds, but 325 would be needed in Europe.

The relatively high resilience of the Asian scenario was further tested by varying the survival rates and applying harvest pressures in the deterministic matrix model. With the conservative survival rates, the Asian population could sustain a 22% harvest of juveniles with 85% of adults breeding (Table 4, column 2). This is the breeding rate considered practical in other raptor yield models (Kenward *et al.* 2007).

Table 11 Effects on maximum sustainable harvest, with 85% of adults breeding, of varying the basic survival rates. With the basic survival (36%, 58%, 80%) and productivity (3 young/pair) scenario in Asia, the maximum harvest sustainable with 85% breeding would be 22% (column 2). See text for other scenarios. Yellow shading shows when parameters were changed, green shows harvest sustainable at constant breeding rates of 84-85%.

	Asian productivity, conservative survival						
Column 1. (the text below explains the contents of columns 3-8 in more detail)	2. basic survival	3. adult survival up 3%	4. adult survival 3% less	5. mo 9-21 survival up 9%	6. mo 9-21 survival 7% less	*7.* mo 0-9 survival up 6%	*8.* mo 0-9 survival 5% less
survival rate to 9 months	36%	36%	36%	36%	36%	*42%*	*31%*
survival rate 10-21 months	58%	58%	58%	*67%*	*51%*	58%	58%
survival rate 3+ year	80%	*83%*	*77%*	80%	80%	80%	80%
breeding rate for single adult	*85%*	*85%*	*85%*	*84%*	*84%*	*84%*	*84%*
young produced per pair that lay eggs	3.00	3.00	3.00	3.00	3.00	3.00	3.00
maximum harvest rate of juveniles	**22%**	**33%**	**11%**	**33%**	**11%**	**33%**	**10%**

The effect on possible harvest of changes in survival rates is also examined in Table 4. A three percent addition to adult survival, from 80% to 83%, enables a 50% increase in harvest to 33% of young at an 85% breeding rate (column 3), whereas a decrease in adult survival of 3% halves the estimate for sustainable harvest (column 4). Greater changes in survival of juveniles (columns 7-8), and especially of sub-adults (columns 5-6) are needed for the same changes in sustainable harvest in juveniles. Accuracy of estimation of adult survival is clearly very important for this modelling, with estimates for second-year birds allowing the greatest leeway. A further conclusion, also noted in Kenward *et al.* (2007) is that added losses of adults, whether through trapping , electrocution or other factor, is a much more severe threat to Sakers than harvest of juveniles. In effect, it is drawing on capital rather than interest.

The effect of disproportionate removal of one particular sex, such as females because this larger sex is better able to subdue large prey, was not investigated specifically. This is because, in the absence of any compensatory effect of removal (for which there is no evidence) or of polygamy, dynamics should be modelled for the least abundant sex will be limiting for the whole population and merely be offset by differential breeding rates between the sexes. This occurred due to reduced survival of juvenile male goshawks in an area with abundant rabbits, which are easier prey for females to subdue, and resulted in a higher breeding rate for surviving males than for females (Kenward *et al.* 1999).

However, the potential for harvest from healthy Saker populations is probably higher than indicated in Table 4. Hungary also provides evidence of two types that 36% and 58% underestimated the survival of Sakers prior to breeding. Among 65 ring recoveries from Sakers found dead or injured, 25 (45%) were in the first 9 months, indicating a survival of 55% (Table 5). Even this estimate would be conservative, because many ringed adults would not have had time to die by the end of the project. However, it could also be inaccurate due to small sample size effects, and there is also the possibility that ring recovery rates are biased downwards by many first year birds dying outside Hungary. Therefore a final plausible modelling scenario used 50% survival for the first 9 months, with 80% adult survival and 65% interpolated for months 9-21. Another reason for considering these sub-adult survival rates more plausible is that they estimate 26% of adults alive to breed in their third year. Sakers in Hungary were observed generally to start breeding at that age and, in the decade when numbers were increasing from 31 to 82 pairs (before a lower rate of recruitment as natural sites became heavily occupied and artificial sites were introduced) the increase rate would have recruited 23% of 3-year-olds as breeders (Prommer, pers. comm.). This is much closer to 26% than to the 16% (0.36*0.58*0.80) estimate from conservative data.

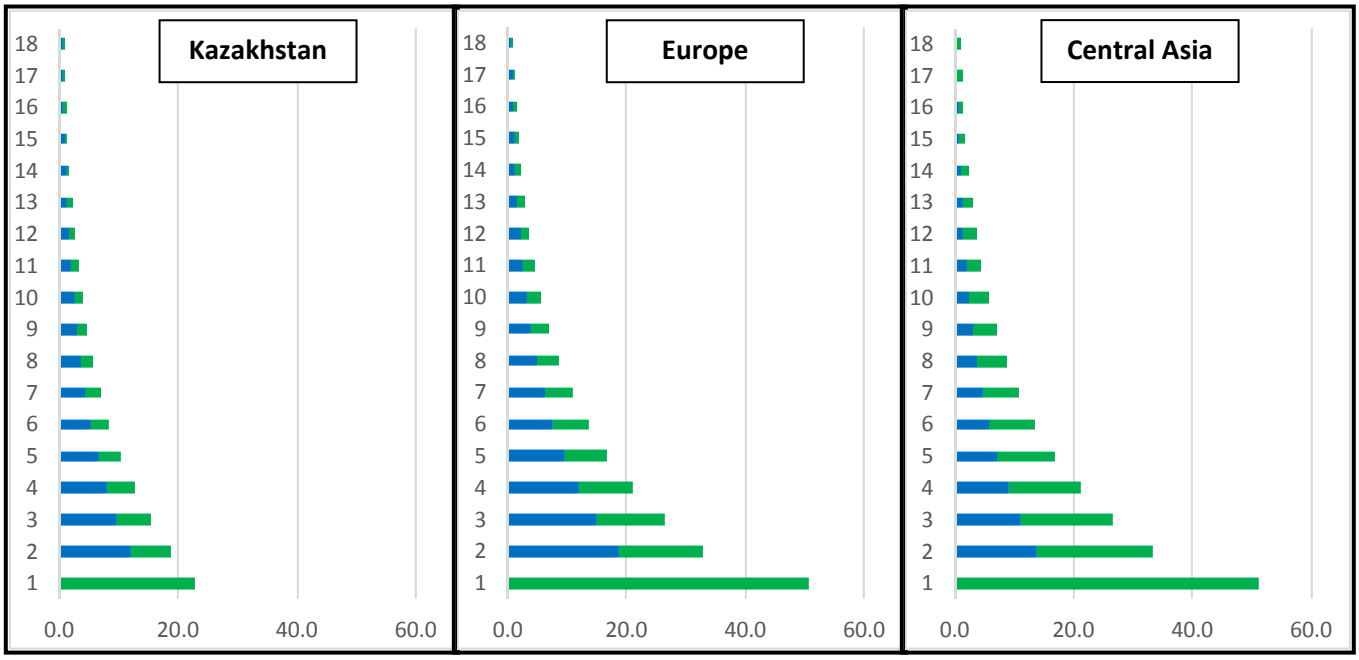
Table 12 Estimates of survival during the first 9 and 12 months of life from ringing of nestling Saker Falcons in Hungary during 1951-2013 (data kindly provided by Birdlife Hungary).

	Dead	Injured (later dead or not known)	Injured (later released)	Dead + injured
up to 9 months	21	8	0	29
between 9 and 12 months	6	0	0	6
beyond 12 months	20	6	4	30
Total	47	14	4	65
Survived 9 months	55%	56%		55%
Survived 1 year	43%	56%		46%

On this basis, it can be estimated that Saker populations in Europe and Asia would be stable with only 58% and 42% of adults breeding (Table 6). These rates resemble male and female goshawks; a stable buzzard population in southern Britain had only 30% of adults laying. At an adult breeding rate of 85%, harvest rates of juveniles from such populations could be 32% with European productivity of 2.2 young per clutch and 50% for Asian productivity of 3.0. If these survival parameters apply, then the Saker populations studied in Europe and northern Kazakhstan were showing excellent resilience to harvest and other perturbations.

Table 13 The survival rates are increased from those in Tables 2-4 to accommodate the new estimate for juveniles from ringing in Hungary (in Table 5). The bar graphs show not only far more survivors from 100 birds fledged than in the original Kazakh scenario (left), but greater resilience at stability due to more non-breeding adults.

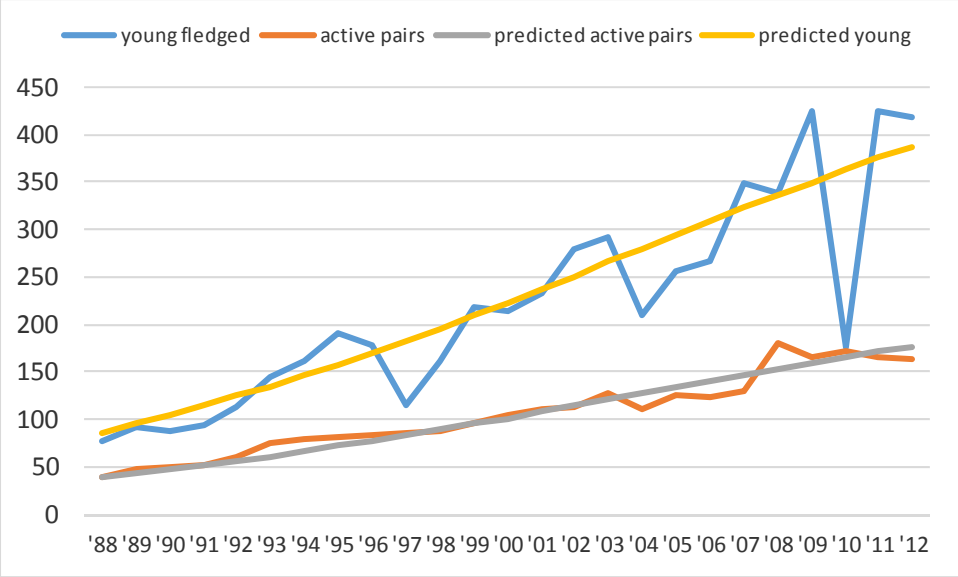
	Original Kazakhstan Data	European Plausible Survival	Asian Plausible Survival
survival rate to 9 months	23%	*50%*	*50%*
survival rate 10-21 months	82%	*65%*	*65%*
survival rate 3+ year	82%	80%	80%
expected breeding rate for single adult	**65%**	**57%**	**42%**
young produced per pair that lay eggs	3.10	2.20	3.00
harvest rate of juveniles	0%	0%	0%



IV.4 Implications from modelling growth of the Saker population in Hungary

Finally, it is instructive to use the IAF model to model the growth of a Saker population that has occurred in Hungary, where excellent data were collected during a period of Saker Falcon population recovery during the 25 years from 1988 to 2012. With the observed productivity in Hungary of 2.2 young per clutch (from a nest success of 67% and 3.02 young per successful nest), the survival parameters of 50%, 65% and 80% (as in Table 6) tended to under-predict initial growth and over-predict in the last decade. However a very close prediction of the population development (Figure 2) was obtained if an initial breeding rate of 95% of adults breeding fell steady to 70% breeding. Equivalent fits with a decline in adult breeding rate from 85% to 60% could be obtained with either 4% increases in adult survival or 4% increase in both juvenile and sub-adult survival. It seems likely that survival was actually slightly higher than the 50%, 65%, 80% scenario and that breeding rates were declining as the population tended towards environmental carrying capacity.

Figure 5 The numbers of active nests and fledged young observed in Hungary compared with models of breeding rates decline from 95% to 70%, or from 85% to 60% with 4% increase in survival



IV.5 Conclusions and recommendations from demographic modelling

The registration of productivity data for Sakers has progressed well in both Europe and Asian breeding areas. Although that is not equally true in all countries, experience in registering nesting pairs, their breeding success and brood sizes is available to be shared. One recommendation would be the effective recording of productivity, by checking for nest occupancy during incubation (which can be done from a distance with little disturbance but may stretch observer capacity), as well as during brood rearing, in order to detect early failures. For demographic modelling in general, the main shortfall is in estimation of survival rates. Whereas banding data are accumulating for estimating adult survival, for which minimum estimates can also be obtained from turnover rates, survival of first and second year birds badly needs further work.

The dispersive tendencies and relatively high philopatry of young Saker Falcons found when tracking by satellite (Prommer *et al.* 2012) shows that survival of young birds cannot easily be estimated either by VHF tags or genetic re-identification of young at nests in their natal area. Tags for tracking by satellite show promise, but are likely to underestimate survival if they impact wearers or cease transmissions prematurely. The most reliable tags are those with primary cells that are not dependent on solar-powered rechargeable cells, so the most practical approach may be to use these with transmissions at relatively long intervals for the first 3-4 years of life. Tags sending once a week, synchronised to satellite passes, should give more reliable than solar-powered tags at low weight. Moreover, by not needing to protrude through plumage, they should reduce the risk of creating drag on the birds when in flight.

More reliable tags would also provide increased data on causes of death of Saker Falcons. It was noteworthy one of two radio-tagged Sakers that attempted to over-winter in southern Kazakhstan was found dead (in good condition) under a powerline, and that two of the nine deaths recorded for birds for satellite tracking were caused by electrocution. Power-lines seem to be an appreciable mortality

factor for Saker Falcons (Dixon *et al.* in press) and more data are needed to indicate whether losses to this threat are, at least locally, unsustainable.

However, even with two of nine losses on power lines, and a further two tags ceasing to transmit in circumstances that suggested trapping, and a relatively low productivity of young compared to Asia, the Saker population in Hungary has been increasing strongly. It seems likely that estimates of 50%, 65% and 80% are conservative baseline values for estimation of fledged Saker Falcon survival for, respectively, up to 9 months, during months 9-21 and as adults.

A matrix model in MS Excel is understandable for representatives of falconers, trappers, local land managers and government (with translation if necessary). The IAF model is also suitable for planning release of Sakers to rebuild populations, such as those in Kazakhstan, or to increase populations by provision of artificial nests (Dixon *et al.* 2011). A deterministic model can also be reduced to a few lines of computer code, which can be used for cellular spatially predictive modelling through use of remote imagery, both as an independent prediction of population sizes and to forecast possible effects of habitat change (due to agricultural intensification or global warning). In all cases, Vortex has a potential follow-up role for investigating uncertainty of measurements and setting safe limits on harvest (through sensitivity analyses).

There is a strong incentive for falconers to assist in gaining better data on survival and movements, because it can be used to justify harvest from populations with good productivity. It cannot be stressed toohighly that adults should not be trapped in breeding areas, because this degrades the natural capital of this wildlife resource. Engaging with falconers and trappers to explain this would also open the possibility of sponsoring of radio-tagging which has proved successful in projects on a number of species.

Sponsoring of tagging could also very useful for encouraging biologists and local people to mark and gather genetic samples inexpensively from Sakers breeding in their areas, which would enable marker-recording estimates of population sizes and harvest levels. Marking with harness-based tags needs to be considered carefully, although survival to first autumn may not be greatly affected for VHF tags (Kenward *et al.* 2001), but methods based on rings, transponders and feather markers give rise to less concern. At the end of this report we outline a systematic approach to engaging falconers, trappers, biologists (including falcon-vets) and regulators with a system to facilitate monitoring of populations, and recording as well as regulating trade, through the use of such markers.

The matrix model used for the above analyses is in principle extremely robust and underlies all estimations of yield from animal populations. It can be rended more sophisticated, for instance through incorporation of stochastic effects in Vortex, if likely variability is also measured (as it is through annual recording). It can also in principle be broken into cellular components to summate from geographic or genetic subpopulations, if the variables that define cells are understood. If the mechanisms by which genes and environmental factors interact to affect the survival and breeding parameters are also understood, further levels of spatial specificity can be added. Thus, although we have restricted our modelling to a basic level, we believe it provide a good foundation for further research as well as for applied management of Saker Falcon populations.

V. Socio-economic modelling for conservation through use in falconry

Saker Falcons are a wildlife resource that has traditionally been harvested on migration by falconers for use by themselves and close colleagues (Allen 1990). They have always been a very desirable acquisition, and with the development of modern transportation it became possible for supply chains to build and for trappers to move further from migration sites. With increasing wealth in Gulf States, there was also increase in the demand for falcons. This raised concern in the 1990s about the scale of future harvest of wild Saker Falcons (Riddle & Remple 1994).

Both matrix and Vortex modelling can in principle be used to estimate safe harvest quotas ***H*** from ***i*** different Saker Falcon populations, giving a total harvest of $\Sigma \boldsymbol{H}_i$. However, that begs questions about the size of those populations. Populations can be counted, as the total number of breeding pairs, but this is prohibitively expensive for widely spread species except in small areas. There can be merit in counting areas where populations are under severe pressure, but it is unreliable to gross-up to total numbers of breeders from the proportion of area covered by these samples, especially where attrition may be varying over small scales.

An alternative is to use marking-recording techniques (e.g. mark-recapture, mark-resighting), in which young are marked in the sample areas and then, on dispersal, are assumed to have a similar likelihood as other unmarked birds of being caught elsewhere. Their proportion among the total number trapped is used to estimate the total juvenile population of a catchment area and, from observed productivity, the number of pairs. With this approach, there is a role in conservation monitoring for trappers, and potentially also for local people to boost numbers marked across the Saker range, as well as for supervisory scientists, who become especially important if there are many sub-populations so that marking-recording estimates need to be adjusted by genetic markers for each sub-population. An advantage of this approach is that estimates made with data owned by trapping and falconry stakeholders could be cross-checked by other estimates, provided for example by the long data series from Hungary or more intensive radio-tracking, and if proved satisfactory could be less expensive than alternatives in the long term. There would be added costs of training observers, but also gains for community-based conservation through engagement of local people.

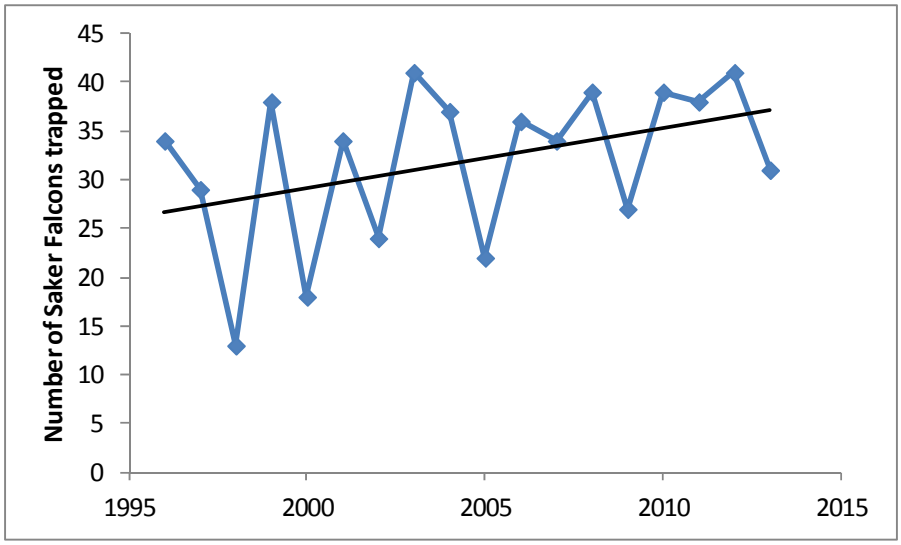
Moreover, if these stakeholders are prepared to cooperate for estimating population sizes and harvests, the resulting monitoring of trade could lead to guidance of trade and other potential benefits for wild Saker populations by voluntary actions based on peer-pressure and codes of conduct, with less cost than the need to promulgate and enforce restrictions. To investigate this possibility, we gained information on trapping and falconry in Saudi Arabia. However, for guiding the potential trade in Saker Falcons to ensure sustainability, other stakeholder groups must be recognised and their roles considered. These other stakeholders include the vets at falconry clinics, the breeders of falcons as an alternative to procurement from the wild, the governments and their institutions that act as regulators, the non-government organisations involved in conservation and the local people whose management affects habitats that are important for Sakers. For effective conservation, **all** these stakeholder groups need to be considered and encouraged to cooperate. Their roles will be identified in more detail through this section, and the potential for bringing them together then considered.

V.1 Trapping and the potential for monitoring through marker-recording

Sakers migrate along the Coast of the Red Sea and are trapped by falconers in small numbers, along with Peregrine Falcons, at a number of sites. The number of Sakers reported by Mohammed Al Khathlan, as a

representative of these trappers is shown in Figure 3. There is considerable fluctuation between about 15 and 40 captures per year, but a rising trend despite an apparently similar annual effort. This would be consistent with a tendency for increase in the Saker Falcon populations on this migration route, which includes birds from steppes lying north of the most arid zones of central Asia.

Figure 6 The number of wild Saker Falcons trapped annually in Saudi Arabia since 1995 as recorded by Mohammed Al Khathlan



When the first research on wild Saker Falcons was commissioned by government falconers in Abu Dhabi in 1993, it was noted that veterinary hospitals were becoming widespread in Arabian Gulf countries and were using micro-transponders to identify falconers there were treating. Therefore, when wild Sakers were first being marked to investigate harvest levels, they were not only ringed but also tagged with micro-transponders for identification after capture in case rings were removed. By using rings from British Trust for Ornithology, and with excellent cooperation from the veterinary hospitals in the Gulf States and Saudi Arabia for recording transponders, 13 of 171 falcons marked in Kazakhstan during 1993-7 were recorded as trapped. That represents a minimum harvest of 8%.

Knowing also the productivity of young, such marker-recording by trapping provides data for an estimate of population size. The approach was used to estimate breeding populations of Northern Goshawks in Fennoscandia (from widespread trapping in Sweden during the 1970s) and on Gotland (from trapping for research in the 1980s). In both cases, tens of ring recoveries have estimates very close to those obtained by extrapolating nest densities in study areas to the whole areas concerned (Kenward 2006). From records at veterinary hospitals, Riddle & Remple (1994) estimated that 2,750 falcons were being obtained in the Gulf States (including Saudi Arabia) annually in the late 1980s. With the 8% harvest rate, these would have represented about 36,000 young, or progeny from 12,000 laying pairs with 3.0 young per clutch.

However, that estimate assumes not only similar marking and harvest rates from all Saker populations concerned, but also the reporting of all markers. Neither assumption may have been valid. Eight rings were from 126 young Sakers ringed in northern Kazakhstan and reported by trappers in Saudi Arabia (4), Iraq (1), Syria (1), Turkey (1) and Yemen (1). Although Syrian trappers travel widely, seven birds had

almost certainly migrated southwest (and five were on the Red Sea flyway). The other five recoveries were from 45 Sakers tagged in southern Kazakhstan. Not only were the recoveries in different countries (Pakistan, China and the UAE), but only two were notifications of rings while three more were detected in falcon hospitals after rings had been removed.

Clearly, the observed recapture rates have potential for estimating both harvests and population sizes. However, could monitoring become extensive enough through marking in breeding areas and through the trapper community to create large enough samples, and could attitudes of trappers and falconers become supportive enough to remove sources of error, such as tag removal? This was studied through a survey of falconers and trappers in Saudi Arabia in June 2013.

V.2 Falconer/trapper attributes and the potential for a management system

A questionnaire developed for falconers and trappers is shown in Annex II. It was designed by Dr Monif AlRashidi following a previous successful survey (AlRashidi 2004), and will when completed and analysed provide evidence of any changes from that earlier survey, plus comparable data from other countries where trapping and flying Saker Falcons is popular. The results presented here are from the first 37 responses, in Saudi Arabia, and are therefore preliminary. Nevertheless, the findings in Tables 7 and 8 are quite clear enough to indicate the extent and thoroughness of engagement that could be practical, and also what might not be practical. Both aspects are important.

Table 14 Attributes, experiences and value placed on Saker Falcons for the first 37 falconers and falconer/trappers surveyed in Saudi Arabia in 2013

	Region	Age	Why do you practice the sport of falconry ?	How many years have you practiced the sport of falconry?	How many falcons do you have now?	And from which species are they?	If none, why?
Mean/ reply %		48.8		29% 10-20 years	2.3	52% of 61 are saker	27% (10) not active
Median/ majority	**78% Hail**	**49.0**	**100% Hobby**	**54% more than 20 years**	**2.0**	**8% are hybrid**	**Shortage of quarry (Houbara, Stone Curlew and Arabian Hare)**

How do you mark your falcon?	In the last 10 years, how many wild falcon have you had with CITES?	What is the longest period which a falcon has stayed with you?	From which species is it?	What happened to it?	Sort falcon species according to your preference	How many Saudi Riyals do you expect to pay for a wild Saker now?	How many falcons have you trapped (captured) by yourself in the last 10 years?
100% marked	100% reply	5.3 years	100% reply	**16% died**	100% reply	US$8313	18% of falconers also trap
96% ring +micro-chip	**10% had CITES**	**4.0 years**	**91% Saker**	**66% sold**	**91% Saker first choice**	**US$7500**	**Saker was 38/100 falcons trapped**

To summarise these results:

1. In a sample of 37 falconers, of which 78% from the Hail area, average age was 48 (range 29-75); 54% had practised falconry for more than 20 years and only 17% for less than 10 years.
2. The falcon preferred by 34 (91%) was the Saker, which was also the longest held falcon by them (up to 15 years, median 4 years), with most leaving due to sale (66%) not death (16%).
3. Ten (27%) were no longer keeping falcons, due in all cases to lack of quarry; the other 27 had a median 2 birds each (maximum 6), with 52% of the 61 falcons being Sakers.
4. Only 8 of the 27 active falconers did not have Sakers, and 3 of those had 3 of the 5 hybrid falcons recorded (8% of the total falcons possessed).
5. Seven (18%) of the respondents had also trapped 2-60 falcons in the last decade, Sakers being 38% of the 100 hawks trapped.
6. CITES permits would not be needed for falcons trapped and flown entirely within Saudi Arabia, and only 4 falconers had flown birds with CITES certificates.
7. All active falconers marked their hawks, in only one case without a ring as well as a microchip; however, 2 of 7 trappers did not want to mark trapped birds before sale even if paid to do so.
8. A wild Saker was considered worth about US$8,000 (range US$1,900-19,000).
9. All agreed that numbers of falconers had increased; only 3 disagreed that trapping was reducing numbers of falcons, with half considering prolonged possession to be a problem (Table 8).
10. Favoured solutions were more falcon hospitals, clubs, domestic breeding and certification, although falconers volunteered to pay only about 1% extra for certification by CITES (Table 8).

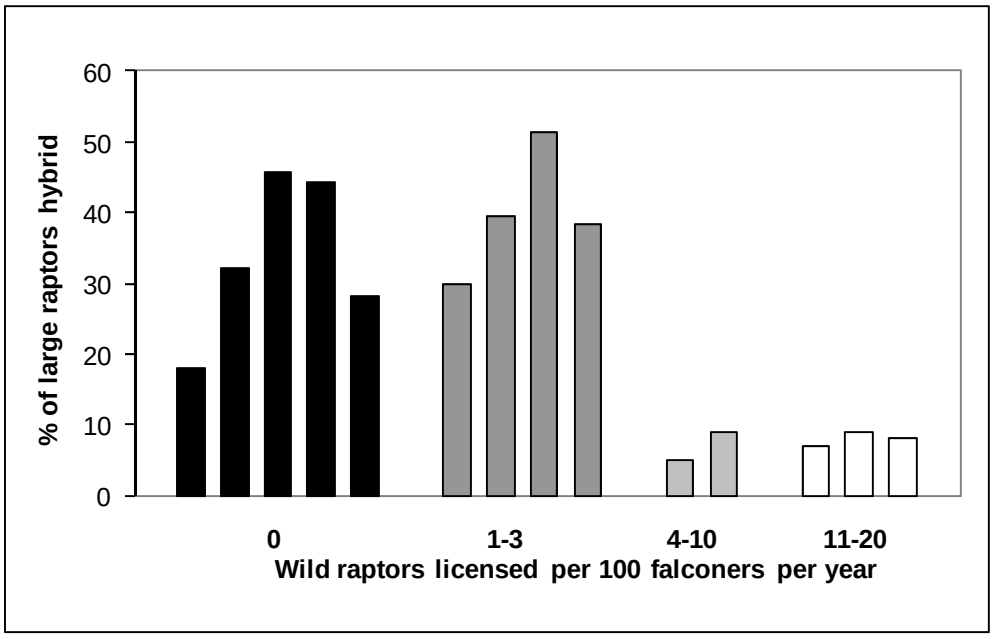
Table 15 Opinions of the first 37 falconers and falconer/trappers surveyed in Saudi Arabia in 2013, of which 100% replied to these questions.

Question	% who agreed
Do you think that the number of falconers increased or decreased in the last 10 years? Increase	**100%**
There are many falcons' trappers which decreases the number of falcons	**91%**
Maintaining a falcon in the captivity for a long time leads to decrease the number of falcons	48%
Increasing the price of falcons which leads trappers to seek them more to gain more of money	75%
There should be an Identification Card issued by the Wildlife Authority for the falconers that allows them to possess a falcon	**81%**
There should be an Identification Card for the falcons which allows that falconer to use it for hunting	**86%**
The price of the falcon should be set according to its species	37%
Setting a specified period for keeping a falcon	45%
Establishing breeding centres for falcons	**94%**
Establishing veterinary hospitals for falcons in the areas with high abundance of falconers	**100%**
Establishing falconers clubs in the areas with high abundance of falconers	**94%**
New regulations are making it harder to have wild Sakers	0%

A visit to Riyadh in June 2013 allowed useful discussion with falconers at a large communal moulting station and members of the Saudi Wildlife Authority. It became clear that ownership of falcons in KSA is at most levels in society, and that although the majority of falconers own few birds, some also have very large establishments and at these sites there can be a high proportion of hybrids obtained from domestic breeding. Motivations to own such birds are strongly competitive; catching wild Houbara is still an aspiration, but for this hybrid falcons (notable gyr-peregrine) are faster and stronger than pure Sakers. As hunting opportunities have decreased, falconry competitions (for racing as well as catching released quarry) have increased.

Among ordinary falconers, Sakers have remained popular during the last decade, keeping prices high, and wild birds are still sought after. It is likely that, with 7 trappers catching an average 10 birds per year among 37 falconers, there are more than 4 wild birds obtained by ordinary falconers per year. International survey by IAF for the European Commission showed that falconers in countries with this extent of access to wild raptors kept relatively few hybrids (Figure 4).

Figure 7 The proportion of hybrid raptors is low in countries where more than 4 wild falcons per 100 falconers are available per year (from Kenward & Gage 2008)



Falconers at a communal moult site, and in general responses to the survey, proved remarkably aware of conservation issues including pressure on wild stocks, and favoured solutions which included better care and information through falcon hospitals and clubs. Certification too was acceptable but other regulation less favoured. Initial suspicion of the survey team was overcome in discussion that showed strong links to international falconry: trust-building was important for cooperation. There were then reports that many Sakers are captured illegally in Russia and smuggled to the Arabian Gulf countries, with smuggling by impoverished Syrian trappers mentioned as cause of many falcon deaths in transit.

It is important to note that capture and flying of wild Sakers within a country has not been subject to CITES restrictions on international trade, and has therefore remained legal. Thus falconers have been able to answer surveys truthfully without fear of prosecution. Trappers in Saudi Arabia tend to be falconers, and have used the internet to report captures since 2005, albeit unsystematically. Once obtained, birds are checked and micro-chipped in falcon hospitals; this identification is used for their management, for example in communal moulting sites. Although 5 of 7 trappers would be prepared to marked trapped falcons prior to sale, there is reluctance to do so, presumably as this would raise suspicions about lack of wild origin.

However, it was felt that trappers could be motivated by payments to report captures on the site and provide a feather from trapped birds for DNA extraction, for genetic fingerprinting and investigation of origins. Adverse legislation and lack of contact would make this harder to arrange overseas, although there is benefit in use of Arabic as a lingua franca and it would be practical to gain trust by providing information and other benefits for trappers on a web-site. Although falconers were loathe to pay for certification, they pay high prices for birds and pay falcon hospitals to mark them, so DNA fingerprinting of feathers could be used to match birds at hospitals to reported trapping as an interim measure before establishment of a less analysis-intensive approach, of marking on capture and banking feathers for DNA analysis only if marker tampering is suspected.

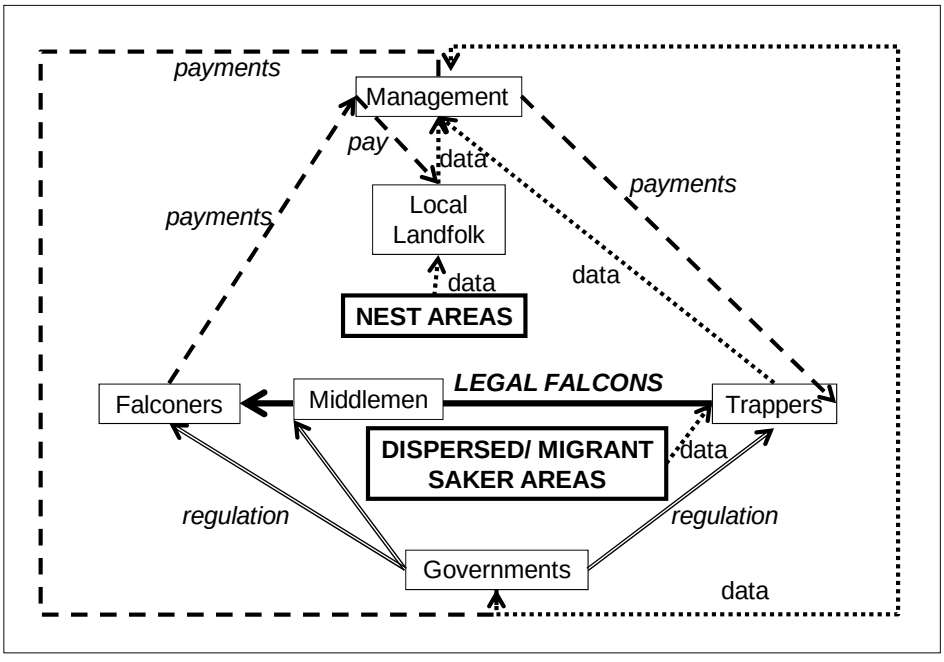
In conclusion, ordinary falconers in KSA keep relatively small numbers of hawks, retain a strong preference for pure, un-hybridised Sakers, and are prepared to pay good prices for them. They are cooperative enough with researchers for 37 to complete questionnaires at short notice. They have opinions on problems, are already getting their hawks marked by vets with implanted microchips and favour conservation solutions based on falcon hospitals and clubs and, but are not prepared to pay much for extra certification.

V.3 The conceptual model for a possible management system

CBD's Addis Ababa Princples and Guidelines make it clear that adaptive management, based on monitoring and then appropriate adjustment of the management, is a *sine qua non* for sustainable use of wild resources. A management system for conservation through use of the Saker Falcon, based on the reporting of trapping, could in principle enable monitoring of wild populations through marking in breeding areas and regulation of trade through marking or genetic fingerprinting of all harvested birds at capture.

To implement this conceptual model, several types of mathematical predictive model are required. One is for population demography to estimate harvests possible from different Saker populations. Another is to estimate sizes and trends recording markers on young falcons and sizes of harvests, possibly complicated by need to identify origins of birds trapped without markers. The first model will require expanded work in breeding areas, with survival parameters a knowledge gap to be overcome by improved techniques. The second model lacks important data on numbers of falconers and trappers, though survey indicates that these knowledge gaps too can be overcome if engagement of those stakeholders can be organised adequately. Models of a more socio-economic nature would be needed to optimise flows of information and payments in such a system (Figure 5).

Figure 8 An outline of the data and motivation flows (economic and regulatory) between actors that need to be modelled in a possible management system for Saker Falcons.



Operation and modelling in such a conservation management system would need :

1. For population monitoring, local land managers in breeding areas to record nest productivity, mark young, and provide feathers (DNA) in exchange for payments (P_m) from a conservation budget; local people could also benefit by providing information about illegal trapping.
2. For population monitoring, trappers to record and provide feathers (DNA) and other simple data from birds they capture, in exchange for payments (P_t) from the conservation budget.
3. For trade control, falconers to require birds marked to certify legal-origin, for which ultimately a fee (F) is contributed to the conservation budget (ΣF).
4. For trade control, trappers to agree to supply data from trapped birds, ultimately in exchange for permission to trap and share the harvest quota (H_i) from population i.
5. For detailed population monitoring and social acceptance, for scientists to find geographic markers through start-up finding, supplemented later by a proportion (s) of the conservation budget ($s\Sigma F$).
6. For social acceptance, governments in j countries to share payments for logistic or scientific support from a proportion (g) of the conservation ($g\Sigma F$) supplemented initially by start-up funding.
7. **For start-up, an initial conservation budget and funding for socio-technological infrastructure**.

This approach has become progressively more feasible since 2000. Due to improvements in mobile technology, the otherwise rather intractable problem of dealing with trappers (2,4), exacerbated by the problems in Syria, is probably practical. Thanks to UAE efforts and KSA surveys, copied in other countries, falconers are now more organised and contactable too (3). Saker issues have generated funding leading to contacting of more and more local people (1) and relevant science (5), including the ability to deter tampering with markers on trapped hawks by banking genetic material at the time of marking for 'mark-bank' comparison with fresh material from a bird (Kenward & Gage 2008). Thanks to UAE efforts initially and with IAF for the inscription by UNESCO (2012) of falconry as an intangible cultural heritage, many range-state governments are engaged (6), while socio-economic studies of resource use and technology have advanced substantially too. The socio-technological design needs to be based on mobile phone apps, which provide a new infrastructure for central-local communication to provide instructions, collect data and deliver payments to trappers and local people (7).

For socio-economic modelling it will be especially important to understand:

1. Levels of reward for legal compliance (e.g. payments for marking to trappers, P_t, and local land-managers, P_m) at which compliance becomes more cost-effective for trappers than illegality. Such calculations must include hidden costs of compliance (e.g. costs of time for reporting) as well as hidden costs of non-compliance (e.g. detection probability and value of fines).
2. Whether the fees (F) that are practical can combine with likely size of harvest (i.e. $F \times \Sigma H_i$) to cover the cost of running the system (including central administration, payments for marking and to a number (i) of governments for facilities), to ensure long-term socio-economic sustainability and ideally enough marking payment for local people (P_m) to motivate habitat conservation.

Promising results on costs and benefits which favour or deter illegal hunting are starting to come from studies of bushmeat procurement (e.g. Knapp 2012). A critical knowledge gap at present is whether falcon hospitals could contribute through marking to fees (F) for a conservation budget.

Governments would be rewarded (by recognition, technology/skill transfer and possibly funding) for logistic and scientific support with regulations and data on populations. Collection of feathers at the time of marking is important, as it provides DNA as a control against marker tampering and for population genetics in mark-recapture estimation. Feather handling needs an envelope and foolproof system. Other serious knowledge gaps are whether governments would help with this in exchange for the payment in country ***j*** of ($\boldsymbol{g_j \Sigma F}$), and whether CITES could approve transport of feathers, as a non-destructive sample, to approved institutions.

Whereas population modelling is a well-recognised process, the proposed socio-economic modelling is likely to evolve during implementation. The important thing is to recognise the need for such modelling and to plan processes within the management system for recording at least the above variables, whose possible interactions can again be modelled in MS Excel.

V.4 Technical design of a possible Saker Adaptive Management System (SAMS)

Annex III details a preliminary costing for a system to monitor Saker Falcon capture and transportation across borders. It is a rough estimate of what is required, with Use-Cases listed to estimate the time required for programming, but not for initiating and testing the system. The cost would comprise about eight person-months of programming and four of administration and testing.

It must be noted that, although the administration team to manage such a system could be small (a single administrator is foreseen) the steering team needed to develop rules and protocols acceptable to all stakeholders would be much larger. Indeed, managing that that steering group would require appreciable time from the administrator (or part-time administrators). The steering group would at the least need representatives of CITES, CMS and major stakeholders (e.g. falconers, other conservation interests). Whether the group should also include scientists (other than represented among those mentioned) and range states in another form than represented among the falconry and other conservation interests, would need decisions too. Rather than increase the size of core steering an alternative might be to have a separate science, technology and range states (STARS) group.

Application Overview

The following is an overview of the design for information technology which could be used to manage a system for monitoring raptor harvests and population sizes and trends on the basis of (nest-based) marking and (trapping-based) recapture, by exploiting new communications technology in mobile phones and the internet. The concept is based on the combination of rings and microchips used and recorded by biologists, trappers, falcon hospitals and falconers, which was used to demonstrate possible data flows in Kenward *et al.* (2001). Although such a system could work (and be motivated) on a voluntary basis, it could also double as an enforcement tool.

The Modelling for Conserving Saker Falcons project comprises six different areas of development, each a different interface to a central database. These are interfaces for System Administration, Biology Administration, Taggers, Falconers and Law Enforcement and a public-facing interface, known as the Access pages, to provide a point of entry to the browser-based interfaces, a description of the project to the wider public and an advertisement to falconers who wish to join the project.

Central to the application is a database. The database is accessed through web pages for all users except for law enforcement who will need non-browser-based software to control specialised tag scanning

hardware. Taggers will be able to supply a small amount of data with their mobile phones as described below.

The system administrator interface will allow administrators to create and edit all the user accounts and give them access to the various areas of the application. Administrators have access to all areas of the application and can also manage payments and law enforcement institutions.
Biology admin manage the bird data, creating and managing bird records and history. Outside of the software they will send a tag and an envelope containing the code of the specific bird to a tagger.

Taggers trap birds and attach the tag sent by the biology admin. When they have attached the tag they will send an SMS text message which is received automatically by the system so the bird data can be updated automatically. They will also send a feather back to the biology admin in the provided envelop so that biology admin can update DNA data for the bird. Taggers also have their own web interface in order to view tagged birds and payments made to them.

Falconers can register their birds with the system and match their birds with individuals already recorded. They will be able to view the bird's history but they will have to make payments to use the system.

Law enforcement will have access to terminals, personal computers, tablets or smart phones, running Windows, iOS or Android, running forms-based software. They will scan bird tags as they come through customs; the scan data will update the bird record in the central database. They will be informed via the terminal if the bird is not legal and will be instructed to send a feather if a bird has no tag.

The application also includes a messaging system that provides pages for all users to contact other users, ask support from administrators, reply to messages and carry on conversations. Communications relating to the project are kept in a central place and can searched and referenced more easily than with disassociated email. Users are, of course, emailed when a message arrives but will link from the email back to the Saker system in order to reply.

V.5 Conclusions and recommendations from socio-economic modelling

Current harvest rates of Saker Falcons are uncertain, but may be in the region of 5-10%. The best current estimate of the global population of the Saker Falcon is estimated at 6,400 to 15,400 breeding pairs (Birdlife International 2013). With annual productivity (young/pair, including nest failures) of 2.6 young (the mean of European and Asian values, but noting that Europe is a small part of the population), there would be 16,000-40,000 young. A 5% harvest of young would be 800-2,000 birds. A major gap in socio-economic knowledge is not only the actual harvest rates for different saker populations, and whether this is sustainable, but also the size of the total demand. The demographic models predict that a harvest much greater than 5% may be sustainable, but we do not know whether populations are actually being harvested at higher rates now. The decline in the southern Kazakhstan population was consistent with a harvest rate of 55% of adults, and adults are trapped in some areas (Kenward *et al.* 2007). This is clearly undesirable, and an early priority for the Saker Falcon Task Force should be to encourage appreciation of this among falconers and trappers. Falconers elsewhere have appreciated this and avoided trapping adult raptors in most other parts of the world.

If trapping is to continue within countries, it would also be in line with the precautionary principle (Cooney 2004) for local falconers and their authorities to be monitoring whether those harvest levels are likely to be sustainable. The apparent increase in harvests in Saudi Arabia (Figure 3) indicates that

they may be sustainable, but knowledge of the total size and nature of the populations concerned is highly desirable.

The scientific capabilities, practical skills, attitudes and local knowledge appear to be available for running a system for adaptive management of Saker Falcons through sustainable use in traditional falconry. Such a system could control trade through quotas, with registration of harvest rates that are necessary for simple ecological modelling. Marking-recording techniques could be used to monitor sizes and trends of the populations being trapped. The required marking in breeding areas could in turn motivate local communities to conserve those areas in order to get payments-to-mark from the scheme. With such payments direct from the scheme to trappers and local communities, payments to central governments could be precisely and transparently targeted for required services/facilities. Scientists would be important too, for providing and handling genetic information and remote-sensed habitat data that would gradually fine-tune the system optimally to conserve sub-populations and the habitats they require.

The whole system, from which falconers, trappers, local communities, government officials, scientists, Sakers and their habitats would benefit, would require an ICT infrastructure to minimise costs, and a small management team. A contract for the programming of an appropriate system would require one person-year of technical work, plus further costs for implementation. Although such a system is virtual and can be run anywhere, a site would be needed for storage and analysis of genetic material, for which CITES administration would also be required. As the system involves a complex interplay of actors, data and motivation flows in ecological and socio-economic fields, development and management would benefit from appropriate complex engineering skills, such as are present at the Centre for Complex Engineering Systems of King Abdulaziz Centre for Science and Technology in Saudi Arabia.

VI. Conclusions for SakerGAP

Simple matrix modelling, of a transparent nature as implemented in the IAF MS Excel implementation, has already shown ability to model declining and expanding Saker Falcon populations. Such models require productivity rates as observed by biologists in local breeding areas, combined with estimates of survival from which additional rates of attrition, for example due to harvest or mortality on power-lines, can be subtracted. Minimum estimates of 50%, 65% and 80% of natural survival for months 0-9, 10-21 and >21 post-fledging, respectively, seem likely to be conservative. These base-line estimates are below estimates for other raptors of similar size to the Saker Falcon (e.g. of 58%, 65% and 81% for Northern Goshawk and 70%, 91%, and 88% for Common Buzzard). Funding for increased use of reliable long-life radio tags to improve estimates to first breeding, and for adults, could involve sponsoring of marked adults by falconers. The relative importance of additional attrition for Sakers from mortality on power-lines, and of harvest for falconry, could also be defined by such tagging provided that trappers cooperate to report tags.

There are now suitable human resources in terms of science and technology capabilities, and of attitudes and knowledge among local falconers, for a Saker Adaptive Management System to be run in the Gulf States to estimate harvest rates and, given cooperation with falcon trappers, sizes of trapped Saker populations. The increasing use of web-sites and mobile communications by falconers and trappers means that the internet could be used increasingly to engage with and build trust among these stakeholders, using Arabic as a *lingua franca*, and providing useful information on falcons, falcon management, individual marked falcons (if a monitoring system is developed), surveys, survey results and other rewards for participation. However, it requires time to attract people to new sites and build their trust. International legislation which increases opportunity costs for trappers is a further complication to building a trusted system to monitor population sizes and harvests of Saker Falcons.

The engagement of scientists, governments and NGOs for the STF Stakeholders' Workshop is important if Multilateral Environmental Agreements (MEAs) are to have any chance of accommodating a complex system for managing conservation of the Saker Falcon through sustainable use. It is already recognised that the interactions of MEAs can create complications for conservation (Ivanova & Roy 2007, Kanie 2007). Although this recognition is leading towards synergies (UNEP-WCMC 2012), the immediacy of conflicting business models (in the triangular relationship of protection, cultivation and wild-resource use) does not favour patient deliberation needed to inform and converge the thinking of all actors. Those genuinely wishing to conserve Sakers, and their important steppe habitats that were cradles of western civilization, must seek to keep the topic broad and avoid hasty decisions. Can they provide the time needed for other stakeholders to engage productively, or will they prefer to create conditions in which falconers and trappers find it hard to keep their roles legal?

To ensure legal procurement of a desirable commodity, it is necessary for end-users to require evidence of legal provenence; given that requirement, legality can be driven back up a supply chain. In this case it is falconers in Arab countries who are the recipients of the birds, and trappers who operate within their countries or abroad, together with falcon traders who are especially important components in the supply chain. Moves are already afoot to have at least one prominent falconer/trapper at the Stakeholders' Workshop, but a key challenge is to ensure that ordinary falconers and trappers become engaged in as many countries as possible. Representation of the falcon hospitals, as a major link between falconers/trappers and higher levels, is also essential. Key knowledge gaps are the time that

would be required to engage falconers, falcon hospitals and, especially, falcon trappers in the effective operation of a Saker Adaptive Management System.

Although any management system for wild resources may ultimately only be socio-economically sustainable if it self-funds from contributions of the resource beneficiaries, funding the initial start-up budget and technology costs for a Saker Adaptive Management System is beyond the capability of individual falconers. With wealthy falconers moving already along the road of breeding enhancement that characterises competition with domesticated animals, are any enlightened enough to see the ultimate social-sustainability benefits for their passion from environmental philanthropy?

If not there remains the possibility that an organisation representative of stakeholders could provide enough funding for a bottom-up approach, to run a trust-building portal and gradually build interest, trust, cooperation and funding from those involved. Whether that approach could work would depend on the extent of voluntary support from local stakeholders and enduring tolerance of high-level stakeholders. It is not clear whether either would suffice.

VII. Recommendations, strategy and actions proposed

The data and techniques for monitoring of Saker Falcon populations in a generic way are reasonably satisfactory. However, they need refinement for falcon populations with different ecological conditions in terms of breeding, migration and wintering areas, and hence of food supplies, harvests, attrition from power-lines and other threats. Given data on productivity, from nest studies, a balance of natural mortality and other attrition factors needs to enable sufficient resilience, in terms of non-breeding adults, for populations to persist despite natural variations, which can also be added transparently to the IAF model to avoid relying on less transparent assumptions in other models. It is clear that good productivity data are needed from harvested populations, and also estimates of their size, which can conveniently come from marker-recording if trapping is permitted. Refinement of breeding area data may in due course enable cross checking through modelling of nest densities across breeding areas. Marker-recording estimation of populations also involves harvest estimation, and engages stakeholders in breeding areas and in the falconry-interest community, including trappers and falcon hospitals, which is likely to build trust and a cooperative environment for management of the species and its habitats, especially healthy steppes that support many other important species.

On this basis, we recommend engagement of:

- Biologists to build networks of local land managers to mark and record productivity in breeding areas;
- Falconers and falcon hospitals to record marked birds and fund marking in exchange for information;
- Trappers to record all captures, but especially marked birds, in exchange for payment and information;
- Governments and international NGOs to support this cooperative approach to Saker management.

We also recommend work on:

- Radios that can give reliable long-distance signals from pre-breeding Sakers;
- Genetics to identify falcon origin areas (particularly the source populations of trapped falcons);
- Information Technology to facilitate recording data from local falcon markers and trappers;
- Ways to engage falconers and trappers in 'citizen-science' data provision in exchange for information.

We conceive a pathway for implementing these recommendations. The first stage of the pathway is practical rapidly through cooperation of UNEP-CMS with appropriate stakeholder organisations. The second phase has two options, for which the choice will depend on high level stakeholder decisions.

Saker Management Pathway Stage 1 involves agreeing with relevant stakeholders to:

- ❖ Immediately develop a portal in Arabic offering benefits to attract falconers and trappers;
- ❖ Run surveys and competitions for information on the site to build trust;
- ❖ Promulgate the idea of not trapping adults in breeding areas or buying such birds.

Saker Management Pathway Stage 2 involves either:

1. Funding for the portal to host a system for monitoring populations and regulating trade.
or

2. Using the portal to promulgate exchange of data for information, bird sponsorship, etc, then using sponsorship to gradually equip the portal with tools to monitor populations and trade through trapping, and finally inserting a tool to monitor and, if necessary, regulate trade if Saker populations remain depressed.

Additional outputs of the contract

Two Powerpoint presentations based on its contents and the IAF model framework in MS Excel.

VIII. References

*(Internet documents were last visited on **/**/2013)*

Allen, M. (1980) Falconry in Arabia. Orbis, London.

AlRashidi, M. (2004). An ecological study on hunting falcon species and their protection in Saudi Arabia. Master Thesis (in Arabic), Biology Department, Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia.

Bagyura, J., Szitta, T., Haraszthy, L., Demeter, I., Sándor, I., Dudás, M., Kalláy, G. & L. Viszló (2004). Population Trend of the Saker Falcon *Falco cherrug* in Hungary between 1980 and 2002. Pages 663-672 in R. D. Chancellor & B.-U. Meyburg (eds): Raptors Worldwide. Proceedings of the VI World Conference on Birds of Prey and Owls. Budapest, Hungary.

Bagyura, J., Fidlóczky, J., Szitta, T., Prommer, M., Tihanyi, G., Zalai, T., Balázs, I., Váczi, M., Viszló, L., Klébert, A., Haraszthy, L., Tóth, I., Török, H. A., Demeter, I., Serfőző, J., Pigniczki, Cs., Kazi, R. & K. Erdély (2012) A Kerecsensólyom-védelmi Munkacsoport 2010 évi beszámolója (Report of the Saker Conservation Working Group, 2010). Heliaca 8: 22-30.

Baumgart, W. (1991) Der Sakerfalke. Second edition. Wittenberg Lutherstadt: A. Ziemsen Verlag (Neue Brehm-Bücherei 514).

BirdLife International (2013) Species factsheet: *Falco cherrug*. Available at: http://www.birdlife.org on 05/05/2013.

Cooney, R. (2004). The Precautionary Principle in Biodiversity Conservation and Natural Resource Management: An issues paper for policy-makers, researchers and practitioners. IUCN, Gland, Switzerland and Cambridge, UK. xi + 51pp.

Cade, T. J., Enderson, J. H., Thelander C. G. & G. M. White (eds) (1988). Peregrine falcon populations: their management and recovery. The Peregrine Fund, Boise, Idaho, USA.

CBD (1992) Convention on Biological Diversity. Available at: http://www.cbd.int/doc/legal/cbd-en.pdf

CITES (1979) Convention on International Trade in Endangered Species of Wild Fauna and Flora. Available at: http://www.cites.org/eng/disc/E-Text.pdf

Convention on Biological Diversity (2004a) Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity (CBD Guidelines) Montreal: Secretariat of the Convention on Biological Diversity 21 p. Available at: http://www.cites.org/eng/res/13/addis-gdl-en.pdf

Convention on Biological Diversity (2004b) The Ecosystem Approach, (CBD Guidelines) Montreal: Secretariat of the Convention on Biological Diversity 50 p. Available at: http://www.cbd.int/doc/publications/ea-text-en.pdf

Council of Europe (1979) Convention on the Conservation of European Wildlife and Natural Habitats. CETS No.: 104 Available at: http://conventions.coe.int/Treaty/Commun/QueVoulezVous.asp?NT=104&CM=8&DF=&CL=ENG

CMS (2003) Convention on the Conservation of Migratory Species of Wild Animals. Available at: http://www.cms.int/documents/convtxt/cms_convtxt_english.pdf

Dixon, A., Batbayar, N., Purev-Ochir, G. & N. Fox (2011) Developing a sustainable harvest of Saker Falcons (*Falco cherrug*) for falconry in Mongolia. Pages 363-372 in R. T. Watson, T. J. Cade, M. Fuller, G. Hunt & E. Potapov, eds. Gyrfalcons and Ptarmigan in a changing world. The Peregrine Fund, Boise, Idaho, USA.

Dixon, A., Ming, M., Gunga, A., Purev-Ochir, G. & N. Batbayar (in press) The problem of raptor electrocution in Asia: case studies from 1 Mongolia and China. Biological Conservation.

Farmer, C.J., Hussell, D.J.T. & D. Mizrahi (2007): Detecting population trends in migratory birds of prey. Auk 124: 1047-1062

Fehérvári, P., Bagyura, J., Belényesi, M., Prommer M., & J. Fidlóczky (2010): Modelling the Spatial Distribution of Saker Falcons in Hungary. Background analysis to the final report of the project LIFE NAT/HU/000096.

Gombobaatar, S., Sumiya, D., Potapov, E., Munkhzaya, B. & B. Odkhuu (2007) Breeding biology of the Saker Falcon in Mongolia. Raptors Conservation 9: 17-26.

Hiraldo, F., Negro, J.J., Donázar, J.A. & P. Gaona (1996): A demographic model for a population of the endangered lesser kestrel in southern Spain. Journal of Applied Ecology 33: 1085-1093

Ivanova, M. & J. Roy (2007) "The Architecture of Global Environmental Governance: Pros and Cons of Multiplicity," (PDF) in Global Environmental Governance: Perspectives on the Current Debate, (Lydia Swart and Estelle Perry, eds.), New York: Center for UN Reform Education. Available at: http://www.centerforunreform.org/system/files/GEG_Ivanova-Roy.pdf

Kanie, N. (2007) Governance with Multilateral Environmental Agreements: A healthy or ill-equipped fragmentation? In: Global Environmental Governance: Perspectives on the Current Debate, (Lydia Swart and Estelle Perry, eds.), New York: Center for UN Reform Education. Available at: http://www.centerforunreform.org/system/files/GEG_Kanie.pdf

Karyakin, I.V., Levin, A.S., Novikova, L.M., Pazhenkov, A.S. (2005). Saker in the North-West Kazakhstan: results of the 2003-2004 surveys. Raptors Conservation 2: 42-55. Available at: http://docs.sibecocenter.ru/programs/raptors/RC02/raptors_conservation_2005_2_pages_42_55.pdf

Karyakin, I.V., Smelansky, I.E., Bakka, S.V., Grabovsky, M.A., Rybenko, A.V., Egorova, A.V. (2005/2). The Raptors of the Altai Kray. Raptors Conservation 3: 28-51. Available at: http://docs.sibecocenter.ru/programs/raptors/RC03/raptors_conservation_2005_3_pages_28_51.pdf

Karyakin, I. V. & E.G. Nikolenko (2008). Monitoring results on the Saker Falcon population in the Altai-Sayan region in 2008, Russia. Raptors Conservation 14: 63-84. Available at: http://docs.sibecocenter.ru/programs/raptors/RC14/5_research_Karyakin_Nikolenko.pdf

Karyakin, I. V. & E.G. Nikolenko (2011) Results of monitoring of the Saker Falcon population in the Altai-Sayan Region in 2011, Russia. Raptors Conservation 23: 152-167.

Katzner, T., Bragin, E. & E.J. Milner-Gulland (2006): Modelling populations of long-lived birds of prey for conservation: a study of Imperial Eagles (*Aquila heliaca*) in Kazakhstan. Biological Conservation 132: 322-335

Kauffman, M. J., Pollock, J. F. & B. Walton (2004): Spatial Structure, Dispersal, and Management of a Recovering Raptor Population. The American Naturalist 164: 582-597.

Kenward, R.E. (2001). A manual for wildlife radio tagging. Academic Press, London, UK.

Kenward, R.E. (2006). The Goshawk. T. & A.D. Poyser / A. & C. Black, London, U.K.

Kenward, R.E. & M.J.G. Gage (2008). Opportunities in falconry for conservation through sustainable use. Pages 181-204 in Sielicki, J. & Mizera, T. (eds.): Peregrine Falcon Populations - status and perspectives in the 21st Century: EPFWG/Turul, Warsaw.

Kenward, R., Katzner, T., Wink, M., Marcström, V., Walls, S., Karlbom, M., Pfeffer, R., Bragin, E., Hodder, K. & A. Levin (2007): Rapid Sustainability Modeling for Raptors by Radiotagging and DNA-Fingerprinting. Journal of Wildlife Management 71: 238-245.

Kenward, R.E. & V. Marcström (1988). How differential competence could sustain suppressive predation on birds. Pages 733-742 in Proceedings of the XIX International Ornithological Congress.

Kenward, R.E., Marcström, V. & M. Karlbom (1991). The goshawk (*Accipiter gentilis*) as predator and renewable resource. Gibier Faune Sauvage 8: 367-378.

Kenward, R.E., Marcström, V. & M. Karlbom (1999). Demographic estimates from radio-tagging: models of age-specific survival and breeding in the goshawk. Journal of Animal Ecology 68: 1020-1033.

Kenward, R.E., Pfeffer, R.H., Al-Bowardi, M.A., Fox, N.C., Riddle, K.E., Bragin, Y.A., Levin, A.S., Walls, S.S. & Hodder, K.H. 2001. Setting harness sizes and other marking techniques for a falcon with strong sexual dimorphism. Journal of Field Ornithology 72:244-257.

Kenward, R.E., Walls, S.S., Hodder, K.H., Pahkala, M., Freeman, S.N. & V. R. Simpson (2000). The prevalence of non-breeders in raptor populations: evidence from rings, radio-tags and transect surveys. Oikos 91: 271-279.

Knapp, E.J. 2012. Why poaching pays: a summary of risks and benefits illegal hunters face in Western Serengeti, Tanzania. Tropical Conservation Science 5: 434-445.

Lacy, R.C. & J.P. Pollak. 2013. Vortex: A stochastic simulation of the extinction process. Version 10.0. Chicago Zoological Society, Brookfield, Illinois, USA. http://www.vortex9.org/vortex.html

Levin, A. S. & A. Dixon (2008) Long-term monitoring of breeding Saker Falcons in eastern Kazakhstan. Falco 32: 11-14.

Levin, A.S. (2008). Saker Falcon in Eastern Kazakhstan. Raptors Conservation 14: 85-95. Available at: http://docs.sibecocenter.ru/programs/raptors/RC14/5_research_Levin.pdf

Millsap, B. A. & G.T. Allen (2006): Effects of Falconry Harvest on Wild Raptor Populations in the United States: Theoretical Considerations and Management Recommendations. Wildlife Society Bulletin 34: 1392-1400.

MME & RPS (2010). Conservation of Saker (*Falco cherrug*) in the Carpathian Basin (LIFE06 NAT/HU/000096). http://sakerlife.mme.hu/en/content/show?dattype=kerecsen

Myloboh, Y. V. (2012) [Falconiformes in the Ukraine steppe: species composition, spatial distribution, dynamics, size and trends.] PhD dissertation, Kryvorizko National University. (In Ukrainian.)

Nagy, S. & I. Demeter (2006). Saker Falcon: European Single Species Action Plan. Bern Convention: T-PVS/Inf (2006) 2 revised

Newton, I. (1979). Population dynamics of raptors. Poyser, Berkhamsted.

Prommer, M., Bagyura, J., Chavko, J. & M. Uhrin (2012). Migratory movements of Central and Eastern European Saker Falcons (*Falco cherrug*) from juvenile dispersal to adulthood. Aquilo 119: 111-134.

Puzović, S. (2007). Dalekovodi kao strukturni faktor staništa ptica *(Power lines as a structural factors for bird habitats)*. PhD dissertation. University of Novi Sad. Serbia. (in Serb)

Ragyov, D., Kmetova, E., Dixon, A., Franz, K., Koshev, Y. & N. Nedialkov (2009): Saker Falcon *Falco cherrug* reintroduction in Bulgaria. Feasibility study. SESN. Sofia, 2009

Riddle, K. E. & J. D. Remple. (1994). Use of the saker and other large falcons in Middle East falconry. Pages 415–420 in B.-U. Meyburg and R. D. Chancellor, editors. Raptor conservation today. World Working Group on Birds of Prey, Berlin, Germany.

Sergio, F., Tavecchia, G., Blas, J., López, L., Tanferna, A. & F. Hiraldo (2011). Variation in age-structured vital rates of a long-lived raptor: Implications for population growth. Basic and Applied Ecology 12: 107-115

Smart, J., Amar, A., Sim, I.M.W., Etheridge, B., Cameron, D., Christie, G. & J.D. Wilson (2010). Illegal killing slows population recovery of a re-introduced raptor of high conservation concern – The red kite *Milvus milvus.* Biological Conservation 143: 1278-1286.

UNESCO (2012) Inscription **Falconry, a living human heritage** on the Representative List of the Intangible Cultural Heritage of Humanity. Intergovernmental Committee for the Safeguarding of the Intangible Cultural Heritage. Decision 7. COM. 11.33.

Vazhov S.V., Bachtin, R.F., Makarov, A.V. , Karyakin, I.V., Mitrofanov, O.B.(2010). Monitoring Results of Raptor Breeding Groups in the Republic of Altai in 2010, Russia. Raptors Conservation 20: 54-67. Available at: http://docs.sibecocenter.ru/programs/raptors/RC20/RC20_054_067_Vazhov_etal.pdf

Walls, S., Kenward, R. & G. Holloway (2004). How common is the Common Buzzard, Buteo buteo? Biologist 51: 23-26.

Wink, M., Staudter, H., Bragin, Y. Pfeffer, R. & R. Kenward (1999). The use of DNA fingerprinting to estimate survival rates in the Saker Falcon (*Falco cherrug*). Journal für Ornithologie 140: 481-489.

Annexes

Annex 1 Saker breeding data

	Average number of nestlings (/successful breeding)	**Number of observed pairs**	**Number of successful pairs**	Total number of juveniles	**Region**	**Source of information**
BULGARIA						
?	2.00		7	14		Baumgart (1991)
CZECH REPUBLIC						
1999-2010	2.90	92	72	(209)	all country	Beran. Unpublished
HUNGARY						
1980	2.00	13	2	4	all country	Bagyura *et al.* (2004)
1981	3.00	14	3	9	all country	Bagyura *et al.* (2004)
1982	2.86	17	7	20	all country	Bagyura *et al.* (2004)
1983	3.71	21	7	26	all country	Bagyura *et al.* (2004)
1984	2.91	26	11	32	all country	Bagyura *et al.* (2004)
1985	2.82	31	11	31	all country	Bagyura *et al.* (2004)
1986	2.83	33	12	34	all country	Bagyura *et al.* (2004)
1987	2.47	37	15	37	all country	Bagyura *et al.* (2004)
1988	3.12	40	25	78	all country	Bagyura *et al.* (2004)
1989	3.07	47	30	92	all country	Bagyura *et al.* (2004)
1990	2.49	49	35	87	all country	Bagyura *et al.* (2004)
1991	3.21	52	29	93	all country	Bagyura *et al.* (2004)
1992	2.73	61	41	112	all country	Bagyura *et al.* (2004)
1993	3.09	75	47	145	all country	Bagyura *et al.* (2004)
1994	2.89	80	56	162	all country	Bagyura *et al.* (2004)
1995	3.13	82	61	191	all country	Bagyura *et al.* (2004)
1996	3.18	83	56	178	all country	Bagyura *et al.* (2004)
1997	2.83	85	41	116	all country	Bagyura *et al.* (2004)
1998	3.00	87	54	162	all country	Bagyura *et al.* (2004)
1999	3.13	95	70	219	all country	Bagyura *et al.* (2004)
2000	3.00	104	71	213	all country	Bagyura *et al.* (2004)
2001	3.11	111	75	233	all country	Bagyura *et al.* (2012)
2002	3.49	113	80	279	all country	Bagyura *et al.* (2012)
2003	3.15	127	91	287	all country	Bagyura *et al.* (2012)
2004	2.61	111	80	209	all country	Bagyura *et al.* (2012)
2005	2.94	125	87	256	all country	Bagyura *et al.* (2012)
2006	2.91	124	92	268	all country	Bagyura *et al.* (2012)
2007	3.16	130	110	348	all country	Bagyura *et al.* (2012)
2008	2.97	180	113	336	all country	Bagyura *et al.* (2012)
2009	3.13	165	137	429	all country	Bagyura *et al.* (2012)
2010	2.59	172	68	176	all country	Bagyura *et al.* (2012)
2011	2.95	165	144	425	all country	Bagyura *et al.* (2012)
2012	3.19	164	131	418	all country	Bagyura *et al.* (2012)
KAZAKHSTAN						

1941	3.30				Naursum	Baumgart (1991)
1946	3.40				Naursum	Baumgart (1991)
1947	4.40				Naursum	Baumgart (1991)
late 1940s	2.33		21	49	Naursum	Baumgart (1991)
1973	3.60		12	(43)	Naursum	Baumgart (1991)
1974	3.10		11	(34)	Naursum	Baumgart (1991)
1993	4.07	16	15	61	Naursum	Kenward *et al.* (2007)
1994	3.17	16	12	38	Naursum	Kenward *et al.* (2007)
1995	3.73	17	15	56	Naursum	Kenward *et al.* (2007)
1996	3.50	14	12	42	Naursum	Kenward *et al.* (2007)
1993-1996	3.33		12	40	South-central Kazakhstan	Kenward *et al.* (2007)
2003-2004	4.10		77		Caspian-Aral	Karyakin *et al.* (2005)
2003-2004	2.90		24	(70)	North (NW Kazakhstan)	Karyakin *et al.* (2005)
2000-2008	3.90		31	(121)	East Kazakhstan	Levin (2008)
2000-2008	3.70		156	(577)	East Kazakhstan	Levin (2008)
2005	4.50		4	18	Aral	Levin (2008)
MONGOLIA						
(2002-2006)	3.70		330	1221		Gombobaatar *et al.* (2007)
1998-2005	3.79		401	(1520)	all country	Gombobaatar *et al.* (2007)
1998-2005	3.34		401	(1327)	all country	Gombobaatar *et al.* (2007)
1998-2005	2.80		401	(1123)	all country	Gombobaatar *et al.* (2007)
2005-2010		75			Bayan+Darhan wild	Dixon *et al.* (in press a)
2005-2010	3.55	69	58	206	Bayan+Darhan grids	Dixon *et al.* (in press a)
ROMANIA						
2013	2.00	3	2	4	West-Romania	Prommer (unpublished)
RUSSIA						
1999	2.25	53	52	117	Altay-Sayan	Karyakin & Nikolenko (2011)
2000	2.38	20	20	48	Altay-Sayan	Karyakin & Nikolenko (2011)
2001	2.44	31	29	71	Altay-Sayan	Karyakin & Nikolenko (2011)
2002	3.00	46	45	135	Altay-Sayan	Karyakin & Nikolenko (2011)
2003	2.69	46	20	54	Altay-Sayan	Karyakin & Nikolenko (2011)
2004	2.24	51	34	76	Altay-Sayan	Karyakin & Nikolenko (2011)
2005	3.73	39	25	93	Altay-Sayan	Karyakin & Nikolenko

						(2011)
2006	2.69	19	16	43	Altay-Sayan	Karyakin & Nikolenko (2011)
2008	*2.48*	*108*	*55*	136	*Altay-Sayan*	Karyakin & Nikolenko (2011)
2009	2.50	34	20	50	Altay-Sayan	Karyakin & Nikolenko (2011)
2010	2.83	51	28	79	Altay-Sayan	Karyakin & Nikolenko (2011)
2011	2.86	46	22	63	Altay-Sayan	Karyakin & Nikolenko (2011)
2008	2.48	(65)	33	82	Altay-Sayan	Karyakin & Nikolenko (2008)
ex 2008		436	311	829		Averaged by RK from red data, excluding 2008
1999-2008	**2.63**	**413**	**243 (296)**	**639**	**Altay-Sayan**	Karyakin & Nikolenko (2008)
2003	2.90		10	29	Altay-Kray	Karyakin & Nikolenko (2005/2)
2004	2.86		7	20	Altay-Kray	Karyakin & Nikolenko (2005/2)
?	(1,63)		(3)	(~5)	Tula	Baumgart (1991)
?	(0,33)				Tula	Baumgart (1991)
2010	2.50		4	(10)	Republic of Altay	Vazhov *et al.* (2010)
2009	2.50		12	(30)	Altay-Sayan	Karyakin & Nikolenko (2011)
2010	*2.83*	*(42)*	*23*	*(65)*	Altay-Sayan	*Karyakin & Nikolenko (2011)*
2011	2.86		22	(63)	Altay-Sayan	Karyakin & Nikolenko (2011)
2011	*3.08*		*13*	*(40)*	*Republic of Tuva*	*Karyakin & Nikolenko (2011)*
2011	*2.17*		*6*	*(13)*	*Republic of Altay*	*Karyakin & Nikolenko (2011)*
2011	*3.33*		*3*	*(10)*	*Altay Kray*	*Karyakin & Nikolenko (2011)*
SERBIA						
1986	2.50	9	4	10	Sreme	Puzovic (2007)
1994	2.60	8	3	7	Sreme	Puzovic (2007)
2004	2.50	5	2	4	Sreme	Puzovic (2007)
SLOVAKIA						
1982	2.93	18	14	41		Baumgart (1991)
1983	2.70	18	9	24		Baumgart (1991)
1984	2.30	13	3	7		Baumgart (1991)
1976-2010	3.20	345	247	797	all country	Chavko. Unpublished.
UKRAINE						
late 2000s – early 2010s	3.09		64	198	Crimea	Myloboh (2012)

	3.90				Dnipropetrovsk	Myloboh (2012)
	2,7-3,2				Odessa	Myloboh (2012)

Annex 2 Falconer survey questionnaire

Date:…….. Country: ……..Name (optional): …….. Age: ……..
1 - Why do you practice the sport of falconry? ……..
2 - How many years have you practiced the sport of falconry? 1-5 years 5-10 years 10-20 years more than 20 years
3 - How many falcons do you have now? And from which species are they?
4- In the last 10 years, how many wild falcon have you had with CITES? …….. without CITES from within your country? …….. without CITES from another country? ……..
5 - What is the longest period which a falcon has stayed with you? ……..From which species is it? ……..What happened for it? ……..
6 – Which one from the species of falcons do you prefer? What is the reason?
7 – Sort falcon species according to your preference?
8 - If you are someone who traps (captures) wild falcons: A - How many falcons have you trapped (captured) by yourself in the last 10 years? - Saker…….. - Peregrine…….. - Barbary……..- Lanner…….. B - In which months of the year the trapping of falcons take place? And what is the most convenient time of the day to catch them? C- In order to ensure a good supply of wild falcons for the future, would you be prepared to register and mark (e.g. with a ring) all trapped birds? □ Yes, gladly □ only if paid to do so □ No
9 - Reasons for the decreasing numbers of falcons: - There are many falcons' trappers. □ Agree □Disagree - Maintaining a falcon in the captivity for a long time □ Agree □Disagree - Increasing the price of falcons which leads trappers to seek them more to gain more of money. □ Agree □Disagree
10 - Methods that can be followed to reduce the diminishing numbers of falcons:
• There should be an Identification Card for the falcons which allows that falconer to use it for hunting. □ Agree □Disagree
• There should be an Identification Card issued by the Wildlife Authority for the falconers that allows them to possess a falcon. □ Agree □Disagree
• The price of the falcon should be set according to its species. □ Agree □Disagree
• Setting a specified period for keeping a falcon. □ Agree □Disagree
• Establishing breeding centers for falcons. □ Agree □Disagree
• Establishing veterinary hospitals for falcons in the areas with high abundance of falconers. □ Agree □Disagree
• Establishing falconers clubs in the areas with high abundance of falconers. □ Agree □Disagree
11- New regulations are making it harder to have wild Sakers: □ Agree □ Disagree
12- How many dollars do you expect to pay for a wild Saker now? ……..
13- In order to ensure a good supply of wild Sakers for the future, how much above that price would

you pay for a wild Saker that was legal with CITES?			
□ Nothing	□ $100	□ $200	□ $500

Annex 3 Costing of use-cases for Saker adaptive management system

The costing takes into account the following requirements:

- A large part of the application is designed as a web application running through a suitable web server such as Internet Information Server (IIS) on a Microsoft server operating system or Apache on Linux.
- The application is to be developed in Microsoft .Net 2010 with ASP .Net written in C#, if running on IIS, or in PHP if running on Apache
- Application data are to be stored in a relational database, e.g. SQL Server or MySql. Database tables will be optimised with indexes and will be normalised as far as is sensible for optimal performance.
- XHTML, CSS and JavaScript are to be used to manipulate and display the application in the browser. This code will be written to W3C accessibility standards.
- The user interface is designed to run in Internet Explorer versions 8 and above, Mozilla Firefox, Apple Safari, Opera and Google Chrome. It will run on any computer that supports the above browsers e.g. Microsoft Windows, Linux variants and MAC OS. It is possible to develop the applications to run the pages in smart phones and tablets browsers though this has not been costed.
- The application is to use third party web services where necessary and available, for example to take and distribute credit card payment.
- To receive SMS text messages, a GSM (Global System for Mobile Communications) modem must be attached to the server, or to a remote computer that can communicate with the server, and suitable software, written in Java, C#, C++ or PHP, must be created to communicate with the modem, parse the received messages and insert the data in the database. Alternatively it may be pertinent, for example if a phone signal is not available, to use a third party service such as Twilio to send and receive messages and pass the message to our server.
- The law enforcement application controls an RFID scanner and it is unlikely that any provided developer toolkits can be run from a browser. This means this application will use a runtime that can access the native API and will be written in Java, C#, Objective C or C++ depending on the developer toolkit provided.

Actors in this costing include:	The developer: costed for Anatrack and its development partners System administrators: set up and edit all users and manage payments Biology administrators: manages bird data Taggers: tag birds and are paid for tagging Falconers: register birds, view bird history and make payments Law enforcers: scans bird tags, views birds info and is alerted to illegal birds

All except for the developer is considered an application user; each actor above has a proprietory interface. A design and preparation stage must be completed before the application is programmed.

Action	Description	Hours of code writing
Design and Preparation		
Analysis and architecture	Build a requirements list, identify data objects and functionality and create formal designs based on these.	40
Specification document	Complete with costings and roadmap	16
Wireframe designs	To indicate GUI requirements (approx 60 pages @ approx 1 hour each)	60
Database design	Designing the database tables, fields, indexes and data relationships and scripting to SQL so it can easily be installed.	24
Graphic design	General graphics design for web page and form layouts of each application. This is crucial for a professional looking application though is as important for usability as for good looks.	32
Environment setup	Setting up a development environments (installing software, databases, creating paths etc)	8
Payment mechanism	Payment is critical and could be mixture of one-off and subscription payments, credit card and direct debit, automated and manual processes. A suitable payment engine should be selected. To avoid strict security compliance laws actual payment could be handled by the chosen engine's own payment pages but these would need to be integrated into the application. Note that the procedure for acquiring payment engine accounts often takes several months to complete.	40
Messaging mechanism	Users could be encouraged to communicate with each other through a web-based messaging system built in to each of the interfaces. As well as emailing the relevant users, the message would be stored in the database for a central record of conversations, to help solve disagreements and to log ideas/enhancements etc	40
System Administrator Interface		
The system administrator interface will run in web pages for remote access to the central database		
Template and navigation	Includes page furniture to appear throughout the administrator web pages with links to all pages in the administrator tool.	16
Login	Access to administrator tools must be restricted. Here he enters user name and password	8

Forgot password	Two pages and an email to allow user to reset his own password. For security, all system passwords are encrypted and cannot be read directly.	8
View/edit details	Allows for changing name, address, password etc	8
List users	List all users for editing. Filters and search tools help find events quickly.	8
Create users	Create other system users: administrators, biology admin, taggers, falconers and law enforcers	8
Edit users	Change their details, name, email address, password and role	8
Email users	Bulk email users from the application or email individuals	8
View user events	Provides the ability to quickly see user activity - log in, event creation etc.	8
Access to biology admin accounts	Use biology admin application as if the administrator had logged in as a particular biology admin user.	4
Access to tagger accounts	Use tagger pages as if the administrator had logged in as a particular tagger.	4
Access to falconer accounts	Use tagger pages as if the administrator had logged in as a particular falconer .	4
List law enforcement installations	A list of the law enforcement installations	8
View/edit law enforcement installations	Allows set up and logging of law enforcement installations recording where they are and providing an installation code to identify communications from the installation.	8
Delete law enforcement installations	Delete an installation record	4
List payments	View all payments made	8
Create payments	Make payments to users as required. So that all payments are recorded within the system, refunds must also be made through the interface.	16
Manage messages	As part of the databased messaging system, admin can view, filter and search all messages and conversations, create new messages to start a conversation or to reply to another message. Messages are emailed as well as stored in the database.	24
View user conversations	A specific list of conversations for a particular user. This would be accessed from the user's page and includes search tools.	8
Biology Admin Interface		
The interface for Biology admin will run in web pages for remote access to the central database		
Template and navigation	Includes page furniture to appear throughout the biology admin web pages with links to all pages in this interface.	16

Login	Biology admin enters username and password to allow him to use these pages. As for system administrator.	4
Forgot password	As for system administrator	4
View/edit details	Allows for changing name, address, password etc. As for system administrator	4
List birds	List all birds currently registered. Biology admin can use filters and search tools to help find an individual bird quickly.	8
View bird	Allows the biology admin to view the bird details. This will include a generated bird code for sending to taggers for them to send back in an SMS text message. Images can be viewed.	8
Create bird	Creates a database record for a bird. This data in this record will populated by the biology admin and the other actors.	8
Edit bird details	Edit the bird data record such as the description, location caught, feather received, recognition code etc.	8
Add bird images	Photographs of the bird can be uploaded.	8
Delete bird	Delete a bird record only if it is not valid or a repeat.	4
Merge birds	It is possible that two separate records are created for the same bird for example, a facloner registers a new bird that turns out to be already logged. This functionality allows the records to be merged, keeping the events and, where possible, the details for both records.	16
Manage bird events	Bird events describe a history of a bird as it is initialised, one of its feathers is received and analysed, it is tagged, registered with a falconer, passed through customs, dies etc. The biology admin can see these events and may be able to create/edit/delete them as he sees fit. Events have a User, Type, Description and Date associated with them.	16
Create "Received feather" event	The biology admin will definitely create an event when he receives a feather from a tagger.	8
View bird alerts	Displays a summary of bird alerts and other reports	8
Contact admin/manage messages	As for other users, this provides a system-recorded way of contacting admin or other users with queries and continuing conversations. Includes the ability to view, filter and search conversations, create new messages and continue conversations.	8
Tagger Interface		
The most important part of the tagger application is the ability for the system to receive SMS text messages containing the bird ID and add a "tagged" event to the database. The rest of the tagger's application is a browser application for viewing tagged birds and payments.		

Receiving SMS text messages	Text messages received from the tagger must be parsed and the data for the relevant bird written to the database. There are two sensible ways to deal with the small amount of traffic anticipated: either connect a GSM modem to the server or imploy a third party such as Twilio to intercept messages and send them to our server. The SMS will parse for bird code and telephone number. A "tagged bird event" database record is created for the bird matching the code and tag user matching the telephone number. Repeat events and events with unrecognised codes and telephone numbers are also logged and flagged as alerts for the biology admin	32
Template and navigation	Includes page furniture to appear throughout the tagger web pages with links to all pages in this interface.	16
Login	Tagger enters username and password to allow him to use his pages. As for system admin.	4
Forgot password	As for administrator	4
View/edit details	Allows for changing name, address, password etc. Importantly, the tagging mobile telephone number can be changed in order to recognise the user sending the SMS	4
View/edit payment details	Depending on the payment mechanism utilised, the tagger and view and perhaps edit the details of the bank account/paypal account/credit card to which payments are sent.	8
View birds	View a list of birds tagged with a limited view of events	8
View payments	View a list of payments to date	8
Contact admin/manage messages	As for other users, provides a system-recorded way of contacting admin or other users with queries and continuing conversations. Includes the ability to view, filter and search conversations, create new messages and continue conversations.	8
Privacy Policy	What we do with collected data	8
Terms and Conditions	What a user can do with the application	8
Falconer Application		
The interface for falconers will run in web pages for remote access to the central database		
Template and navigation	Includes page furniture to appear throughout the falconer web pages with links to all pages in this interface.	16
Signup	Falconers can sign up to the use the application. They enter username, password, contact details, etc.	16
Login	Falconer enters username and password to allow him to use these pages. As for system admin	4
Forgot password	As for administrator	4
View/edit details	Allows for changing name, address, password etc	4

List birds	List all birds currently registered to logged in falconer. Filters and search tools to help find an individual bird quickly.	8
View bird	Allows the falconer to view the bird details and its history.	8
Register exisiting bird	Falconer registers a bird by entering the provided bird code. This will create a bird registration event.	8
Register new bird	Falconer can add a bird he already owns to the system. This will create a bird registration event. Bio admin is alerted to send tag/envelope.	8
View payments	View payments made to the system	8
Make payment	Payments are made either on registering a bird or on sign up.	8
Privacy Policy	What we do with collected data	8
Terms and Conditions	What a user can do with the application	8
Law Enforcement Interface		
The law enforcement application uses a runtime with native access (e.g. Java, Winforms or Cocoa) on a suitable hardware terminal (e.g. personal computer or smart phone). Tag scanning hardware is attached; scans are logged centrally and the law enforcer is alerted to illegal birds.		
System startup	The software runs when the system starts. There is no login - system has been installed with a unique code to identify it.	4
Interface and navigation	Create the interface and buttons to different parts of the application	16
Test connection	The software regularly tests its connection to the central database and alerts the user if there is a problem.	8
Store data locally	If the internet connection is lost, store input data locally until it is restored.	8
Software update	The software is alerted to new versions and automatically updates itself.	8
Scan tag	RFID scanner is attached to the terminal. When it is used to scan a tag on a bird, the tag data and terminal id is automatically posted to the remote database to create a scanned bird event record for the bird.	16
View bird details	The server responds by posting back the bird details. This will include the legal status of the bird so that suitable action can be taken.	8
Report untagged bird	If bird is untagged, law enforcer and bio admin are alerted so that suitable action can be taken.	16
Access Pages		
The access pages are a web page or pages that provide links to the different areas of the application, significantly to the falconer signup and login. They can also act as marketing for the project and would be search engine optimised for "saker falcon"		

Graphic Design	These pages are public-facing and need to be suitably styled and layed out.	16
Template and navigation	Site headers and footers for every page. Would include links to the various user applications.	12
Home Page	Introduction to the project. Photographs and screenshots	8
About	Describes the project in more detail.	8
Privacy Policy	What we do with collected data	8
Terms and Conditions	What a user can do with the application	8
Cookies policy	Provide explanation of cookie use and allow user to agree to their use (users cannot log in without cookies enabled)	8
Contact Us	Provides contact details and form to message the system administrator	8
Search Engine Optimisation and Registration	Site needs to reach the those who are interested	16
Other Application Tasks		
Help Files	Implementation of a help file system and integration with all the applications.	32
System Testing	The system will be comprehensively tested by the developer. It will also need to be tested by non-development staff or final users.	16
Encryption for secure data transferal	Displaying login and cc card pages over a secure socket layer (SSL) for secure data entry	4
Exception handling	Trapping exceptions and passing them to the developer whilst displaying a friendly message to the user.	4
Server specification and selection	Servers and a hosting solution need to be selected to run the applications and database with an eye to performance and on-going cost.	8
Law enforcement terminal and tag scanner specification and selection	Terminals for running the law enforcement software need to be selected along with the scanners for the tags	8
RFID tag specification and selection	Suitable RFID tags for attaching to birds must be selected.	8
Server patching strategy	Describes a mechanism to update the operating software (OS and databases) on the live servers with the minimum of downtime.	4

Load balancing and redundancy strategy	Describes a mechanism for adding new servers to the application in case the current hardware cannot support the user load (makes the application scalable). It also considers a database redundancy mechanism as emergency backup, possibly automated in case of primary database failure. This needs to be considered but there may be no work to be done as the user base, and server loads, will not be large.	2
Application installation and update strategy	Automated scripts to aid recompilation and database rebuild. Describes a mechanism to update to the live application with the minimum of downtime.	8
Backup mechanism design and development	Automated scripts to transfer compressed copies of the database to a remote location. In case of total server failure, the application can be reconstructed from these backups.	16
Staging setup	This is where updates to the system will be tested for user acceptance. It needs to run web and database server software, a GMS server and a firewall. The small-to-medium sized scale of the project suggests it will not need load balancing.	16
Live setup	This is where the final system resides after thorough testing. It needs the same hardware and operating software as the staging setup.	16
	TOTAL HOURS	1,090
	Total Days	136.25

Notes
Development documentation can be provided in as much detail as required but has not been costed.

As well as the time required for coding there are a number of architecture and design tasks as well as time required to specify server and terminal hardware and install the software. There is a approximately 140 days of development work for the application laid out but this might change as other requirements become clear.

There are a number of uncosted tasks including the costs of hosting the web applications and database, law enforcement hardware acquirement and software installation, system testing, training and support, use of a third party payment and/or SMS engine, content creation for some of the pages and system use. The cost of these elements cannot be estimated here. They include:

Hosting hardware and software	This is the cost of physical or virtual machines, owned or rented and hosted at a data centre. It includes the cost of licences for software required to run the database, receive SMS text messages and serve web pages.
Tag hardware	Each bird will need a RFID tag. A number of these will also be required for testing purposes.

Law enforcement terminal hardware	Law enforcement will need computers with an RFID tag scanners attached to each. Scanners, and in some countries also the computers, will need to be provided by project administrators.
Law enforcement terminal software installation	The law enforcement machines will need to be set up to run the software to scan tags and communicate with the central database.
System and acceptance testing	Crucial to guarantee a stable and functional web application. The more the application is tested, the better. This should not be completed by the developer.
Training, support and help page content.	Users, particularly taggers and law enforcement will need training in the use of their applications. Though this should be minimal, it should be factored in to project costs. Administrators will need to supply support to users, answering usage questions via email or on the phone. All applications will need comprehensive help pages. The better the written help, the less time will be needed to train users or supporting them.
Access page content	The marketing pages will need clear and to-the-point content - images and text to explain the content and to encourage falconers to participate.
Payment engine costs	The payment engine provider will specify a fee for use of its product.
Third party SMS service	If required, there will be a fee for this service
System administration	There is a cost involved with running the system, administration of users and payments and other tasks.

Saker Falcon Task Force, Objective 8 Working Group Report

A review and synthesis of current Saker Falcon *Falco cherrug* field monitoring and research activities

Lead: Johannes Stahl

Contributors: Daniel Kachelriess, András Kovács, Mátyás Prommer, Robert E. Kenward, Janusz Sielicki

Version: Final version

Date: 11 July 2013

Acknowledgments

Many thanks to the Saker Falcon Task Force Objective 8 Working group members: Monif Al Rashedi (Faculty of Science, KSA), Nigel Collar (BLI), Andrew Dixon (IWC), Maxim Gavrilyuk (CNU, Ukraine), Daniel Kachelriess (CMS, Secretariat), András Kovács, Martiros Nalbandyan (MoNP, Armenia), Elvira Nikolenko (RRRCN, Russia), Mátyás Prommer (MME), Mohammed Shobrak (KSA), Janusz Sielicki (IAF), Fernando Spina (CMS, Scientific Council) and Johannes Stahl (CMS, Secretariat).

Additional information was provided by the following Saker Falcon Specialists: Evgeny Bragin (KZ), Anatoliy Levin (KZ).

We also wish to convey our gratitude to the the Coordinating Unit for the Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MoU), Aurelie Boutrou and Nick Williams.

Recommended citation:

Stahl, J., Kachelriess, D., Kovács, A., Prommer, M., Kenward, R.E., Sielicki, J. (2013) A review and synthesis of current Saker Falcon (*Falco cherrug*) field monitoring and research activities. *In:* Williams, N.P., Galbraith, C. and Kovács, A. (eds.) Compilation Report on WorkPlan Objectives 4 – 8, including a modelling framework for sustainable use of the Saker Falcon *Falco cherrug.* UNEP/CMS Raptors MoU Coordinating Unit, Saker Falcon Task Force, Abu Dhabi, UNEP/CMS Secretariat, Bonn.

Table of Contents

List of abbreviations

CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
COP	Conference of the Parties
EURAPMON	Research and Monitoring for and with Raptors in Europe
IUCN	International Union on the Conservation of Nature
MoU	Memorandum of Understanding
PIT	Passive Integrated Transponder
PTT	Platform-Terminal-Transmitters
SakerGAP	Saker Falcon Global Action Plan
SFT	Saker Falcon Task Force
UNEP	United Nations Environment Program

I. Executive Summary

1. The Saker Falcon *Falco cherrug*, due to the negative trend of some populations and high uncertainty in global population estimates, was listed on Appendix I of CMS at COP10 2011 (UNEP/CMS/Res.10.28). It is also protected through other international (e.g. CITES Appendix II) and European (Bern Convention, EU Birds Directive Annex I) instruments and listed as globally endangered by International Organizations (IUCN & BirdLife International). A Saker Falcon Task Force (SFT) was established in the same resolution (UNEP/CMS/Res.10.28). Four working groups were established relating to objectives of the 2012-2014 Work Plan with the aim to present a Global Action Plan for the Saker Falcon (SakerGAP) to COP11 of the CMS, scheduled to be held in 2014.

2. The aim of the Objective 8 Working group was: **to plan and implement fieldwork**, with the following sub-Objectives:
    - 8.1 Utilize best practice to design a monitoring plan and potential monitoring methods applicable in key range countries at different scales and sufficient to ensure that information about the status of the Saker Falcon populations is available to inform conservation decisions.
    - 8.2 Provide assistance in setting up and maintaining population monitoring systems.
    - 8.3 Promote and support research planning and field research on the conservation of the Saker Falcon.
    - 8.4 Facilitate active collaboration between researchers, falconers, trappers (where possible) and local administration involved in Saker studies.
    - 8.5 Explore the possibility of monitoring the impact of pollutants on the Saker Falcon.

3. A short questionnaire was circulated to all Working Group members. Five answers to the questionnaire were received (attached in Annex II), providing information for Croatia, Hungary, Kazakhstan (three replies, one specifically for Northern Kazakhstan), Mongolia, Romania, Russia, Slovakia & Ukraine as well as knowledge transferable for China. Additionally two monitoring protocols were received, one for Mongolia, and one for Hungary, that is also applied in Croatia, Slovakia & Romania (attached in Annex III). Reviewing the specific role of the countries for the Saker Falcon we find that we have information from 5 out of 9 countries in the key breeding range (Hungary, Kazakhstan Mongolia, Russia & Ukraine).

    3.1. Design of Monitoring Plan

    Common elements of current Saker Falcon Monitoring protocols are:

    - Monitoring of previously known nests
    - Determination of nest occupancy & brood size
    - Definition of Age/Growth stages
    - Some convention concerning tagging/identifying individuals
    - Interaction rules to limit disturbance of bird

However the methods and definitions behind these common elements still vary strongly between the countries and harmonization is necessary.

The global Saker Falcon population is not continuous, but fragmented into several meta-populations. Prioritization of the conservation efforts of the various meta-populations would be important to maximize resource use efficiency. However, first a relatively accurate geographical mapping of meta-populations and connections between them is necessary. To this end, a base-line field survey, monitoring of some selected sample areas, as well as satellite-tracking of individuals of meta-populations are needed.

As only parts of populations are monitored, up scaling the data collected in the field through modeling is necessary. For this a monitoring plan should provide the input data. For information on reproduction data on occupied nests, brood size and productivity needs to be collected. Another parameter on which good information is needed is survival/mortality.

Sources of data that are not represented in our review results but should be considered are the following:

- Trapping Data
- Official records by authorities (e.g. confiscation)
- Compilation of Data published in Raptor Conservation Journals and similar sources
- regular monitoring of pylons of electric power lines in the breeding/wintering area (e.g. data on mortality)
- Data from existing Marking/Reporting Networks (e.g. breeders, veterinaries in falconry hospitals and during ringing chicks in some regions).

This report recommends developing a common standard monitoring protocol within the SakerGAP process, by agreeing on a minimum set of parameters to be collected in each range state, using comparable methods and common definitions, - taking into account the inputs and needs by other WGs.

3.2. Assistance in setting up and maintaining monitoring systems

Drawing on the SFT country priority list (Version 1.0), it was possible to review how well our knowledge on the current monitoring entails countries that are important for the Saker Falcon. Winter habitat use remains to be assessed.

Of the countries not directly covered in our survey replies, gathering information on and providing assistance to China has the highest priority. In addition, countries of importance are the countries with medium priority: Afghanistan, Bahrain, Kuwait, Kyrgyzstan, Pakistan, Qatar, Syria, Turkmenistan & Uzbekistan. Engaging more countries in which key users live and trapping takes place should also be a priority. For trapping those would be Afghanistan, Pakistan and Syria, for key users Bahrain, Kuwait and Qatar.

Based on these considerations, this report clearly identifies a need for a better understanding of monitoring efforts, if existent, especially in the following countries: China, Afghanistan, Bahrain, Kuwait, Pakistan, Syria, and Qatar.

Where no monitoring system exists ways to provide assistance to setting up and maintaining monitoring systems should be explored, based on the best practice agreed on in Chapter 3.1. This also applies to Saudi Arabia, where setting up a monitoring systems or integrating trapping data (as discussed) should have a high priority as well.

3.3. Promote and support research planning

Coordinated research planning and field research can save a considerable amount of money and effort. Inputs from other working groups highlight the need to increase data quality on population size, trends and range/habitat as well as on survival and migration routes.

Several suitable methods are presented and discussed in this report to meet these needs. Better knowledge on population sizes and trends could be achieved by extended marking/tagging at nests and collection of DNA samples combined with a standard protocol and a common data and DNA sample repository. Also as discussed in 3.1 the possibility of using different kinds of data, e.g. trapping records and/or official records to monitoring population size and trends should be explored. Better knowledge on habitat use could be gathered by including data collection on habitats and prey species into monitoring plans of field research activities. To analyze migration routes, solid tracking methods would be needed, such as the ones which are already in use in some countries (e.g. Hungary). Improvement could come from advanced tracking technology. This would also lead to better data on survival, as would research on specific sources of attrition, (e.g. electrocution, trapping, pollution). It should be considered whether it is feasible to integrate data collection to address these issues into a regular monitoring plan or whether separate research efforts are to be conducted.

In sum, the conservation of the Saker Falcon would benefit from coordinated research planning. This report recommends first identifying the most pressing research needs, taking into account the gaps and needs identified in the SFT Objective 6 and 7 Working Groups.

3.4. Facilitate collaboration

From the responses to the questionnaire and the monitoring protocols received it becomes evident that already within the science community among different countries, standards and methodologies differ. Agreeing on a minimum set of data to collect, common definitions and comparable methods will likely be necessary for good collaboration. Synergies should be sought when facilitating active collaboration, building trust, collecting data for socio-economic models and possibly exploring new sources of data for Saker population monitoring. Also, a common data infrastructure would be beneficial.

3.5. Monitoring the impact of pollutants

Finally it can be concluded that the monitoring of pollutants seems feasible and now needs to be implemented in all study areas.

II. Introduction

The Saker Falcon (*Falco cherrug*) is considered threatened by land use and land cover change, unsustainable rates of live capture, chemical pollution, hybridization and electrocution by power lines (BirdLife, 2012). The estimate of the global population (ca. 12,800-30,800 mature individuals) has a high uncertainty; national estimates within the range states have varying certainties.

Due to the negative trend of some populations and high uncertainty in population and trend estimates, the Saker Falcon was listed under the Appendix I of CMS at COP10 2011 (UNEP/CMS/Res.10.28). It has also been listed under Appendix II since the initial CMS. The Saker Falcon is further protected under other international (e.g. CITES Appendix II) and European (Bern Convention, EU Birds Directive Annex I) instruments and listed as "Globally endangered by International Organizations (IUCN & BirdLife International). For a detailed overview of relevant international policies & legislation, see the Saker Falcon Task Force, Objective 4 Working Group Report.

To advance global action on the Saker Falcon protection a Saker Falcon Task Force (SFT) was also established at COP 10 in the same resolution (UNEP/CMS/Res.10.28).During its first Meeting in March 2012 in Abu Dhabi, UAE, four working groups were established relating to objectives of the 2012-2014 Work Plan with the overall aim to present a Global Action Plan for the Saker Falcon (SakerGAP) to COP11 of the CMS, scheduled to be held in 2014.

The aim of the Objective 8 Working group is: **to plan and implement fieldwork**. The following Objectives of the working group were agreed on:

8.1 Utilize best practice to design a monitoring plan and potential monitoring methods applicable in key range countries at different scales and sufficient to ensure that information about the status of the Saker Falcon populations is available to inform conservation decisions.

8.2 Provide assistance in setting up and maintaining population monitoring systems.

8.3 Promote and support research planning and field research on the conservation of the Saker Falcon.

8.4 Facilitate active collaboration between researchers, falconers, trappers (where possible) and local administration involved in Saker studies.

8.5 Explore the possibility of monitoring the impact of pollutants on the Saker Falcon.

The availability of high quality field data with low uncertainty is vital for the successful protection and/or management of the Saker Falcon.

There is however no comprehensive overview of global field work and monitoring efforts for the Saker Falcon. The first step to advance towards these objectives is therefore to compile a body of knowledge of how and what field and monitoring work has been conducted until now in the different range states.

Then the methodologies will be compared between countries or, if applicable, between different ecosystems. It has been agreed by the Working Group Members that the group should not "simply

perpetuate existing activity, hence the need to take a wider view, developing a clear programme of activity based on the needs as expressed through the SakerGAP process." (Raptors MoU, unpublished). This involves identifying if- and if yes, which - methodologies are best suited to standardize Saker Falcon monitoring and field work for the different range states and ecosystems. Suggestions on best practice, taking into account the different regions, will be agreed on, where possible.

Based on this review, suggestions for the design of an ongoing monitoring plan for Saker Falcon populations across the range of the species will be drawn.

It will also provide insight in how assistance in setting up and maintaining monitoring systems can be best provided and where it is most necessary, e.g. by comparing knowledge on field monitoring to the Country Priority List of the SFT (Version 1.0) and identifying important gaps.

This review will also help to promote and support research planning and field research and identify, where possible, the best ways to do so.

It will facilitate active collaboration between researchers, conservationists, falconers, trappers (where possible) and local administration involved in Saker studies by contributing to the SakerGAP process.

Taking into account available knowledge of the different monitoring and fieldwork methodologies it is necessary to assess the feasibility of monitoring the impacts of pollutants of the Saker Falcon. Being aware of the relevance of this topic, this report will explore if it is possible to integrate this aspect in the future monitoring plan and research.

It should be noted that the implementation of a monitoring and research plan of the Saker Falcon across its range will be a medium to long term effort, therefore the focus of this working group will be on how to best implement and manage this work (Raptors MoU, unpublished).

In the conclusions the report will present and evaluate the findings of the Working Group which are most relevant for the SakerGAP and then give recommendations on the next steps to be taken in setting up a monitoring and field work system for the Saker Falcon. A short executive summary of the compiled information in this report will be prepared and incorporated into the drafting process of the first SakerGAP.

III. Work methods / Approach

The report follows the definition of monitoring of Elzinga *et al.* 2001 in which authors define "*monitoring as the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective."*

In contrast the term 'study' is used for example in the case of non-repeated data collections[3].

EURAPMON also offers further considerations concerning the role of monitoring for adaptive management[4]

III.1. Country Prioritization Report

As in other fields work prioritization is essential for the effective allocation of limited resources in the global conservation of the Saker Falcon. During the initial planning phase of the SakerGAP, the Coordinating Unit of the Raptors MoU performed a country prioritization exercise and prioritized range countries in a grid analysis based on the following weighted criteria:

- Countries with significant Saker breeding population size
- Countries with declining Saker populations
- Key breeding range countries
- Key source countries of wild Sakers
- Key user countries of Sakers of wild origin
- Countries applying Sustainable Use initiatives (e.g. Mongolia, UAE)
- Countries with well-studied Saker populations
- Parties of Multilateral Environmental Agreements (CITES, CMS, Raptors MoU)

An early Version (Version 1.0) of the Country Prioritization list can be found in Annex I. The countries with critical priority are: China and Russia. Countries with high priority are Hungary, Kazakhstan, Mongolia and Saudi Arabia. Countries listed with medium priority are Afghanistan, Bahrain, Kuwait, Kyrgyzstan, Pakistan, Qatar, Syria, Turkmenistan, Ukraine and Uzbekistan..

[3] *Based on this definition "we can make a clear difference between 'monitoring' and 'study'", 'study' describing a situation when you do not compare your data coming from different time-series to reveal changes in time in the conditions of the environment.*

[4] *There is a clear link between conservation objectives, monitoring and adaptive management. Good objectives are critical to successful monitoring. What is measured, how well it is measured, and how often it is measured are features of a monitoring scheme that are defined by how an objective is articulated. The objective describes the desired condition. Management is designed to meet the objective. Monitoring is designed to determine if the objective is met. Management is changed if monitoring reveals a failure to meet the objective. "Objectives form the foundation of the entire monitoring project."*

III.2. Questionnaire

In order to seek initial information on current monitoring and research activity concerning the Saker Falcon a short questionnaire was circulated to all Working Group members.

Five answers to the questionnaire were received, providing information on monitoring for **Croatia, Hungary, Kazakhstan (**three replies, one specifically for **Northern Kazakhstan), Mongolia, Romania, Russia, Slovakia & Ukraine** as well as knowledge transferable for **China** (attached in Annex II).

Furthermore for **Saudi Arabia** no scientific monitoring takes place but trapping data would be available. The possibility of including trapping data will be discussed in the respective chapters (e.g. 3.1., 3.3. and 3.4.).

The following presents the questions of the questionnaire and a summary of the most common answers in the replies:

1. Please indicate to which country/countries the information you provide is applicable.
   Croatia, Hungary, Kazakhstan (& Northern Kazakhstan), Mongolia, Romania, Russia, Slovakia & Ukraine

2. Which data is collected for monitoring Saker Falcons?
   All countries reported that **nest occupancy** and **brood size** are collected. **Breeding success** is systematically monitored in Croatia, Hungary, Northern Kazakhstan, Mongolia (using the program MARK (White & Burnham, 1999))**,** Romania, Slovakia & Ukraine and selectively monitored in Kazakhstan & Russia**. Clutch size** is collected in Mongolia, Kazakhstan & Russia. In Croatia, Hungary, Mongolia, Romania & Slovakia a **ringing program** is implemented and ringed chicks and ring recoveries are counted. In Ukraine a few individuals are ringed selectively.

3. How is the data collected? Which methods are used?
   All countries base a part of the data collection on **previously known nest locations and areas** (artificial nests in the case of Mongolia). In Russia & Kazakhstan, this is combined with a **random stratified survey.**

4. How often is data collected? At which time of the year?
   In **Croatia, Hungary, Romania & Slovakia** monitoring is conducted at least twice a year, at the start of the breeding season and at the time when chick can be ringed. In **Mongolia, Kazakhstan & Russia** it is conducted annually during the breeding season (April -July), as well as in some areas of **Northern Kazakhstan**, while others are not annually monitored.

5. How many people are involved in data collection? How much time are they dedicating on average?
   Data collection effort was calculated multiplying people involved with days of monitoring. Effort by country varies from 14-35 Person*Days (**Ukraine**) to 1050-1400 Person*Days (**Mongolia**), with **Hungary** (350-400 Person*Days) and **Russia & Kazakhstan** (152.5-305 Person*Days, 270-360 Person*Days) in the middle.

6. Are the data collection efforts coordinated at national level? If so, by whom?
   Coordination a national level takes place in **Croatia** (Darko Grlica)**, Hungary** (János Bagyura), **Romania** (Luca Dehelean), **Russia** (Igor Karyakin) **& Slovakia** (Jozef Chavko)**.** In In **Mongolia** coordination exists only for specific study areas (artificial nests) and in **Ukraine** and **Kazakhstan** it only happens partially (in part by Igor Karyakin).

7. Are there differences in data collection between different areas/ecosystems (e.g. in the kind of data collected, or methods used)?
   No

8. Is there a standardized field monitoring protocol? (If so, could you share it with the working group?)
   Some countries have an extensive standardized monitoring protocol (**Croatia, Hungary, Mongolia, Romania & Slovakia**). **Kazakhstan & Russia** have a standardized data entry form.

9. Does the data collected allow for monitoring the impacts of pollutants?
   With the current Monitoring Methods, Monitoring for pollutants is only possible in some countries. In Croatia, Hungary, Mongolia, Romania & Slovakia **feather samples** and **food remains** are collected**.** In Croatia, Hungary, Romania & Slovakia **unhatched eggs** are also collected.

III.3. Monitoring Protocols

Additionally to the questionnaire replies two Monitoring Protocols were received, one for **Mongolia**, and one for **Hungary**, that is also applied in **Croatia, Slovakia & Romania** (attached in Annex III).

The monitoring protocols provided additional input to the survey questions, but also some additional information that was not covered in the survey questions. The report will first summarize the common elements:

- All answers received, Monitoring Protocols & Responses to Questionnaires) show that not the whole population is covered by monitoring.
- Both Monitoring Protocols included a guide to identification of age groups. However the number groups which are differentiated varies, with 4 (Chick, Juveniles, Sub-Adult, Adult) in **Croatia, Hungary, Romania & Slovakia** and 14 Growth stages in **Mongolia**.
- Also, the convention and procedure for bird marking is elaborated in both protocols. In **Croatia, Hungary, Romania & Slovakia** the left leg is marked with an ornithological ring and sometimes the right leg of the Bird is marked with a Passive-Integrated-Transponder (PIT) tag[5]. In **Mongolia** there is no convention for which leg to use for ringing.

[5] *The PIT was used in two subsequent years and on a limited number of birds. Now, color rings are used in some areas in Hungary and Romania.*

- Both Monitoring Protocols contain rules on how and when to approach the nests: In **Croatia, Hungary, Romania & Slovakia** during hatching and small chicks period observations should be made hidden within 500m distance of the nest and cancelled, should the birds be disturbed. In **Mongolia** as well data collectors are asked to not scare off the breeding birds.
- Collection of moulted feather samples, food remains and pellets is intended in both Monitoring Protocols.

The Monitoring Protocol for **Hungary** that is also applied in **Croatia, Slovakia & Romania** adds the following elements:

- The monitoring protocol for Hungary differentiates between monitoring the Saker Falcon if no nest is found and nest monitoring. Both old and new nests are monitored. Nevertheless they also stress that not the whole population is covered.
- Satellite Transmitters (PTTs) are mentioned additionally to color rings and PIT tags. Satellite tracking is used for studying juvenile and breeding dispersal, migration and habitat use. Considering financial constraints satellite-tracking has been part of the two LIFE programme (2006-2010 and 2010-2014). More than 60 juveniles (at fledging) and 19 adults have been tagged in Hungary so far.
- Furthermore a definition of "territory" and different kinds of nests, including different kinds of artificial nests, is provided.
- From 2012 some nests (mostly where adults are satellite tracked) have been equipped by camera traps to collect information on prey items. Remains are collected when ringing the chicks and after the breeding period for later analyses.
- The Hungarian Monitoring Protocol also addresses procedures relating to data protection, to regulate that GPS data of nest locations is not centrally stored. This important and interesting additional requirement will be discussed in more detail in chapter 3.4.

The **Mongolian** Monitoring Protocol adds the following points:

- During the ringing procedure of chicks, feather samples are taken to allow for DNA retrieval. In general DNA-based methodology is used to identify individual birds.
- Prey availability, e.g. small mammal and passerine abundance within 50m of a vehicle moving at *ca*. 20 km/h is recorded along a sampling grid

Photos are taken of each nest and the temperature of the eggs is recorded.

Table 1: Summary of Questionnaire and Monitoring Protocol information

Data Type	Hungary	Slovakia, Romania, Croatia	Mongolia	Ukraine	Russia, Kazakhstan	Northern Kazakhstan	Kazakhstan, Russia, Mongolia, China
Nest Monitoring	Old and new nests		Artificial nests	Previously known nests	Representative random stratified surveys and census research in 10 plots (Russia)	Known areas	Some Saker Falcon populations
Timing (& Frequency)	At least two times a year (at the start of the breeding season and at the time when chick can be ringed), but possibly more times between [Hungary]		April - July	Varies between regions, mostly focussing on the Crimea and neighbouring areas (areas N-NE from Crimea)	Breeding season(April to July) Russia: Annually	Some areas annually, others not, Survey period from April until the beginning of July (fledglings)	1993 to 2011, annually in breeding season (April-June)
Data collected	Nest occupancy, breeding success, brood (but no clutch) size	Nest occupancy, breeding success, ringed chicks and ring recoveries	Nest occupancy, brood & clutch size, egg temp.	Nest occupancy, brood size	Nest occupancy, clutch size, brood size, catering facilities. Selectively: phenotype +age of pairs, breeding success, nest choice	number, breeding success, productivity, causes of negative impact, nest contents	data on numbering dynamics of species.
Defintion of Ages	4 stages		14 stages	?	?	?	?
Tagging (passive or active)	right leg (PIT) colour ring, left leg ornithological ring		yes, ring	No ringing programme, only few individuals ringed occasionally	?	?	?
Sampling effort	350*400 Person*Days	Slovakia: 8-10 experts, Romania 3 experts, Croatia 1 expert	1050-1400 Person*Days	14-35 Person*Days	152.5-305 Person*Days	?	270-360 Person*Days
Feather Collection	Yes		Yes	Occasionally/No	?	?	?
Food remains	Yes (2 times per year: bone, fur, feather, pellets + nest camera)		Yes (5 new pellets and all prey remains, each visit)	Occasionally/No	?	?	?
Photo	No		Yes	?	?	?	?

Data Type	Hungary	Slovakia, Romania, Croatia	Mongolia	Ukraine	Russia, Kazakhstan	Northern Kazakhstan	Kazakhstan, Russia, Mongolia, China
Non-Nest Monitoring	Yes, Bird monitoring even if nest location is unknown		No	?	Yes, random stratified survey	?	?
Prey Species Monitoring	No		Yes, vehicle transects	?	?	?	?
DNA-Samples	Occasionally / No		Four breast feathers plucked from chicks	Occasionally / No	No	No	No
Satellite Tags	a few dozen birds (juveniles and adults) between 2007 and 2013 to monitor juvenile and breeding dispersal, migration and habitat use	?	No	Ten birds in total in 2011 and 2012	?	?	?
Data Protection	Yes (no central data storage)		?	Yes	No	No	?
Coordination on National level	Yes, there is a programme coordinator for all rare raptor species on national level - János Bagyura	Yes, Slovakia - Jozef Chavko; Romania - Luca Dehelean. Croatia - Darko Grlica	partly, for artificial nests	partly	Yes, Igor Karyakin	No	No
Method depends on habitat?	No		No	No	No	No	No

IV. Outcomes relating to Working Group Objectives

IV.1. Design of Monitoring Plan

(Objective 8.1 Utilize best practice to design a monitoring plan and potential monitoring methods applicable in key range countries at different scales and sufficient to ensure that information about the status of the Saker Falcon populations is available to inform conservation decisions.)

Table 1 summarizes the results from reviewing the questionnaire replies and Monitoring Protocols. Common elements of Saker Falcon Monitoring systems are:

- Monitoring of previously known nests
- Determination of nest occupancy & brood size
- Definition of Age/Growth stages
- Some convention concerning tagging/identifying individuals
- Interaction rules to limit disturbance of bird

The details behind these elements still vary strongly between the countries. The harmonization of existing monitoring activities is an important issue. It therefore needs to be discussed if and how the existing differences can be reconciled in order to make data comparable. Also, for the identification of best practice this will be necessary.

Concerning the timing, monitoring in the key breeding areas mainly revolves around the breeding time of the Saker Falcon, which varies by region, but is around April - July. An earlier report by Birdlife to the Saudi Wildlife Service recommends intensive springtime survey work (Birdlife, 2011). The sampling effort in Person*Days is hard to compare given the data available. It would probably be useful to compare the scales of effort to the estimated population sizes.

Given that one of the aims of this working group is to explore the possibility to monitor for the effect of pollutants on Saker Falcon (see 3.5), it should be noted that the results show five of the nine countries collecting both feather and food remain samples to some degree. For a common monitoring plan this should be extended to all study areas, if feasible. Also the collection and analysis of unhatched eggs, as implemented in Hungary 2010 should be carried out. Analysis shows the presence of 17 different types of persistent chemical pollutants, even DDT that has been banned in Hungary since the 1960s.

Furthermore, agreeing on definitions and then collecting information on the type of nest and the habitat in which the nest is located, although not yet widely implemented, appears to be a relatively easy step to ensure better comparability between the study regions. Also information on habitat management schemes could be collected, as habitat loss and habitat change are important factors for Saker Falcon conservation.

Whether or not to include the other elements of Table 1 that are not yet widely applied (Non-Nest Monitoring, Prey Monitoring, etc.) will also be a question of the amount of resources available (e.g.

manpower & time), on the availability of infrastructure and knowledge and how important the additional information is considered. One option to proceed would be to provide a range of monitoring options from which range countries can choose according to their capacity.

The global Saker population is not continuous, but it is fragmented into several meta-populations. Prioritization of the conservation efforts of the various meta-populations would be important to maximize resource use efficiency. However, first a relatively accurate geographical mapping of meta-populations and connections between them is necessary. For that a base-line field survey, monitoring of some selected sample areas, as well as satellite-tracking of individuals of meta-populations are needed.

It should be noted that in all cases only a part of the Saker population of a respective country is monitored. Therefore up scaling the results of field monitoring to a national or population level is highly desirable. To identify the best suited field monitoring methods and to decide which data should be collected, it would therefore be important to know how this up scaling will be done, and which input variables need to be delivered from field work. The SFT Objective 7 Working Group writes in their draft report that in case of Sakers, in theory, all techniques except migration count data can be used for predictive population models. They include direct observations, monitoring the populations of a certain geographic area, DNA sampling, classical capture-recapture as well as radio and satellite tracking.

Sources of data that are not represented in our review results - i.e. seem not to be actively used in current Saker Falcon monitoring and field work - but that could be considered:

- Trapping Data
- Official records by authorities (e.g. confiscation)
- Compilation of Data published in Raptor Conservation Journals and similar sources
- regular monitoring of pylons of electric power lines in the breeding / wintering area (e.g. data on mortality)[6]
- Data from existing Marking/Reporting Networks (e.g. breeders, veterinaries in falconry hospitals and during ringing chicks in some regions).

In the end, in order to upscale the data through modeling it is important to have good information on the reproduction: occupied nests, brood size and productivity. Knowing whether or not eggs were laid at sites thought to be occupied is a more precise measure than only identifying the presence of birds or pairs of birds, which can only serve as an indicator in the absence of better data. Another parameter on which good information is needed is survival/mortality. This includes e.g. mortality from illegal trade and hunting (BirdLife 2011 Report) from indirect poisoning and from electrocution.

The next step for the design of a monitoring plan could be to agree on a minimum set of parameters (e.g. nest occupancy & brood size) to be collected and identify the methods and definitions necessary to

[6] *Independently from the Saker programme, this kind of monitoring programme has for example given valuable information on Sakers' mortality in Hungary.*

collect this data that are considered best practice- taking into account the input by other WGs. A prioritized list of additional "great-to-have" elements (e.g. feather samples) could supplement this.

IV.2. Assistance in setting up and maintaining monitoring systems

(Objective 8.2 Provide assistance in setting up and maintaining population monitoring systems.)

Drawing on the early version of the country priority list (Version 1.0), it was possible to review how well our knowledge on the current monitoring entails countries that are important for the Saker Falcon. This will help to prioritize in which countries assistance in setting up and maintaining monitoring systems should be focused in the next years.

The SFT Objective 6 Working Group, reports country-specific knowledge gaps in the data and (independently from this study) comes to the conclusion that data on productivity is sufficiently available in relevant areas, but data on survival is a challenge.

The results of our review of knowledge about field monitoring methods are mixed: Of 16 countries with any priority (1,2 or 3), we have received feedback on the monitoring efforts from 5. Of the two countries with **critical priority** (3), China and Russia, we have information on one (Russia) and indirect information on China. Both countries are not parties to the CMS. Some studies have been conducted in China, but it is not certain whether they are to be regarded as monitoring programme. Of the four countries with **high priority** (2), we have replies from three (Hungary, Kazakhstan & Mongolia) and proposals on how to include additional sources of data from the fourth (Saudi Arabia). Of the remaining 10 countries with **medium priority**, Ukraine is the only one where we have information[7].

Reviewing the specific role of the countries for the Saker Falcon as breeding range, wintering ground, country with high trapping pressure and key user countries, we find that we have information from 5 out of 9 countries in the **key breeding range** (Hungary, Kazakhstan Mongolia, Russia & Ukraine) - not taking into account the exact area of the breeding range within those countries. **Winter habitat use** still needs to be added in the country priority list (as of June, 13th, 2013), so we cannot make a statement on this. Habitat loss and trapping pressure within the winter range, especially the Sahel Zone would be crucial from the perspective of the European population. Of the 6 countries in which **trapping** mainly takes place, we cover two (Saudia Arabia & Russia) and of the 4 countries that are the **key users** one is represented (Saudia Arabia).

The next step would be to get information on the existence and details of monitoring systems of countries that are not covered by our survey yet. The outcome of the Objective 6 Working Group of the SFT on Knowledge Gaps already provides some input on this. Of the countries not directly covered yet China has the highest priority. The willingness and expertise to conduct further monitoring is present in

[7] *The classification of Ukraine as a country with medium priority can be questioned. It may be more adequate to list the country among the high-priority countries. Ukraine holds the largest European population (despite repeated surveys no breeding pairs have been found in European Russia). The Ukrainian population now seems to be stable, but there are signs and indications that the situation may worsen in the near future.*

China, but funding is lacking. In addition countries of importance are the countries with medium priority: Afghanistan, Bahrain, Kuwait, Kyrgyzstan, Pakistan, Qatar, Syria, Turkmenistan & Uzbekistan. Including more countries in which key users live and trapping takes place should also be a priority. For trapping those would be Afghanistan, Pakistan and Syria, for Key users: Bahrain, Kuwait and Qatar.

Based on these considerations this report clearly identifies a need for a better understanding of monitoring efforts if existent, especially in the following countries: China, Afghanistan, Bahrain, Kuwait, Pakistan, Syria, and Qatar. [8]

Where no monitoring system exists ways to provide assistance to setting up and maintaining monitoring systems should be explored, based on the best practice agreed on in Chapter 3.1. This also applies to Saudi Arabia, where setting up a monitoring system or integrating trapping data (as discussed) should have a high priority as well.

Broadening monitoring efforts in countries where monitoring already takes place should also be considered. These countries have expertise and human resources on which to build.

IV.3. Promote and support research planning

(Objective 8.3 Promote and support research planning and field research on the conservation of the Saker Falcon.)

Coordinated research planning can save a considerable amount of money and effort and ensure that data collected through monitoring are valid, reliable, representative, and can be statistically analysed.

The questions that should drive research planning are: What information about the Saker Falcon is most needed for its long-term conservation and for which parameters is high data quality crucial?

Assuming that knowledge about the status of local populations as well as the status of the global population are vital, reliable methods on how to upscale the data collected in the field are needed. Birdlife (2011) also stresses the importance of more detailed data on the Saker Falcon distribution from field surveys. Data can then be used as a basis for predictive modeling, e.g. in combination with remote sensing data (BirdLife, 2011).

Once the status can be determined with sufficient certainty, another important part of research planning is to make sure that the drivers of change - both natural and man-made - can be captured. If the Saker Falcon population status changes due to a change in environmental variables (e.g. climate), a good monitoring protocol it needs to be possible to differentiate such a natural dynamic from an anthropogenic one (e.g. trapping). Research planning could further explore key drivers of the Saker Falcon population.

[8] *This recommendation is broadly in line with an earlier assessment by Birdlife (2011) which recommends establishing or intensifying fieldwork in China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Ukraine & Uzbekistan.*

From the SFT Objective 6 and 7 Working Group reports it becomes clear that more information is needed on population sizes, trends and range/habitat use as well as on survival and migration routes.

Considering the methods discussed above (3.1) better knowledge on population sizes and trends could be achieved by extended marking/tagging at nests and collection of DNA samples combined with a standard protocol and a common data and DNA sample repository. Also as discussed earlier in Chapter 3.1. the possibility of using different kinds of data, e.g. trapping records and/or official records to monitoring population size and trends should be explored. Marking/ Reporting schemes are another example of data that should also be considered. There is a wide network of institutions using microchipping for Saker Falcons (e.g. breeders, veterinaries in falconry hospitals and during ringing chicks in some regions).

For better understanding the factors that influence habitat use and range of Saker Falcons, information on the habitats could be collected in a standardized way during field research and/or monitoring, including prey species availability. This data would also allow the assessment of habitat change, another key pressure identified by the Objective 6 Working Group.

To analyze migration routes tracking methods, as the ones some countries already use (see Chapter 2), would be needed. Improvement could come from advanced tracking technology (e.g. long-life non-solar PTTs or the planned ICARUS system) and training in their proper use (e.g. safe attachment). Tracking can also help to reveal unknown territories used by the Saker Falcon. The SFT Objective 6 Working groups stresses that for some countries (e.g. China, Uzbekistan) the true breeding ranges are yet unclear. Also tracking can provide some information on survival.

Additionally focused research on specific sources of attrition (e.g. power-lines or trapping) would be beneficial. For the monitoring of electrocution and death by collision with man-made structures, a standardized monitoring protocol and regular visit to these structures (especially electric pylons) both in breeding range countries and countries through which Saker Falcons migrate would be needed. The mortality of electrocution could be as high as 25% of young birds in some regions. For data on trapping both a strategy to communicate and build-trust with them and a standard protocol for data collection, also combined with a trusted data depository – as occurring in Saudi Arabia-, present ways forward.

There is still a lot of potentially relevant ecological data not covered above, e.g. land use. It is necessary to develop methods that are easily integrated into existing regular monitoring plans (see 3.1) or combined with the data that is generated through the monitoring. This could e.g. include the monitoring of prey species, as already implemented in Mongolia, but also the monitoring for pollutants (see Chapter 3.5).

IV.4. Facilitate collaboration

(Objective 8.4 Facilitate active collaboration between researchers, falconers, trappers (where possible) and local administration involved in Saker studies.)

Table 1 shows that already within the science community between the different countries, standards and methodologies differ. Agreeing on a minimum set of data to collect, common definitions and comparable methods will likely be necessary for good collaboration. (As discussed in Chapter 3.1),

How to include data from other communities (falconers, trappers, local administration) remains an open question and methods how to do this should be identified and reviewed (Chapter 3.3)

It also remains to be discussed to what extent collection of input data for socio-economic modeling (See SFT Objective 7 Working Group) should be considered in a Monitoring Plan, especially if synergies can identified between increasing collaboration, building trust and involving other communities data collection (e.g. trappers for trapping data, see above, 3.3.).

Additionally to the topics that were already raised previously, it could be beneficial to think about a common data infrastructure to facilitate data sharing. Here, data protection needs to be considered: In the Monitoring Protocol provided for Hungary, it becomes evident that limiting access to some data (e.g. nest location[9]) is among the aims. It is necessary to explore whether similar concerns also exist in other countries and/or between different stakeholder groups. A possible solution could be to only share the derived results (e.g. a population estimate), not the original data, or using trusted data depositories as already implemented in Saudi Arabia. To which level this is necessary needs to be discussed.

Further considerations of this topic will be part of the implementation phase of the SakerGAP. In SFT Objective 7 Working Group Draft Report Annex 3 are some thoughts on data infrastructure for a Saker adaptive management system.

IV.5. Monitoring the impact of Pollutants

(Objective 8.5 Explore the possibility of monitoring the impact of pollutants on the Saker Falcon.)

As discussed in Chapter 3.1., collection of feather samples and food remains is implemented in 2 out of 3 monitoring schemes for which information is available. This allows for the monitoring of pollutant levels. Also the collection and analysis of unhatched eggs is conducted in some countries. Extending this practice to other countries should be promoted.

[9] In Hungary, the code of the territories, as well as the GPS coordinates are not stored centrally, but kept by the site managers.

V. Conclusions and recommendations for the SakerGAP

From the responses to the questionnaire and the monitoring protocols received it becomes evident that there are very different monitoring methods currently in use. To facilitate collaboration between countries and ensure efficient use of money and effort, we recommend developing a common standard monitoring protocol within the SakerGAP process. Even if existing monitoring plans remain unchanged, an agreement to identify best practice for new monitoring plans (Objective 8.1.) is necessary.

This could be started by agreeing on a minimum set of parameters to be collected in each range state, using comparable methods and common definitions (e.g. age groups). The methods and definitions should be identified as best practice from existing monitoring efforts. The monitoring protocol should take into account the needs identified by the SFT Objective 7 Working Group for input data into a modeling approach and make sure that data is available in sufficient quality.

This monitoring protocol should be supplemented by a prioritized list of additional "great-to-have" elements to be implemented if feasible These should also aim at addressing the knowledge gaps identified by the Objective 6 Working Group where integration into a Monitoring Plan is beneficial (e.g. could be: Marking/Reporting, Genetic sampling, Satellite Tracking, Monitoring for pollutants).

In this context it would also be of importance to find and agree on methods on how to integrate data from different sources, e.g. trappers or official records with the field data.

Our access to knowledge on Saker Falcon monitoring systems has gaps, also in the countries with critical priority, e.g. China. Gathering information on, and if necessary providing assistance in setting up and maintaining monitoring systems in those countries will be a priority.

As with monitoring, other field work and field research planning outside the scope of a monitoring plan would benefit from coordinated research planning to save time and effort. The first aim should be to identify the most pressing research areas, taking into account the gaps and needs identified in the SFT Objective 6 and 7 Working Group, such as increasing data quality in relation population sizes and trends as well as on survival and migration routes. The methodology for this seems to be largely available, including research areas exist where it might not be feasible to integrate data collection into a regular monitoring plan or where separate designated data collection protocols and research plans might be needed (e.g. suggested for attrition factors such as electrocution and trapping). Also the use of advanced tracking technology presents chances to improve the available knowledge.

The collection and integration of other sources of data and socio-economic data could offer some synergies in facilitating collaboration between different user groups. A common data infrastructure could be beneficial here, but lack of trust and need for data protection could present challenges to progress.

Finally it can be concluded that the monitoring of pollutants (Objective 8.5) seems feasible and now needs to be implemented in all study areas.

The conclusions & recommendations of an earlier BirdLife report (2011) should also be taken account, which recommends: to initiate a five to ten - year programme of studies of the Saker Falcon, involving (1) intensive springtime surveys in a number of key countries; (2) ecological research; and (3) satellite telemetry.

VI. References

BirdLife International (2011) Saker Falcon conservation status and research requirements. A report to the Saudi Wildlife Commission

BirdLife International (2012) *Falco cherrug*, In: IUCN (2012) IUCN Red List of Threatened Species, Version 2012.2. <www.iucnredlist.org>, Downloaded on 22 May 2013.

Coordinating Unit for the Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia (Raptors MoU), (unpublished), Saker Falcon Task Force – Working Groups, Version 25 April 2012.

Elzinga, C.L., Salzer, D.W., Willoughby, J.W. (2001) Measuring and Monitoring Plant Populations, BLM Technical Reference.

White, G.C., K. P. Burnham. 1999. Program MARK: Survival estimation from populations of marked animals. Bird Study 46: Supplement, 120-138.

VII. Annexes

Annex I: SFT Country Prioritization Report, v1.0 (Raptor MoU, v1.0, Date: 04/04/2013)

Priority levels:

Critical	- 3	
High	- 2	
Medium	- 1	
Low	- 0	

Key Breeding Range Countries

1 – The estimated breeding population median is over 1000 pairs

2 - The estimated breeding population median is over 100 pairs

Columns with grey heading are not or only partly filled!

	Range countries	CITES	CMS	Raptors MoU	Key Breeding Range Countries	Key Winter Range Countries	Key Source Countries of Wild Sakers (Trapping)	Key Users of Wild Origin Sakers	Sustainable Use Initiative	Well-known/studied, Viable Breeding Population	Total score
1	Afghanistan						1				1
2	Armenia		+	+							
3	Austria		+	+ (as EU)							
4	Azerbaijan										
5	Bahrain							1			1
6	Belarus		+								
7	Bulgaria		+	+ (as EU)							
8	China				2		1				3
9	Croatia		+								
10	Cyprus		+	+ (as EU)							
11	Czech Republic		+	+ (as EU)							
12	Egypt		+								
13	Ethiopia		+								
14	Georgia		+								
15	Hungary		+	+	1					1	2
16	India		+								
17	Iran		+								
18	Iraq										
19	Israel		+								
20	Italy		+	+							
21	Jordan		+								
22	Kazakhstan		+		2						2
23	Kenya		+	+							
24	Kuwait							1			1
25	Kyrgyzstan				1						1
26	Libya										
27	Macedonia										

	Range countries	CITES	CMS	Raptors MoU	Key Breeding Range Countries	Key Winter Range Countries	Key Source Countries of Wild Sakers (Trapping)	Key Users of Wild Origin Sakers	Sustainable Use Initiative	Well-known/studied, Viable Breeding Population	Total score
28	Malta			+ (as EU)							
29	Mongolia			+	2				1		2
30	Monte Negro										
31	Nepal			+							
32	Oman										
33	Pakistan		+	+			1				
34	Qatar							1			1
35	Republic of Moldavia		+								
36	Romania		+	+							
37	Russian Federation / Asiatic Russia				2		1				3
38	Saudi Arabia		+				1	1			2
39	Serbia		+								
40	Slovakia		+	+							
41	Sudan			+							
42	Syria						1				1
43	Tajikistan		+								
44	Tunisia		+								
45	Turkey										
46	Turkmenistan				1						1
47	Ukraine		+		1						1
48	United Arabian Emirates			+							
49	Uzbekistan		+		1						1
50	Yemen		+	+							

Annex II: Answers to questionnaires

Croatia, Hungary, Romania, Slovakia

Mátyás Prommer

17.06.2013

1.	Please indicate to which country/countries the information you provide is applicable.
	Hungary, Slovakia, Romania, Croatia.
2.	Which data is collected for monitoring Saker Falcons?
	number of pairs, number of breeding pairs, breeding success, number of ringed chicks, ring recoveries, satellite tracking (adults & juveniles).
3.	How is the data collected? Which methods are used?
	Visiting nests and breeding areas.
4.	How often is data collected? At which time of the year?
	at least 2x a year (in the beginning of the breeding season and when ringing), but sometimes more occasions.
5.	How many people are involved in data collection? How much time are they dedicating on average?
	Hungary - about 20-30 experts, Slovakia - 8-10 experts, Romania - 3 experts, Croatia - 1 expert.
6.	Are the data collection efforts coordinated at national level? If so, by whom?
	Yes. Hungary - János Bagyura, Slovakia - Jozef Chavko; Romania - Luca Dehelean. Croatia - Darko Grlica.
7.	Are there differences in data collection between different areas/ecosystems (e.g. in the kind of data collected, or methods used)?
	differences are negligible (all are based on the Hungarian modell started in early 1980).
8.	Is there a standardized field monitoring protocol? (If so, could you share it with the working group?)
	Yes. Downloadable from here: http://sakerlife.mme.hu/en/content/show?dattype=dl (Monitoring protocol).
9.	Does the data collected allow for monitoring the impacts of pollutants?
	Partly (unhatched eggs are collected at least in Hungary).

Kazakhstan & Russia

Elvira Nikolenko (Working group: Igor Karyakin)

18.06.2013

1.	Please indicate to which country/countries the information you provide is applicable.
	Russia, Kazakhstan. In Russia Saker is monitored in Altai-Sayan region. This is the most population in Russia and this is only monitored. There exists another population in Baikal region (Republic of Buryatia and Zabaikalskiy kray), we research them in 2005 and 2010, but it is not monitored. In other regions of Russia (Volga region, Ural, Western Siberia) Saker is dissarpied during last 10 yeas, we check these territory regularly during the transect studies. In Kazakhstan we researched different territories in different yeas between 2003–2012. The main area habitat Saker in Kazakhstan was covered. All date is published.
2.	Which data is collected for monitoring Saker Falcons?
	Everywhere: employment breeding areas, the presence / absence of breeding, the number of eggs / nestlings, catering facilities, selectively: phenotype and age of the birds in pairs, breeding success, moving between pairs of nests from year to year.
3.	How is the data collected? Which methods are used?
	Saker monitoring is a combination of representative random-stratified plots and census research of each of the plots. In the Altai-Sayan region there are 10 monitored plots. They were chosen to represent different biotops, so the results can be extrapolated for the whole population. Since 1999 each plot is visited once during breeding season every year, except 2007, several plots were visited twice in 2001. At each plot all known nest from previous years are visited to confirm presence of birds and breeding. In case birds are missing the neighboring area is checked for their presence. Monitored plots represent circa 10% of the whole Altai-Sayan Saker population, the results are extrapolated.
4.	How often is data collected? At which time of the year?
	During the breeding season - from April to July depending on the territory. Different regions differently. In the Altai-Sayan region of Russia - from 1999 to 2011, except 2007. In Kazakhstan - from 2003 to 2012.
5.	How many people are involved in data collection? How much time are they dedicating on average?
	5 persons, 1-2 months in a year.
6.	Are the data collection efforts coordinated at national level? If so, by whom?
	Igor Karyakin coordinates the collection of data at national level.
7.	Are there differences in data collection between different areas/ecosystems (e.g. in the kind of data collected, or methods used)?
	No.
8.	Is there a standardized field monitoring protocol? (If so, could you share it with the working group?)
	Yes. File is attached.
9.	Does the data collected allow for monitoring the impacts of pollutants?
	No.

Kazakhstan, transferrable for China, Mongolia, Russia

Anatoly Levin

04.07.2013

1.	Please indicate to which country/countries the information you provide is applicable.
	Information gathered in Kazakhstan is applicable to neighboring countries – Russia, China, Mongolia.
2.	Which data is collected for monitoring Saker Falcons?
	The populations of Saker Falcon were monitored since 1993 to 2011, we've collected the data on numbering dynamics of species. More detailed information can be provided upon request.
3.	How is the data collected? Which methods are used?
	The Saker Falcon populations were checked regularly in some parts of Kazakhstan (up to 100 living nests per season).
4.	How often is data collected? At which time of the year?
	Data were collected every year in breeding season (April-June).
5.	How many people are involved in data collection? How much time are they dedicating on average?
	3-4 people were involved in data collection every year for approximately 3 months, including volunteers from the European countries.
6.	Are the data collection efforts coordinated at national level? If so, by whom?
	The data collection efforts are not coordinated at the national level in Kazakhstan.
7.	Are there differences in data collection between different areas/ecosystems (e.g. in the kind of data collected, or methods used)?
	There are no differences between different areas in methods used.
8.	Is there a standardized field monitoring protocol? (If so, could you share it with the working group?)
	There is no standardized field monitoring protocol.
9.	Does the data collected allow for monitoring the impacts of pollutants?
	The data collected doesn't allow to assess the impacts of pollutants.

Northern Kazakhstan

Evgeny Bragin

30.06.2013

1.	Please indicate to which country/countries the information you provide is applicable.
	Kazakhstan.
2.	Which data is collected for monitoring Saker Falcons?
	number, breeding success, productivity and causes of negative impact.
3.	How is the data collected? Which methods are used?
	field surveys known areas. Nest locations inside main areas were recorded with GPS unit during last 15-20 years and inserted in an electronic database (including description of a nest sites). Nest contents usually recorded when it is possible.
4.	How often is data collected? At which time of the year?
	in some areas - Naurzum Reserve, mountains in south Kazakhstan - annually, in some (Ustyurt, Altay mountains, forest of Northern Kazakhstan and Pavlodar Region, Betpakdala - not every year. Survey cover period from April until the beginning of July, when chicks have fledged in Northern Kazakhstan.
5.	How many people are involved in data collection? How much time are they dedicating on average?
	Most part of territory of Kazakhstan (mountains and desert mainly) was covered by Anatoly Levin, who worked with Nick Fox and Andrew Dixon. Also Ralf Pfeffer had worked there In previous years and some others. Surveys of two years (2007 and 2008) were made with collaboration with Russia ornithologists (Igor Karyakin..). I am working in Northern Kazakhstan. For now we have no possibility to monitor Saker throughout of it's areal in country because there are no national programme and funding.
6.	Are the data collection efforts coordinated at national level? If so, by whom?
	Unfortunately no. According Kazakhstan's rule the Institute of Zoology is resposible agency for coordination data collection of endangered, threatened and rare species but it has no funding for monitoring and national programme as well.
7.	Are there differences in data collection between different areas/ecosystems (e.g. in the kind of data collected, or methods used)?
	I think we have no essential differences.
8.	Is there a standardized field monitoring protocol? (If so, could you share it with the working group?)
	No.
9.	Does the data collected allow for monitoring the impacts of pollutants?
	No.

Mongolia

Andrew Dixon

16.05.2013

1.	Please indicate to which country/countries the information you provide is applicable.
	Mongolia.
2.	Which data is collected for monitoring Saker Falcons?
	Occupancy at artificial nests, Clutch size, nesting success, fledged brood size.
3.	How is the data collected? Which methods are used?
	Field visits. Nesting success calculated in the programme MARK.
4.	How often is data collected? At which time of the year?
	5 visits to nests from April to July.
5.	How many people are involved in data collection? How much time are they dedicating on average?
	15-20. 10 weeks.
6.	Are the data collection efforts coordinated at national level? If so, by whom?
	No. Co-ordinated only for artificial nest study area.
7.	Are there differences in data collection between different areas/ecosystems (e.g. in the kind of data collected, or methods used)?
	No. Data collection is standardized across whole study area (open steppe landscape).
8.	Is there a standardized field monitoring protocol? (If so, could you share it with the working group?)
	Yes. Attached.
9.	Does the data collected allow for monitoring the impacts of pollutants?
	Yes. Feather samples collected from juveniles can be used for pollution analyses.

Ukraine

Maxim Gavrilyuk

26.05.2013

1.	Please indicate to which country/countries the information you provide is applicable.
	Ukraine.
2.	Which data is collected for monitoring Saker Falcons?
	Monitoring known nest and brood size are collected. (Only a small part of the population is monitored.)
3.	How is the data collected? Which methods are used?
	Control of known breeding territories is used.
4.	How often is data collected? At which time of the year?
	During the breeding season. Every year.
5.	How many people are involved in data collection? How much time are they dedicating on average?
	From 2 to 5 people collect data during one week.
6.	Are the data collection efforts coordinated at national level? If so, by whom?
	A part of it's, by Dr. Yuri Milobog.
7.	Are there differences in data collection between different areas/ecosystems (e.g. in the kind of data collected, or methods used)?
	No.
8.	Is there a standardized field monitoring protocol? (If so, could you share it with the working group?)
	No
9.	Does the data collected allow for monitoring the impacts of pollutants?
	No

Annex III: Received Monitoring Protocols

Click here for the Monitoring Protocol for Croatia, Hungary, Romania, Slovakia (pdf)
Click here for the Monitoring Protocol for Mongolia (pdf)