Developing the Flagship Project for a Saker Falcon Portal and Network – Final Report

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I. Foreword by chairs

The proposed solutions for the conservation of wildlife species for which consumptive use is considered a threat to their survival currently fall into two camps: those with protection-based views who believe that strict laws and enhanced enforcement provide the solution, whilst the alternative view is to embrace the use providing that it is properly managed and sustainable. The currently popular protection-based approach seldom considers and often ignores the wishes and concerns of the local people who live with the wildlife, who may also manage the land on which the wildlife depends, and whose own livelihoods may even rely upon the species concerned. With a species such as the Saker Falcon, which is migratory and occurs throughout a vast range covering at least 80 countries, the imposition of regulations and prohibitions on harvesting and use of the species is particularly difficult to implement and enforce. For these reasons, the Saker Falcon Task Force recognized the importance of considering a more holistic conservation strategy that extends beyond strict protection.

Indeed, the situation of the Saker Falcon is unique, in that it is a species which had been harvested sustainably from the wild, without domestication, for possibly 4000 years. Its use for falconry has become embedded in the culture of a number of nations. Falconry itself has been recognized as an Intangible Cultural Heritage of Humanity by UNESCO, with the largest number of submitting nations of any single element on the UNESCO list. Interestingly, several of these diverse nations are Saker Falcon range states across Africa and Eurasia, including many which are undergoing dramatic social change. They vary between some of the richest in the world and others that are poor and under-developed. To the people in these nations, the Saker Falcon can be considered a valuable natural asset which, if allowed to utilize sustainably, should encourage them to conserve it.

In February 2015, an opportunity arose to present the concept of an Online Saker Portal project to the IUCN Conference – "Beyond Enforcement". We could convey that this project offered a powerful and possibly unprecedented model for addressing illegal transnational trade of an iconic and high value species. In developing the Portal, we have engaged falconers in a number of countries, including contributing to the translations. The Portal has demonstrably attracted attention from a wide spectrum of people in different countries and language groups. Its success has exceeded our expectations and provides a solid platform to build upon. The Portal offers a unique mechanism to monitor trade but also to change attitudes and practices to promote sustainable use. New features and novel ideas are planned to draw more visitors to the site and to stimulate engagement. One such feature could be real-time tracking of satellite-tagged Saker Falcons, perhaps coupled with a new competition to enhance interest.

The Saker Falcon Task Force, supported by the Coordinating Unit of the CMS Raptors MoU, has brought together government officials from range states with the Sustainable Use Groups of IUCN, falconers, ornithologists and other interested parties. It has fully integrated falconers into the hunt for a solution to the plight of this species. Furthermore, it has opened dialogues between practitioners and authorities in nations such as Afghanistan, Iran, Kazakhstan, Kyrgyzstan, Mongolia, and Pakistan, among others. The Portal is the first Flagship Project to emerge from the Task Force. In time we hope that it can be used to develop and monitor sustainable, legal and regulated trade in this species which will benefit local people in the breeding and passaging areas, the end-users, and the Saker Falcon itself.

Adrian Lombard and Nick P. Williams, Co-Chairs of the Saker Portal Project Steering Group

II. Executive summary

1. A portal for falconers and trappers in Eurasia launched in Arabic, Farsi, Pashto & Russian in April 2015 at www.sakernet.org (English at www.saker-staging.net) with a 1000-visit target.

2. There were 2,000 visits in 9 months and 4,500 in 2 years, with 1,136 multipage sessions of which 39% were from Iran, 20% from Arabic-speaking countries, 4% from Pakistan, 4% from Russian-speaking countries and most of the remaining third from Europe.

3. Surveys linked to the website had 19 of 74 responses completed by falconers and trappers from Pakistan (26%), 21 from Central+Northern Asia, and 4-5 each from North Africa, Iran, India and China. Earlier survey gave 37 Saudi and 10 Emirati responses.

4. The ratio of website visits to completed surveys was high in Saker breeding areas of Central Asia and China, with a ratio approaching 1:1 also in Pakistan; in these areas and Iran, respondents were most likely to be trapping and releasing their own Sakers.

5. Many Saudi falconers kept Sakers but a smaller proportion trapped falcons than in more northern areas; like these areas, Saudis kept fewer hybrids than in UAE, where few Sakers were trained; in these Arabian Peninsula countries falconers were older than elsewhere.

6. In North Africa, where trapping and keeping Sakers was also popular, and in North Asia where Sakers were much less flown, Saker numbers were deemed to be increasing, unlike elsewhere; in the Peninsula, Iran and Asia, 50-100% of falconers visited falcon clinics.

7. Staff from 9 veterinary establishments were interviewed; all were marking clients' falcons, in 7 cases with microchips to record re-visits; 6 were prepared to provide small feathers for DNA-banking to confirm ownership securely.

8. The 8 public clinics would cooperate with a scheme to monitor wild populations and trade through mark-recapture methods and would welcome an internet system to facilitate this.

9. All veterinarians were interested to know country of origin of birds marked in nests, and to access records through reading chips if not doing so already; a system to distinguish pure species from hybrids was also sought by some clinics and internet presence by others.

10. During year 2, participation continued in the online survey mainly from Central Asia; lack of new returns, despite strong growth in website visits, indicated that initial high participation had been very dependent on initial recommendations from influential falconers and clubs.

11. The multilingual portal could network sites for falconers and veterinarians in each country, linked with a system to monitor wild populations by mark-recapture, while giving data on marked falcon origins to vets and administering e-passports to check trade is sustainable.

12. However, it is essential that all stakeholders, especially those who influence falconers, including clubs and veterinary clinics, are consulted and agree on the best approach.

III. Background – changing approaches to conservation

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. Sakers are prolific breeders in steppe habitats with abundant rodents as a food supply, and had for many centuries been trapped sustainably for use in falconry. Traditional trapping on autumn migration continues in Asia, with subsequent release of trained birds back to the wild in springtime at the end of the hunting season.

Sakers breed 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 (i.e. recent unsustainable use). Healthy populations still occur in other parts of its range although there are major concerns about electrocution on poorly designed power poles (Dixon 2016) and secondary poisoning during control of rodent populations may be another important threat (Fox et al. 2003). As a result of these factors, as well as large scale anthropogenic changes in land use, Saker populations declined globally, leading BirdLife International (the Red List Authority for birds on the IUCN Red List) to recommend uplisting Saker Falcon to threatened status on IUCN's Red List, and growing pressure for protective action through Multilateral Environmental Agreements.

Indeed, the first modern MEA was the International Convention for the Protection of Birds, which was signed in Paris in 1950. It required licences for "import, export, transport, sale, offer for sale, giving or possession of any live or dead bird or any part of a bird", with special attention for migrants. The 'Washington' Convention on Trade in Endangered Species of Wild Fauna and Flora (CITES, 1975) came a generation later, followed in 1979 by the 'Bonn' Convention on Conservation of Migratory Species (CMS), and the 'Bern' Convention on the Conservation of European Wildlife and Natural Habitats, which was taken almost word for word into the European Commission's separate Directives on Birds and on Habitats. These 1950-92 MEAs were generally restrictive, with emphasis on stopping adverse human impacts.

Nevertheless, the later MEAs also paid attention to human needs. Thus, CMS accepts traditional subsistence use. The Bern Convention with its derivative EU Directives goes further, recommending that wild populations be maintained "at a level which corresponds to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements". In 1992, the Convention on Biological Diversity (CBD), from the United Nation's 'Earth Summit' in Rio, made sustainable use of biodiversity its second pillar, mentioned in 13 substantive articles. Although stipulations for protected areas gained most attention, in 2000 the International Union for Conservation of Nature (IUCN) started a process on sustainable use as a tool for conservation that led in 2004 to CBD's Addis Ababa Principles and Guidelines for Sustainable Use. In the meantime, the UN's World Summit on Sustainable Development in 2002 had emphasised that development needed to be not only ecologically, but also socially and economically sustainable.

Recent approaches recognise that conserving the environment needs positive actions, not just absence of harm. Although CBD had recommended incentives for conservation and sustainable use, it took 15 years for CBD's Principles and Guidelines from Addis Ababa to be combined with the Ecosystem Approach, from Malawi in 1998, for specific recommendations to governments on how to encourage conservation through sustainable use. After the Bern Convention adopted a Charter on Hunting and Biodiversity in 2007, a Charter on Recreational Fishing followed in 2010, and on Gathering Fungi in 2013.

A realisation was growing at international level that coercion of minorities was not necessarily as effective as the consultation of stakeholders in an attempt to reach a consensus to which all could adhere and contribute positively. The days of evicting local people from areas used for their livelihoods

in order to create National Parks were (mostly) past, thanks not just to considerations of equity and human rights but also to realisation that these were often the best people to help manage their ancestral areas, and that the habitats concerned often depended more than appreciated on their past sustainable management. Thus, the millennial Natura 2000 network of protected areas in Europe made specific provision for continued use of land and species, including hunting.

It was in the spirit of these more stakeholder-friendly approaches that CMS took a lead for the Saker Falcon. Resolution 10.28, adopted at the 10th Conference of the Parties (COP10) in November 2011, placed the species on Appendix I, and therefore outside scope of trade. However, an exception was made for Mongolia, where a project funded by UAE was enhancing production by up to 2,500 young Sakers annually from artificial nests in areas lacking natural nest sites (Dixon et al. 2011, 2016). Resolution 10.28 also established a Saker Falcon Task Force (STF), bringing 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.

STF Working Groups were established in 2012 to help draft the Saker Falcon Global Action Plan (SakerGAP). As the issue of sustainable use of Sakers, primarily for falconry, was considered to be a central element to their future conservation and management, a contract was placed with European Sustainable Use Group to review Saker population modelling and collect data on use of the species in falconry. Models with best estimates of productivity and survival (tested against observed Saker population growth in Hungary), predicted resilience to harvest for European and Asian Saker populations above 80 pairs (Kenward et al. 2013). The report also noted potential for using recapture of falcons marked in breeding areas to estimate population sizes as well as harvests, and that UAE-funded liaison with falcon hospitals in the 1990s had been important for testing this mark-recapture approach.

A first draft of the SakerGAP was reviewed at a Stakeholders' Workshop in Abu Dhabi in September 2013. The workshop recommended projects with satellite tracking of 100 Sakers, restocking work with 1,000 nest boxes and to make a million power poles safe for raptors. However, noting recent survey findings that falconers and trappers in the Gulf States remain consistent visitors at falcon-hospitals, the first STF Flagship Project was to develop a portal in Arabic, Farsi, Pashto and Russian to engage with biologists and other markers of falcons at nests, trappers, falconers, and some ten falcon hospitals.

This SakerGAP was adopted by the 11th Conference of the Parties (COP11) in November 2014 through CMS Resolution 11.18. In the meantime, other practitioner-funded work in Mongolia had indicated that severe problems with electrocution on medium voltage transmission lines (Dixon et al. 2013), which were being widely constructed as new infrastructure across Central Asia, was probably the main threat to the species. An offer by International Association for Falconry and Conservation of Birds of Prey (IAF) to take forward the first Flagship Project was welcomed in Resolution 11.18.

IV. Introduction to the project

The population dynamics required for ecological sustainability of Saker Falcons, including a proposed harvest level of 5% from healthy populations, are well defined in the SakerGAP (Kovács et al. 2014). However, sustainability needs to be social and economic as well as ecological. The principles for sustainable use of Sakers that are also socially and economically practical are by no means well defined, and that too affects harvests. If falconers are to be part of the solution for conserving Sakers through sustainable use, how would they like to engage and contribute, and through what form of governance?

The underpinning governance is especially challenging. With conservation hitherto largely based on stopping people doing harm through protective measures, there is a much smaller experience-base for encouraging practitioners to assist monitoring and restoring species and habitats, i.e. for 'carrots'

instead of 'sticks'. Although western-influenced conservation interests who operate mainly in the English language have created restrictions on use of Sakers in some countries, the need for conservation actions have not been explained widely by trusted sources to local people in their own languages. A further complication for work through CMS is that a number of Saker Range States with appreciable practise of falconry are not signatories to CMS, including Bahrain, China, Kuwait, Russia, Qatar, Turkey, Turkmenistan and UAE.

Even well-meant western efforts have also sometimes seemed unhelpful. Thus, a resolution adopted by IUCN in 2000 to illustrate a conservation-through-use approach for the Saker through new technology was premature: solutions based on demand reduction through domestic breeding of falcons were the preferred approach of authorities in the Gulf at that time. The benefits for conservation of training pure species which could then be used to restore wild stocks were not perceived. Yet the survey for the SakerGAP had shown that ordinary falconers owning 1-3 falcons (i.e. without substantial establishments) in Saudi Arabia actually preferred pure wild sakers.

The rationale behind this project was therefore to initiate a dialogue with falconers throughout the range of the Saker Falcon, and thereby to start building trust. At the same time the project would gain information about falconers' practices and preferences that could be used to conserve their falconry as well as aiding conservation through their passion for Sakers. It was considered that, with extensive use of the internet in Arab and ex-Soviet states, and of smart-phones more generally, online portals run by trusted sources could be the best way to win support of falconers and trappers. The advantage of the offer by the International Association for Falconry and Conservation of Birds of Prey to spearhead such a portal was that, with member clubs in 80 countries (including China, Russia, Qatar, Turkey, Turkmenistan and UAE), IAF has better organised links into appropriate countries than other organisations focused on sustainable use of wild resources.

The ultimate target of the project is the creation of a vibrant network of committed enthusiasts to share knowledge and to attract funding to conserve the Saker Falcon. If traditional falconry is to thrive, based on sustainable use of falcons and prey which depend on vulnerable grassland ecosystems, it is essential that falconers become organised to help:
  (i) collect data needed to ensure their harvests are sustainable;
  (ii) halt trapping of breeding adult Sakers;
  (iii) reduce poisoning and electrocution; and
  (iv) restock depleted Saker populations.

To this end, the objectives for the first two years of the project (Stage I) were:
- to construct an internet portal, in at least 4 languages, through which falconers and other conservation interests can engage with some 10 falcon clinics; and
- to attract the interest of as many falconers and falcon trappers as possible throughout the Saker Falcon Range States by means of a "Smartphones for Saker Conservation" survey.

The portal system was therefore designed for long-term use by regional clubs of IAF and by falconry clinics after the completion of set-up work in 2015-16. The Stage I targets included engagement of all existing falcon hospitals, and obtaining an ambitious 1000 visits to the portal by falconers and trappers.

At the start of the project, it was felt that networking to encourage (i) to (iv) might alone be adequate to restore Sakers to a satisfactory conservation status. In any case, data would have been collected for an improved Stage II of the portal system, to host an adaptive management system through which:
- registration of Saker Falcons marked by biologists at nests;
- reporting of falcons when trapped, and
- registration at hospitals of falcons in training,
could be used to estimate harvests, assess population sizes and encourage only legal, sustainable trade.

By completion of the study period, it had become clear that the portal had gained more interest than expected, but that exchange of information alone was unlikely to gain enough conservation support for Sakers for rapid improvement in their status. The data gained during Stage I are therefore used at the end of this report to refine planning for a Stage II, to be run by falconers in the countries concerned.

V. Main approaches and technology

An early title for this project was "Portals for Enhancing Trust" for Sakers. This harks back to an IUCN Resolution of 2008, on "Trust building for biodiversity conservation and sustainable use". This in turn was informed by IAF's early engagement with Saker issues, through supporting marking of wild Sakers in Kazakhstan in 1997 and through the IUCN resolution in 2000 that called for development of:
"an internationally recognized system, initially for this species but applicable for other wildlife, that combines wildlife research and modern marking technologies to:
    (a) monitor populations and estimate sustainable yields;
    (b) regulate procurement and international movements with minimal administrative costs; and
    (c) motivate conservation of the species and its habitats throughout its range".

The first intention of this project was to build trust with falconers, trappers and falcon clinics across several Asian cultures through use of an internet portal system. This required initially to engage their interest, and then to help these practitioners in various ways. Only when trust is established can one attempt also to guide and encourage conservation. In order to reach thousands of falconers across many cultures, some of which are currently in conflict, the approach has been to build a portal that gives helpful information on a number of issues from a trusted source, the IAF, in four widely used languages. Trappers and falconers were attracted to the system partly by multilingual information on Sakers in the wild (e.g. explaining why trapping breeding adults is unwise), about restocking work and migratory movements of falcons, and with tips on care of trapped and trained falcons (including encouragement to visit falcon hospitals).

In order to further attract interest to the portal, IAF developed a survey with prizes for participants. Like the multilingual site for practitioners, the survey was designed for use on smart-phones as well as laptop and desktop computers. Falconers and trappers in some Saker range states have suffered loss of infrastructure at home due to conflicts, but have phones to keep in touch with their families. Prizes were included as they have become popular at falconry competitions on the Arabian Peninsula. As well as trust-building, motivations for engagement in conservation are important.

Help from falcon hospitals with recording falcons marked in the wild was very important during studies in the 1990s (e.g. Riddle & Remple 1994, Fox et al. 1997, Kenward et al. 2001, 2007) and was sought again by discussing what the system could do to help them. The hospitals varied greatly in size: some were extensive buildings in prestigious locations, and others were specialist clinics in locations more easily reached by local falconers on foot. A personal approach was applied for falcon hospitals and clinics, by going to talk with the veterinarians or meeting them at professional gatherings.

Although the main actors to be engaged were trappers, falconers and falcon hospitals, it was important for the future to provide information also for potential markers of nestlings. Markers should be local people trained to attach rings and microchips to nestling falcons, as a mark-recapture process to estimate sizes of falcon populations and harvest rates from them. Although marking needs eventually to engage local land managers, and hence encourage them to conserve habitats, it was realised that initial markers are likely to be biologists. To build trust and inform biologists, the English language version of the portals also makes clear the involvement of BirdLife International, IUCN and UNEP-CMS.

The approach has been socio-technological. It has required assessment of the best ways not only to

build the site and survey, in terms of people working with software, but also how to sustain the running of the portal system effectively in the long-term. This has involved monitoring not only use of the system, but also the extent of engagement with it of the falconry clubs, falcon hospitals and potential sponsors, as well as the numbers of visits by falconers and trappers.

V.1　Web sites

The portal consisted originally of a multilingual site (www.sakernet.org) for practitioners (Fig. 1, **red**) linked to a survey module (**purple**) and to another System for Community Liaison (**green**), which currently runs in English for science and administration at www.sakerfalcon.org). The model for the practitioner site was a portal built in 2011 to provide information on conserving through sustainable use and to conduct survey across different European cultures, by Anatrack Ltd and the (then) European Sustainable Use Specialist Group of IUCN, for a project funded by European Commission to design a Transactional Environmental Support System (see www.naturalliance.eu). The basis is a back-office in English which can be accessed for editing and translation through www.saker-staging.net). Unlike the initial site, the Saker version is designed specifically to be smart-phone-friendly, works well with right-to-left languages, and can have both diagrams and links which are language specific. Thus the legends and labels for diagrams reflect a different image stored for each language, and the links (where appropriate) go to a site, or to a relevant download, in the language being used at the time.

Figure 1　Portal based on use a multilingual Saker template (**red**), linked to a multilingual survey module (**purple**) & System for Community Liaison (SYCL) site (**green**) in each language, from www.anatrack.com.
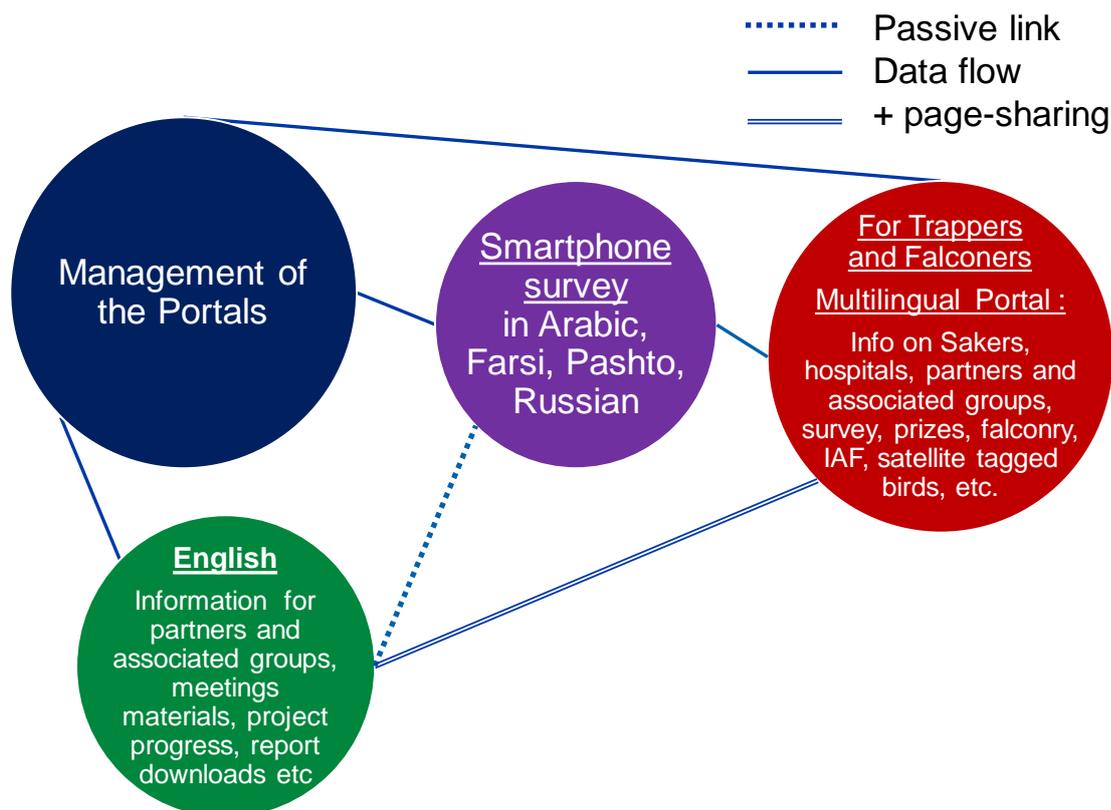
Users of the Practitioner multilingual template (see Figure 2) can:
- (i)　switch between cultures (country/language combinations);
- (ii)　read, download and link-out to further information and survey in the different cultures;
- (iii)　register to be alerted about updates, engage in projects work, etc;
- (iv)　make contact to offer information or donations.

Figure 2   The Home Page of www.saker-staging.net (where English is used to translate for the live site).
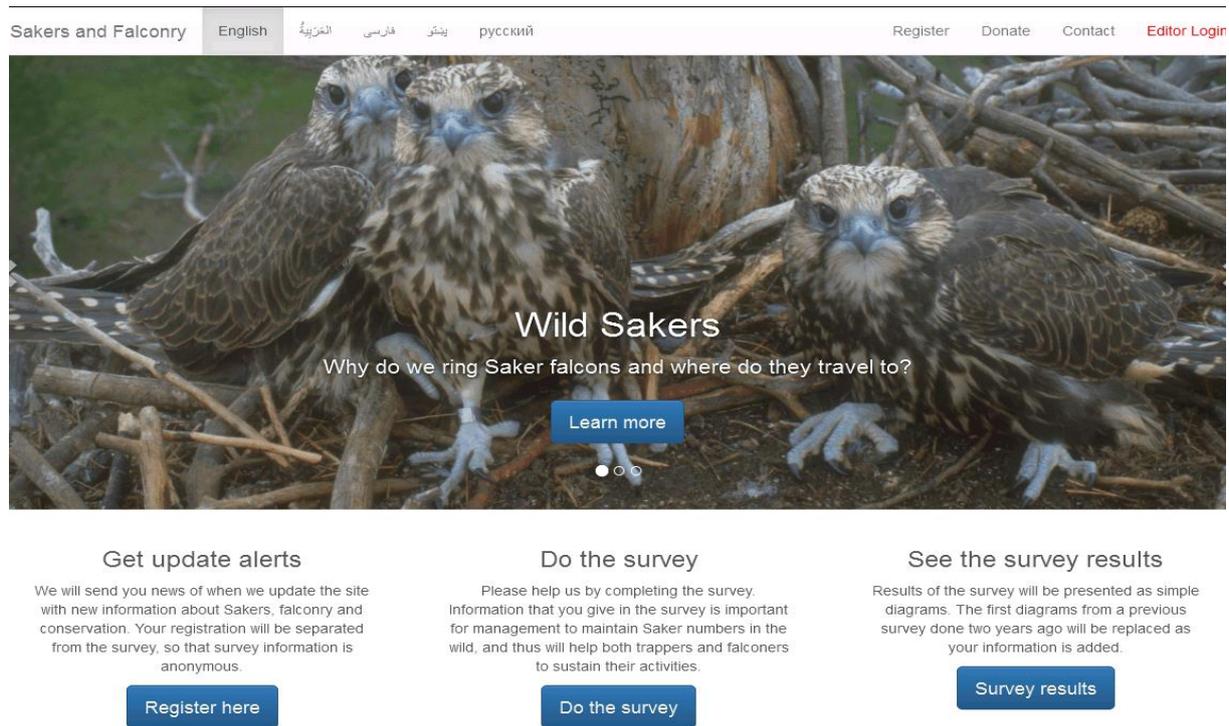
The Practitioner template's Back-office (**red**) can:
   (i)   load and translate text into any language (including for right-to-left script – see Figure 3);
   (ii)   have language-specific images which can update to show survey results without changing text;
   (iii)   accommodate language-specific links for monitoring and survey routines, reports, videos etc;
   (iv)   deliver downloads, including a multilingual mapping tool.

Figure 3   The back-office of the staging site, showing translation of Arabic.
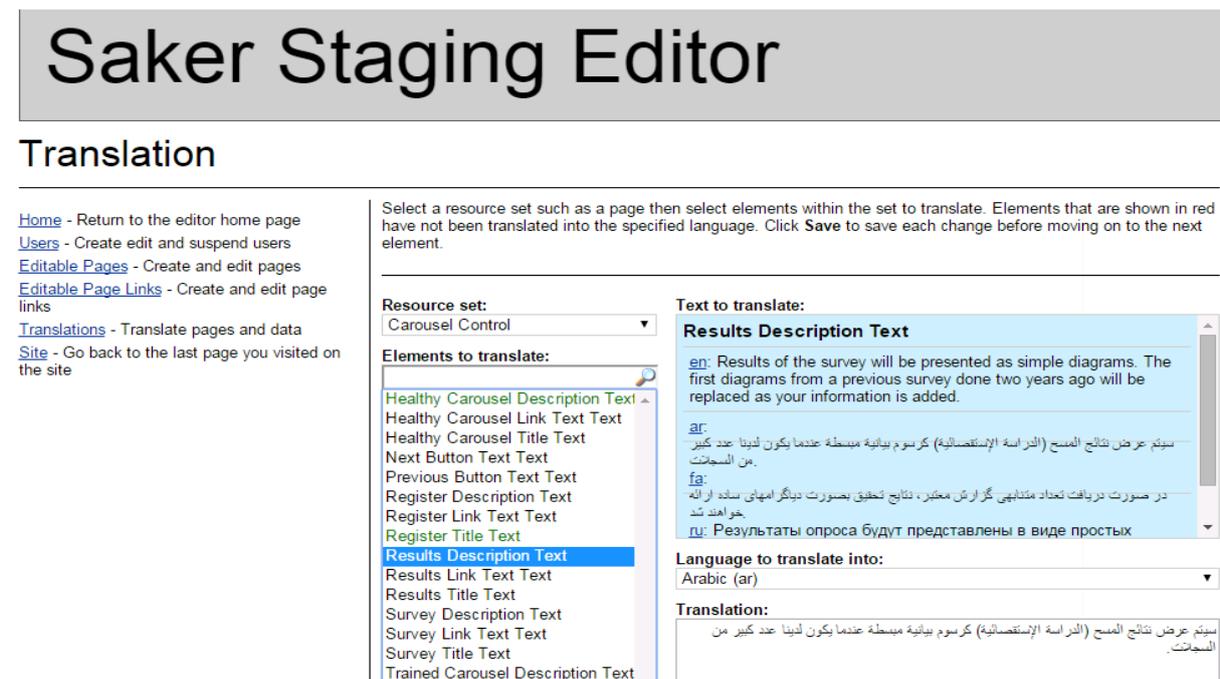
The SYCL template used for www.sakerfalcon.org (Figure 4) is more flexible, enabling local editors in a number of different languages to create content across a choice of page types suitable for (i) basic information including links (ii) news items and calendar, (iii) document storage, (iv) mapping, (v) links to listed services, (vi) photo-galleries and (vii) registering and contacting visitors. Although in Sakernet I the SYCL template was used only for a science and administration site in English, many linked separate sites can each have all these facilities for sophisticated local content through an HTML translation capability.

Figure 4 The site at www.sakerfalcon.org operates in a single language, is rich in links and is easy to edit nationally (e.g. for news) but can have pages inserted by editors of organisations elsewhere (left menu).

Appreciable effort is involved in generating content for web-sites, with translation of content another important task. In both cases a team of helpers is required. The effectiveness of their engagement in the work can be assessed in terms of meeting timelines for the project, as well as from site-use statistics, in this case from Google Analytics. During the second year of the project, IAF also commissioned a portal (www.perdixnet.org) for restoration of the Grey Partridge (*Perdix perdix*) and its farmland habitats in Europe. This second portal was informed by the Saker portal and in turn provided information for making improvements in management, specifically to run a series of national SYCL sites as linked satellites from the multilingual portal, with editing by local organisations to adjust for differing requirements in each of many countries.

V.2   Web survey

The survey was based on a simplified version of a questionnaire developed for falconers and trappers by Monif AlRashidi in the 2013 survey for the SakerGAP (Kenward et al. 2013), following a yet more extensive previous survey (AlRashidi 2004). The questions (Table 1) were ones considered likely, on the basis of the previous surveys, to be easily answered without fear of admitting to any dubious activities. The aim was to build trust, not to make practitioners afraid to respond.

Table 1 List of questions and possible responses in the survey in Arabic, Farsi, Pashto and Russian.

Question	Possible responses
Did you answer our questionnaire before?	Yes/No
In what country do you live?	*List of countries*
Do you have knowledge of wild Sakers in other countries?	*List of countries*
Do you consider that wild Saker numbers which you observe are decreasing or increasing?	Decrease/Increase/Stable/Hard to say/No opinion.
Would you like to help wild Saker numbers remain strong for future trapping?	Yes/No/Not sure
Are you a falconer?	Yes/No
About how many new wild Sakers have you obtained in the last 5 years?	*Scale of values*
How many other new wild falcons have you obtained in the last 5 years?	*Scale of values*
How many new hybrid falcons have you obtained in the last 5 years?	*Scale of values*
How long have you been a falconer?	1-5 y/6-10 y/11-20/>20y
Do you take all your birds to falcon hospitals?	Yes/Only some/Only if sick/No
Do you trap falcons for yourself?	Yes, all/Yes, some/No
Do you release your Sakers or other wild falcons after the hunting season?	Yes, all/Yes, some/No
Are you a trapper?	Yes/No
About how many Sakers have you trapped in the last 5 years?	*Scale of values*
About how many large Sakers - Kamel (female) have you trapped and **kept** in the last 5 years?	*Scale of values*
About how many small Sakers - Mathlotheh (male) have you trapped and **kept** in the last 5 years?	*Scale of values*
About how many adult Sakers – (Algranis) have you trapped and **kept** in the last 5 years?	*Scale of values*
In how many countries do you trap falcons?	*Number*

V.3   Survey of falcon veterinarians

As there are relatively few falcon clinics and their engagement has been so important, each received an individual invitation to participate, with an explanation of the importance of the project both for conservation and for the long-term future of falconry - the passion of their clients. Veterinarians were interviewed personally to obtain basic data on their clinic in Table 2, and information in Table 3 on numbers of falcons handled annually and what IT help they would appreciate in exchange for cooperation with the project. Unfortunately, although two falcon hospitals were identified in Saudi Arabia, it was not possible for REK to visit these to enquire about IT aspects. The presence of a hospital in Kuwait was also discovered too late for a visit to be arranged.

Table 2 Registration data for falcon hospitals.

Date:		
Country:		
Falcon Hospital:		
Period of operation:	**Opening year:**	**Closing year:**
Address:		
Phone:		
E-mail:		
Web:		
Data provider		
Name (title & first & family):		
Affiliation:		
Position:		
Address:		
Phone:		
E-mail:		

Table 3 Induction survey for falcon hospitals.

Roughly how many of your clients keep pure Saker Falcons?	
Approximately what % of Saker Falcons are individually marked when first presented at the Hospital?	
Do you mark any or all previously unmarked falcons during treatment If yes, what method(s) is used?	
Do you record re-visits of each marked Saker Falcon?	
What equipment manufacturer(s) do you use for reading the identity markers (e.g. microchips)?	
Would you be interested for the CMS Saker Falcon Task Force to infor you of the origin of falcons with pre-existing identity codes?	
What other help could the Flagship Project provide for you to reward your assistance with the project, for example as information / increased internet presence of your hospital?	
Would you be willing, if clients agreed, to collaborate with the Project by providing a body feather sample from trapped Saker Falcons for DNA extraction, as a long term project to identify populations from which they originated?	

VI. Findings

The planning aims of the project were to have the portal translated and live in four months, and the survey live in five. After the project started on 1 December 2014, both targets were met. The practitioner component and the administrative SYCL site were ready for testing by April and were launched at a meeting if IAF in Brussels on 20 April 2015, about a month before the survey went live.

VI.1   Web sites

The contents of the practitioner site had to be planned before delivery of the template, which was scheduled for January 2015, because development time was saved by requiring some topics to be hard-coded. Preliminary discussions with IAF in September 2015 resulted in agreement for the practitioner portal to have the following sections (as well as the standard "Home" page and pages for "Terms and Conditions", "Privacy Policy" and "Contact Us"):

1.   Displaying smart-phone survey results, provided by JS, and prize winners;
2.   Information topic on Saker Falcons in the wild, trapped and trained;
3.   Information topic on handling and veterinary care of Saker Falcons;
4.   Information topic on falconry more generally and the IAF;
5.   Registration of contact details for direct provision of information;
6.   Acceptance of sponsorship payments for projects such as satellite tracking;
7.   Maps of satellite-tracked falcons (display small, expand on click);
8.   An English section accessible only via the administration section of the portal.

For brevity on buttons, the topics at launch were "Wild Sakers", "Migration", Healthy Sakers", "Trained Sakers", "Falconry" and "Survey Results", plus a page for Falcon Hospitals

A "Content Committee" was established in early January 2015, consisting of Andrew Dixon (AD), Bakyt Karnakbayev (BK), Gary Timbrell (GT), Kamran Khan Yousafzai (KKY), Margit Muller (MM), Matyas Prommer (MP), Mohammad Kathlan (MK), Mohammed Shobrak (MS), Monif Al Rashidi (MAR), Reza Parastar Namini (RPN) and Zayed Al-Maadheed (ZAM), with chairs of Steering Group, Adrian Lombard (AL) and Nick P. Williams (NPW) and organisation by Janusz Sielicki (JS) and Robert Kenward (REK). During the following 3 months, they kindly corrected and approved drafts of practitioner site content from RK & MM, and of the survey from JS, and agreed domain names for the sites. Images for the practitioner site were kindly provided by AD, JS, MM, RPN, AL and REK, with texts for the administration site from Ian Burfield, JS & REK. Heroic efforts from MAR (Arabic), RPN (Farsi), Pashto (KKY) and Russian (JS) gave translation for the practitioner section within a month.

The target of obtaining 1000 visits to the portal was reached after just 4 months. There had been 2,315 visits by the end of January 2016, some 9 months after the launch), and 4,584 at the end of March 2017, 24 months after launch. During the first 9 months, the most visits to the site (723, representing 31% of the total) had been from Russia. However, a very high "bounce rate" (visits to only one page) of 98% had indicated that many were not attracted to the site by ornithological interest. Ideally, analysis should consider the dwell time on that first page, to exclude visits from "bots" which conduct automated searches across the web and dwell for only a few moments, or from humans who dwell only long enough to read a few words and realise their visit is unintended. However, such data were not available, so further analysis also calculated numbers of visits that clicked to a further page and thus did not bounce. Results in Table 4 are ranked to show countries with most multiple-page visits at the top.

By 31 March 2017, there had been 1,136 multiple-page visits, representing 906 individual visitors with 230 repeat visits. There were 438 (39%) of those multi-page visits from Iran and, assuming that single-page visits were relatively brief, they spent very close to the average 5 minutes 18 seconds on the site,

including 4.5 page visits (Table 4). The other most notable results are shown with bold **red**, for notably poor results, and bold **green** for notably good. Thus, visits from Russia were the second most frequent after Iran, but 97% of the 766 visits were single-page and the multipage ranking was 7th. Multipage visits from Russian-speaking states were 4% of the total, as were Pakistan's, compared with 20% from Arabic-speaking countries and most of the remaining 33% from Europe. Visitors from Pakistan were especially likely to visit several pages, producing a bounce-rate of only 54%. A high proportion of repeat visits from United Kingdom and Poland represented site administrators there, with a high proportions of multipage visits (low bounce rate) also from South Africa due to IAF leadership there.

There were many visits from the United States but relatively few after the first year, perhaps because those reading Arabic, Farsi, Pashto or Russian in the USA were well-connected internationally and heard about it early; UAE and Pakistan may also have been informed early. In contrast, Qatari visits increased substantially in year two (as did those from Ireland, Algeria and India). Other intriguing results were the relatively short duration and few pages visited from Egypt, compared with long perusal by Libyans.

Table 4 Google Analytic statistics from the multilingual web-site at 31 March 2017, in order of multipage visits (right side) for the 25 countries with most such visits. Most notable results are shown in bold **red** and **green**, but only in the top half of the table because samples are too small to be important further down.

		Sessions (% total)	% new sessions	New Users (% total)	Bounce Rate	Multipage (un-bounced) use of the site					
						Sessions	Users 2017	Users 2016	Session Duration	Pages/ Session	Increase visit (%)
	Totals/Averages	4,584	84%	3,836	75%	1,136	906	408	00:05:18	4.54	122
1	Iran	1,461(31.87%)	85%	1,239(32.30%)	70%	438	371	139	00:05:20	4.00	167
3	Saudi Arabia	356(7.77%)	89%	318(8.29%)	79%	75	67	32	00:03:48	3.52	109
4	United Kingdom	271(5.91%)	**56%**	153(3.99%)	63%	99	56	20	00:05:18	7.10	180
5	" States	164(3.58%)	90%	148(3.86%)	78%	36	32	21	00:05:28	5.05	**52**
6	" Arab Emirates	140(3.05%)	79%	110(2.87%)	74%	37	29	17	00:06:41	5.12	71
8	Pakistan	85(1.85%)	71%	60(1.56%)	**54%**	39	28	16	00:05:36	4.49	75
2	Russia	**766(16.71%)**	93%	715(18.64%)	**97%**	22	21	10	00:08:43	6.92	110
7	Egypt	88(1.92%)	98%	86(2.24%)	80%	18	18	8	**00:01:38**	**2.56**	125
9	Libya	67(1.46%)	85%	57(1.49%)	72%	19	16	7	**00:10:49**	4.39	129
10	Qatar	66(1.44%)	67%	44(1.15%)	67%	22	15	4	00:04:06	3.13	**275**
11	Poland	58(1.27%)	**33%**	19(0.50%)	**43%**	33	11	5	00:06:18	4.60	120
13	Germany	53(1.16%)	74%	39(1.02%)	60%	21	15	7	00:08:25	4.96	114
14	Ireland	50(1.09%)	48%	24(0.63%)	56%	22	11	2	00:05:14	5.86	450
16	Algeria	49(1.07%)	90%	44(1.15%)	76%	12	11	3	00:04:54	4.35	267
15	India	50(1.09%)	74%	37(0.96%)	74%	13	10	3	00:03:16	2.69	233
17	(not set)	43(0.94%)	70%	30(0.78%)	65%	15	10	5	00:07:36	4.53	100
20	Netherlands	37(0.81%)	95%	35(0.91%)	73%	10	9	5	00:03:20	3.52	80
21	Iraq	31(0.68%)	97%	30(0.78%)	71%	9	9	6	00:06:19	4.00	50
22	Morocco	29(0.63%)	86%	25(0.65%)	62%	11	9	6	00:06:51	3.90	50
28	South Africa	18(0.39%)	78%	14(0.36%)	44%	10	8	5	00:03:09	5.70	60
12	Kuwait	54(1.18%)	83%	45(1.17%)	85%	8	7	4	00:02:22	2.35	75
26	Italy	19(0.41%)	79%	15(0.39%)	58%	8	6	4	00:01:21	6.75	50
27	France	18(0.39%)	83%	15(0.39%)	61%	7	6	3	00:07:02	4.86	100
36	Portugal	15(0.33%)	93%	14(0.36%)	60%	6	6	5	00:05:55	5.68	20
41	Switzerland	12(0.26%)	92%	11(0.29%)	42%	7	6	4	00:02:51	3.43	50

It is hard to estimate how many visits to the site were genuine rather than by bots. However, if the average bounce-rate of 75% is applied to the Russian multi-page data, there would have been just under 4,000 sessions from 3,200 users in total, and thus 3-4 times the initial target.

VI.2   Web survey

During the first 3 months of operation (until the Muslim new year of Eid al Adha in September 2015), those completing the survey and leaving their email address were entered into a raffle for prizes valued at about US$250 each (the first prize was a smart phone and the other three were falconry equipment). The 54 people who completed the survey could be compared across global regions with visitors to the web-site, and with numbers who had started the survey but failed to complete it. The completion of the survey was considered to indicate a greater degree of trust in the survey organisation than starting and failing to complete.

After the first three months of the survey, when the first-year competition closed, there had been 507 visitors to the web-site. These visits broadly showing the same pattern as in January 2016 and March 2017. However, year 2 visitors using Arabic, both from North Africa (Algeria, Egypt, Libya, Morocco and Tunisia) and associated with the Arabic Peninsula (Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, UAE, Yemen), and using Farsi (from Iran), overtook in numbers those using Russian, both from Russia and European states from which surveys were provided (Moldova, Serbia, Turkey, Ukraine), and from Central Asia (Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan). This strong growth in visitors, and change in preponderance of visitors speaking Arabic and Farsi, can be seen in the comparison of numbers visiting by the first prize draw, at Eid Al Adha in September 2015, and by the second draw in November 2017 (Figure 5).

Figure 5   Visitors to the website grew substantially between the first prize draw, at Eid Al Adha in September 2015, and the second draw in November 2016.
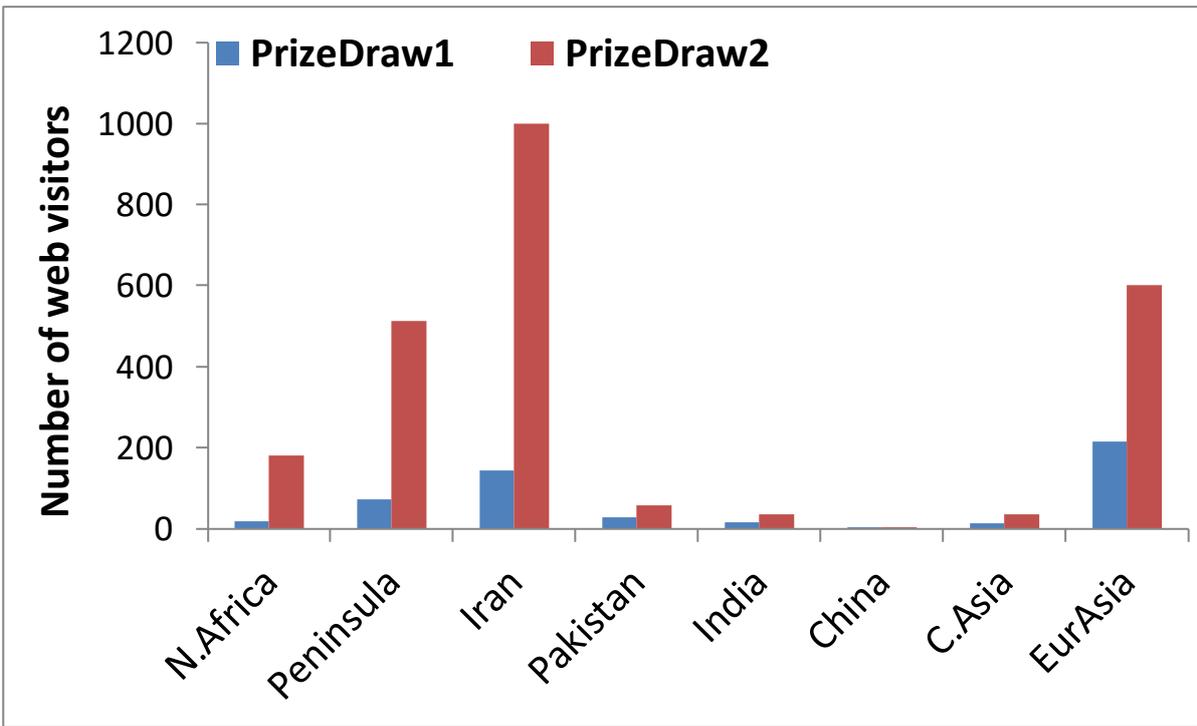
However, if one looks at the numbers of people who started and completed the survey, and compares this with web-site visits (especially in terms of multi-page use), there is a marked change in the pattern across the different geographic regions (Figure 6).

Relative to multipage visits to the web-site, which probably best indicated interest in its content, the strongest tendency to start and complete the survey, was among visitors in Pashto (almost entirely from Pakistan), and in Russian from other parts of Europe and central Asia. Although the numbers of multipage visits was highest from regions speaking Arabic and Farsi, fewer surveys were started from these regions than from Pakistan and the Russian-speaking areas, where there was also a greater tendency to complete the surveys. No surveys were started, despite high page-reading interest from Europe and North America, presumably reflecting minimal ownership of wild Sakers in those regions.

Figure 6 The proportions of visitors to the website, of those making multipage visits, and of those who started and completed the survey, during 24 months of web-site operation.
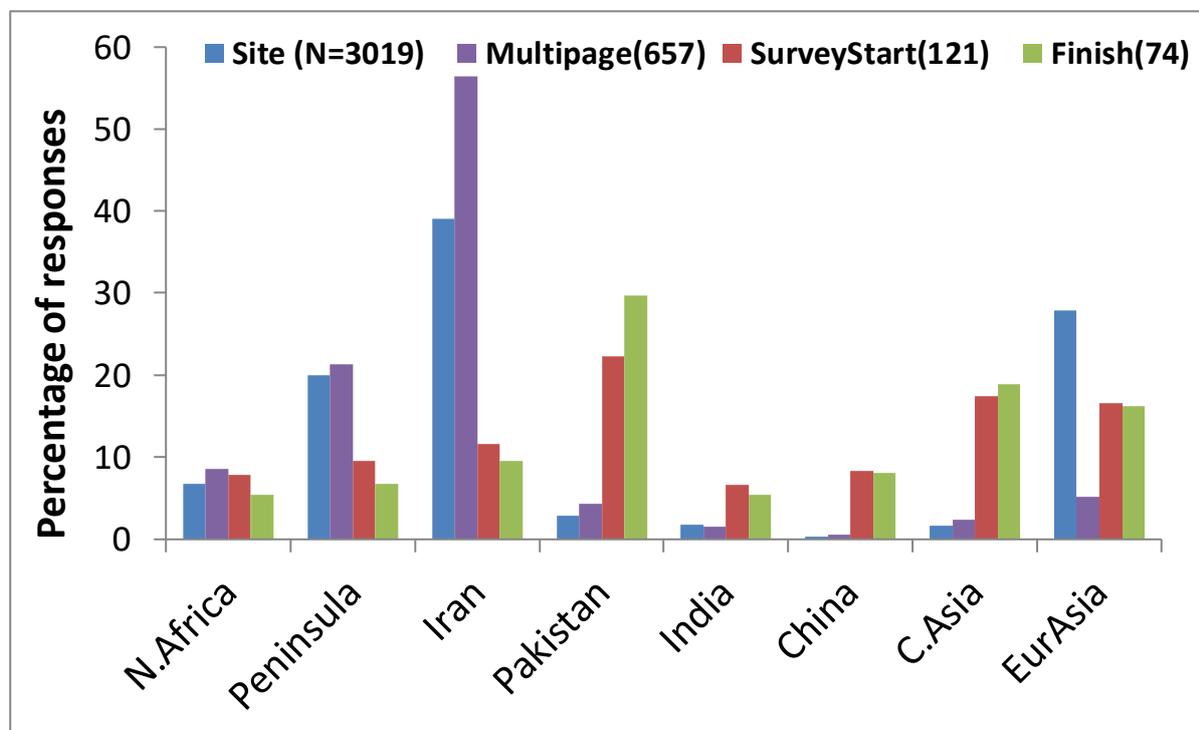
The contributors from China and India (Figure 6) were impressive because they completed the survey in English, as did some participants from Central Asia. For all these three areas more people in the first period started the survey than visited the web-site, with only one more web-site visit than survey start in Pakistan (where about half the visitors used English rather than Pashto). This may have reflected the leaflets promoting the survey, which were circulated by falconry clubs and gave an internet address from which the survey could be accessed in English, whereas the link to the web-site was not in English.

However, if one considers the number of on-line surveys started and completed in the 3 months that these were open each year before the prize draws, there was a great contrast between years. In comparison with the considerable increase shown in Figure 3 for visits to the web-site, the 114 surveys started before the first draw (and 67 completed) were followed in the second year by only 14 started and 7 completed. Only one survey in the second year came from Pakistan, none from Iran, 2 from Arabic-speaking countries and 4 from the areas using Russian. This suggests that most people likely to do the survey had been reached in the first year, but leaves unanswered the question of why there was

so much interest in the web-site yet relatively few survey returns from the Arabic speaking countries.

Ten or more survey returns were obtained from North Asia, Central Asia and Pakistan. However, the 2013 survey gave additional data from Saudi Arabia and UAE for most questions that were also asked in the internet survey. Thus, there were at least 10 responses from five regions, justifying some comparison between their responses (Table 5, for rows shown green), although samples of at least 20 would be preferable for making comparison between regions (Table 6).

Table 5 Completed responses for the first three months of internet survey (samples of ≥10 in green).

| | No. of survey returns | Saker 'increase'-'decrease' as % of N | % of repondents in each country or region who: | | | | | |
			keep Sakers	keep hybrid	falconers for <10 years	use falcon clinics	trap own Sakers	release trained Sakers
North Africa	4	+25	100	75	25	25	75	50
Saudi Arabia	37		70	15	14	100	17	50
UAE	10	-33	30	90	20	80	22	100
Iran	5	-100	100	40	80	80	100	100
Pakistan	19	-50	84	42	68	26	63	84
India	4	-25	0	0	25	50	75	100
China	4	-75	100	0	50	0	25	100
Central Asia	10	-25	90	0	50	50	40	90
North Asia	11	+10	27	55	45	73	18	45

 ▮ **regions with barely tolerable (10) or more adequate (>20) samples**

Table 6 Completed responses for the internet survey, with strongest effects in green or orange.

| | No. of survey returns | Saker 'increase'-'decrease' as % of N | % of repondents in each country or region who: | | | | | |
			keep Sakers	keep hybrid	falconers for <10 years	use falcon clinics	trap own Sakers	release trained Sakers
North Africa	4	+25	100	75	25	25	75	50
Saudi Arabia	37		70	15	14	100	17	50
UAE	10	-33	30	90	20	80	22	100
Iran	5	-100	100	40	80	80	100	100
Pakistan	19	-50	84	42	68	26	63	84
India	4	-25	0	0	25	50	75	100
China	4	-75	100	0	50	0	25	100
Central Asia	10	-25	90	0	50	50	40	90
North Asia	11	+10	27	55	45	73	18	45

 ▮ **within notably high 20% (tolerable sample)**
 ▮ **within notably low 20% (tolerable sample)**

 ▮ **within notably high 20% (inadeqate sample)**
 ▮ **within notably low 20% (inadequate sample)**

The relatively small number of responses from four regions reduces confidence in data from those sources. Nevertheless, the unanimity of responses that suggest Saker population is declining in Iran contrasts with a slight preponderance that considered numbers to be increasing in North Africa (where some wintering falcons from increasing populations in central Europe have been detected) and North

Asia. The respondents mostly kept Sakers, which is to be expected in a survey that targeted information on Sakers, but it was notable that less than a third of respondents were keeping them in North Asia and UAE, with none kept in India (where raptors are kept but may not be used legally for hunting). The proportion of respondents keeping hybrids was high in UAE, low in Saudi Arabia and zero in India, China and Central Asia, but appreciable in other countries.

There was considerable variation in the age structure of the falconry community that responded. A majority of respondents had been falconers for less than a decade in Iran and Pakistan, whereas in the Peninsula countries of Saudi Arabia and UAE more than 80% had practised falconry for longer. Further information on the situation in Saudi Arabia is also shown for the 2013 survey in Table 7, where it can be seen that falconers averaged 49 years old and 54% had practised for more than 20 years. Sakers were the strongly preferred species, with only eight of the 27 active falconers not having Sakers (the other ten had stopped flying falcons due to lack of quarry), and they exchanged hands at an average price of US$8,000 (range US$2,000-19,000).

Table 7 Attributes, experiences and value placed on Saker Falcons for 37 falconers and falconer/trappers surveyed in Saudi Arabia in the 2013 survey

	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 % Median/ majority	78% Hail	48.8 49.0	100% Hobby	29% 10-20 years 54% more than 20 years	2.3 2.0	52% of 61 are Saker 8% are hybrid	27% (10) not active 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 96% ring +micro-chip	100% reply 10% had CITES	5.3 years 4.0 years	100% reply 91% Saker	16% died 66% sold	100% reply 91% Saker first choice	US$8313 US$7500	17% of falconers also trap Saker was 38/100 falcons trapped

All the Saudi respondents visited veterinarians and 96% had their falcons marked with micro-transponders. Good veterinary care resulted in trained Sakers leaving the hands of owners mainly due to sale or release, with only 16% through death. In other regions, the new survey (Table 6) showed that falcon hospitals and clinics were used by a majority of respondents in Iran, North Asia and UAE, but less frequently elsewhere and not by respondents in China.

The proportion of falconers who also trapped falcons in Saudi Arabia was only 18%. The seven concerned had each trapped 2-60 falcons in the last decade, 100 altogether. However, the 38 Sakers trapped would have just about sufficed for all 27 falconers in the survey in the previous decade, because the average possession was one Saker at a time for 2-3 years after which 66% of them were sold on. On that basis, the 18-100% of respondents who were trapping falcons in other countries (Table 6) could have been meeting most of the local regional demand. This suggests that widespread, small scale trapping by other falconers, rather than intensive trapping by few people, may have been meeting the demands of the respondents to this survey. Apart from North Africa, North Eurasia and Saudi Arabia, most respondents also reported releasing Sakers back to the wild after their use in falconry (Table 6).

During the verbal survey in 2013, falconers in Saudi Arabia and the United Arab Emirates proved well 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 was less favoured and there was no willingness to pay extra for certificates of legal origin. Initial suspicion of the survey team was overcome in discussion that showed strong links to international falconry: trust-building was important for cooperation.

It is important to note that capture and flying of wild Sakers within a country is not subject to CITES restrictions on international trade, and has not been restricted in Saudi Arabia and some other countries. However, breaches of CITES occur when such birds are taken across land borders between neighbouring states, where with families and friends often living across borders which are not tightly controlled, this can become a routine practice. It was explained more than once during the internet survey that although many falconers on the Arabian Peninsula had visited the web-site and some started the survey, reluctance to provide possibly compromising information had deterred completion and had also deterred others from engagement.

On the other hand, it became apparent during these surveys of falconers, and in the survey of falcon veterinarians described next, that falconers were quite prepared to have their birds marked by veterinarians with micro-transponders. Such marking was originally a convenience for vets to assign medical histories to birds which quite frequently change owners, but has become a requirement in some countries at least for participation in competitions. In combination with the banking of genetic material from each bird (e.g. as a small feather) to detect any transfer of markers, there is scope for monitoring trade through comprehensive marking. Moreover, for monitoring trade from point of capture, it was useful that 5 of 7 Saudi trappers would have been be prepared to mark trapped falcons prior to sale, albeit with some reluctance because this risked raising suspicions about lack of wild origin. Linking a falconry-passport system with the routine veterinary marking could be used both to help birds used in falconry move legally across borders and also to automate providing more accurate records of trade.

Prizes for the survey were distributed in December 2015. The first prize (of a Motorola smartphone but taken as US$250 cash), was won in Pakistan, an appropriate reflection of the good survey response there. The prizes of falconry equipment went to falconers in the United Arab Emirates, Pakistan again and Turkmenistan. In November 2016, prizes for the second year were allocated to falconers in Kyrgyzstan, Moldova, Pakistan and Uzbekistan.

VI.3   Survey of falcon hospitals

Data on 9 falcon hospitals or clinics were obtained by personal interview between 7 and 11 September 2015. Four establishments were visited in Doha, Qatar, one of them a large establishment created in 2011 with government support, and three somewhat smaller and longer established. All had been contacted in advance, and all readily made time for the survey interview. Veterinarians from five other establishments came to the IAF stand at ADIHEX, held in Abu Dhabi in September 2015. Two came by arrangement from falcon hospitals in UAE, and two also from smaller clinics, in one case providing services only for one private client. One veterinarian, with personal experience as a falconer for 25 years, came from Iran.

The large falcon hospitals were handling 6,500-11,500 birds per annum. The smaller establishments were handling 35-350 falcons, although one large clinic apparently saw about 3,000 birds annually. All but two were marking birds with micro-transponders, the exceptions being the clinic in Iran and the private clinic in UAE, which was seeing only domestic-bred falcons with close-rings (Figure 7). The AVID micro-transponder brand was in use at all the other seven sites; as AVID was used in UAE in the 1990s, it had been encouraged as a standard for the work with wild birds at that time (Kenward et al. 2001). Clinics in Abu Dhabi and Dubai were also using ISO Transponders of the more modern FDX-B Standard.

Figure 7   The number (totalling 9) of falcon veterinary establishments using markers on birds, ready to provide a small feather for DNA and welcoming a system giving information on already-marked falcons.
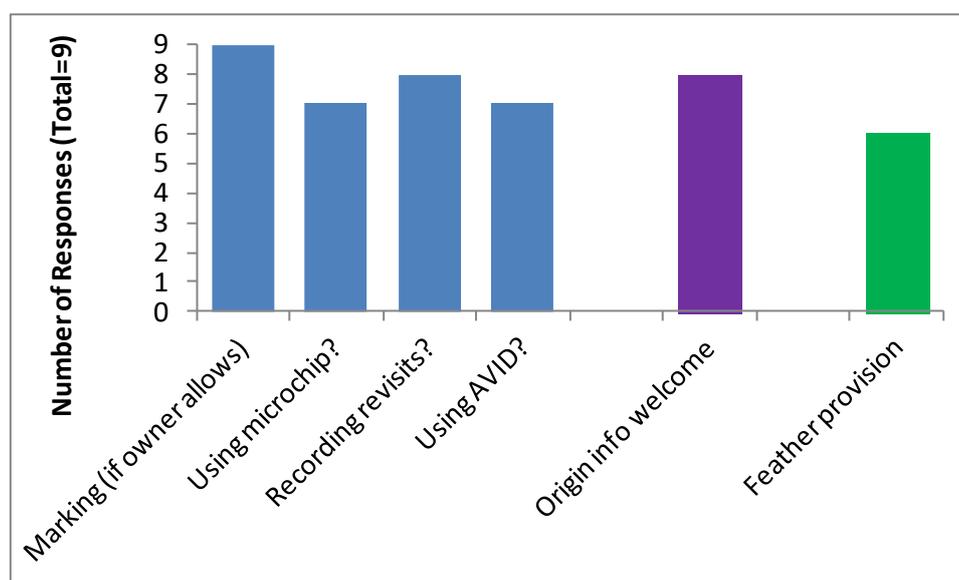
There was one marked difference in data between the public veterinary establishments in UAE on one hand, and in Qatar and Iran on the other. In the three public UAE establishments, less than 5% of the falcons being seen were believed to be pure Sakers, although the private collection of domestic-bred falcons was reported to be 70% pure Saker. In contrast, 30-60% of the falcons seen in Qatar and Iran were Sakers, although one team in Qatar noted that a number of these were likely to be hybrids.

The recognition of hybrids was a particular concern at the largest falcon hospital in Qatar, because the rules for the very popular falcon races required certification of birds as pure stock. As a consequence, the new technology most favoured for the hospital was deemed to be a recognition process for hybrids, such as a test for presence of genes from other species in Sakers. Subsequent to that final interview in

Qatar, three of the establishments in the UAE agreed that such a test would be useful. Five of the nine establishments considered that they would benefit from a system to call up medical records when a micro-transponder was read, and two of the hospitals had such systems already. Three establishments would have welcomed help setting up a presence on the internet. This could be provided in Arabic by using sites in the System for Community Liaison (Figure 8 in **green**) retaining the existing www.sakerfalcon.org in English for science and administration (see Figure 1).

These sites in national languages for falcon hospitals could be networked with sites provided for national clubs. Large numbers of these sites, each being run for a different culture, could be networked with some pages in common and some edited locally by clubs or falcon clinics (Figure 8 in **green**). The sites and their instructions can be in any language (with left-to-right text composed in the back-office and right-to-left text pasted in after formatting elsewhere), and signposted with culture-specific links (which include country and different national languages where relevant) from the multilingual site, as developed by IAF for its Perdixnet system to restore farmland species and habitats

Figure 8 Portal capability for including linked national SYCL sites (**green**) in each language.
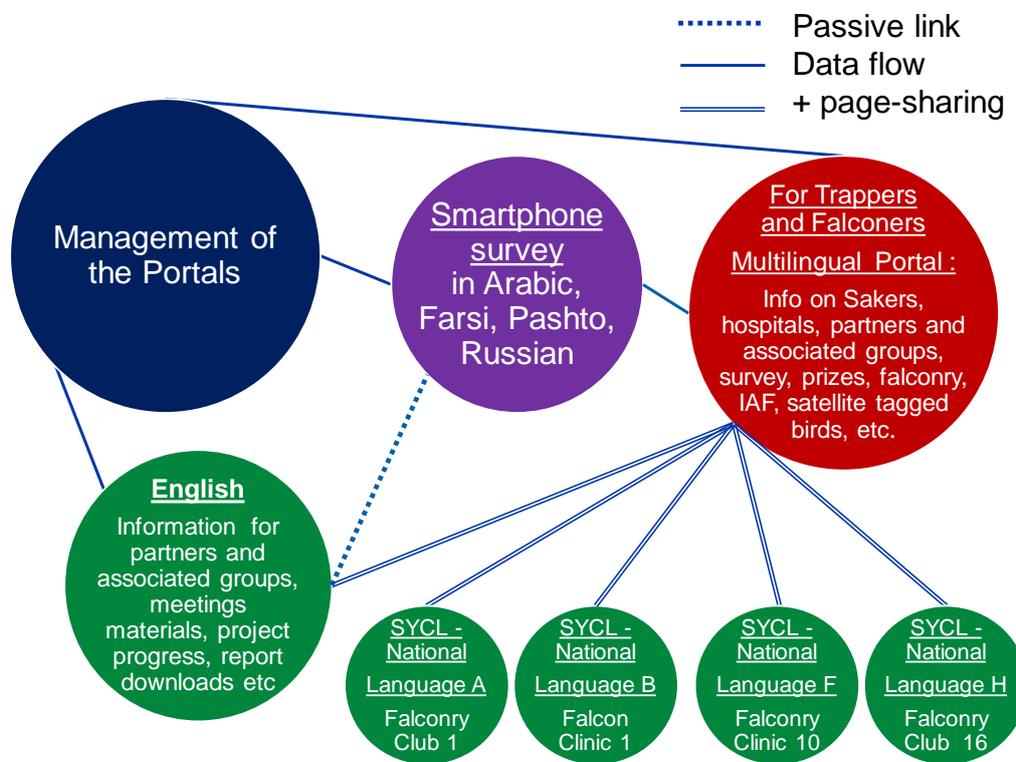
This network would provide the communication channel enabling an electronic management system for the Saker falcon. Such a network seems quite practical, because a major interest, in every establishment except the private clinic with domestic-bred birds, was for the project to provide them, if possible, with a system to indicate the country of origin of any bird that had been marked in the wild (Figure 7). Six of the nine establishments said they were prepared to supply a feather for banking when they marked birds, if such a system was organised; the other three would require further discussion on the topic.

One further comment which arose in discussions both with falcon hospitals and with clubs seems very important. There was a realisation that questions about ownership of wild Sakers, including pure Sakers that were likely to have wild origin (as few were being bred), was a delicate issue in view of the CMS Appendix I listing of the species for all states except Mongolia. On the one hand, it was felt that knowledge of the proportion of 'pure Sakers' being registered at hospitals could be embarrassing for

governments, especially if they were CMS and CITES[1] signatories in states where few wild Sakers were trapped. On the other hand, it was felt that a low response of falconers to the survey was also to be expected in countries where many trained Sakers had come from the wild, because the survey required respondents to give names if they wished to enter for prizes. Where the prizes for falcon races could include high value vehicles, there was less motivation to enter for US$250 prizes than in less wealthy countries in Central and European Asia.

VII.   Conclusions from the findings

VII.1   Year 1 (2015)

The multilingual web-site and survey was delivered on time. A target of 1000 visits was set for the site based on findings with multilingual www.naturalliance.eu, but conservatively in view of lower internet connectivity in many Saker range states than in Europe. The target was exceeded 3-4-fold, with visitors throughout and beyond the Saker geographic range. The presence of falconry clubs linked to IAF in so many of the countries probably contributed to this, especially for countries where numbers of surveys were close to numbers of site visits. The value of community-run multilingual communication is clear.

Targets were not set for the multilingual survey in unknown social terrain. Coverage was wide and samples best from areas that had not previously been surveyed. However, the relatively short duration of the survey before prizes were drawn may have reduced samples, so there is need to run the survey again in the second year. Nevertheless, three facts have become very clear.

One is that traditional trapping, training and release of Sakers by local falconers remains widespread, and many are prepared to give information via the internet at least when there are prizes involved. That was similar to a finding for ordinary falconers in Saudi Arabia, who kept relatively small numbers of falcons, and of which 37 cooperated with researchers to complete questionnaires at short notice in 2013. As in that earlier survey, many were probably already having their Sakers marked with microchips when they visited veterinarians. Like the Saudi falconers, those in poorer countries may well not have been prepared to pay much for extra certification, but to favour conservation solutions based on falcon veterinarians and clubs. It is therefore likely that these falconers and trappers can be an important resource for monitoring Saker populations and harvest levels by mark-recapture techniques, at least in countries that continue to permit trapping.

Secondly, there is also widespread access to veterinary facilities. Although hospitals with many assistant specialists may only be present in and around the Arabian Peninsula, it seems that there are clinics provided by single veterinarians who specialise in raptors in many more countries. Such clinics are very desirable for the welfare of trained falcons, and therefore to be encouraged for more than one important reason. These establishments (together with requirements for non-hybrid falcons in competitions) have encouraged falconers to accept marking of their birds with micro-transponders, and all clinics were prepared to assist with conservation of the species that are the passion of their clients. These centres too are therefore a valuable resource for monitoring, if they can be helped to engage as they have in the past.

Thirdly, the pattern of responses relative to site visits indicated a reluctance to reveal data about Saker ownership in areas where the 2013 survey had showed that falconers were well informed about international conservation issues. Despite providing 37 responses to the GAP-planning survey in 2013 (Table 7) of which most involved Sakers, and 75 multipage visits to the web-site (Table 4), not

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[1] CITES has been signed by almost all Saker range states except Turkmenistan.

one e-survey result was received from Saudi Arabia, the country which provided the second most-frequent visits to the site. Iran, with 438 multipage visits, provided just 5 surveys completed by practicing falconers, although in this case one cannot be sure that many falconers were flying Sakers. In contrast, only 28 Pakistanis made multipage visits to the website, but 22 falconers started surveys and 19 completed them. Two things probably account for this dramatic difference. One is that in Pakistan, KKY made a strong effort to get contacts (known through his organisation) to complete the survey, whereas in Iran and Saudi Arabia there were no organisations; although knowledge of the website was promulgated by word of mouth there was no official encouragement for the e-survey. However, in Gulf States there was also a realisation, described during discussion with veterinarians and officials of falconry clubs, that large-scale informal transport of birds across borders could create a problem for relationships between falconers and CITES authorities in the countries concerned. It was explained that popularity of competitions for pure Sakers as a public spectacle in some countries (Figure 9) created risk of appreciable public dissent if government authorities were heavy handed.

Figure 9 Falcon races in Qatar.

These findings, especially the third, encourage reflection on the process of making international legislation through Multilateral Environmental Agreements. It is already recognised that the interactions of MEAs can create complications for conservation (Ivanova & Roy 2007, Kanie 2007). Although this recognition can lead towards synergies, conservation through sustainable use of Saker Falcons is bedevilled not only by conflicting business models (in the triangular relationship of protection, cultivation and wild-resource use), but also by cultural and geopolitical considerations.

In the MEA's, governments gather to make legislation with discussion mostly in English and sometimes without much opportunity to consult local people in the countries concerned. The results of the legislation may then affect the lives of people who, through lack of information (translation and dissemination), may have little ability to inform let alone be represented in the deliberations. Governments that are in a minority among Parties to an MEA may accede to legislation proposals because of *quid pro quos* on other issues, or be overruled in voting, but then have difficulty implementing measures that provoke public dissent about wildlife. At times of tension between interests allied to different groups in neighbouring conflicts, additional issues of this nature are not welcomed by governments. Great care is incumbent on MEAs in such cases, with responsibility needed both from Parties and powerful Observer organisations. Those wishing to conserve Sakers,

and their important steppe habitats that were cradles for western civilization, need to keep their considerations broad in scope, consult widely at all levels before making decisions, and be patient. The need for such care in the case of the Saker Falcon, which inhabits an area fraught with geopolitical tensions, informed the further survey and discussions with stakeholders in 2016.

VII.2   Year 2 (2016)

At this point, it is worth considering in detail some conservation proposals, in the report commissioned by CMS from Kenward et al. (2013) to inform the SakerGAP (Kovács et al. 2014), which guided the SakerGAP's consideration of what might be possible but were too detailed for inclusion as more than aspirations on conservation through use. These details included the design of a management system for monitoring Saker Falcon populations, harvests and trade through mark-recapture data, as a second stage of work on a Saker Management Pathway, of which the first stage has been established in this project and has produced findings relevant to the second stage, as outlined in Box 1.

Box 1. Proposals that followed from a Saker management system design in Kenward et al. (2013).

On the basis of the management system design, we recommended engagement of:
- Biologists to build networks of local land managers to mark & 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 & information;
- Governments and international NGOs to support this cooperative approach to Saker management.

We also recommended work on technologies for improving population modelling and exchanging 'citizen-science' information with falconers and trappers, and conceived a pathway for implementing all these recommendations. The first stage of the pathway was considered practical rapidly and is indeed now established as the first stage of this project, as follows

Saker Management Pathway Stage 1 involves agreeing with relevant stakeholders to:
- ❖   Immediately develop a portal in Arabic offering benefits to attract falconers and trappers [***done***];
- ❖   Run surveys and competitions for information on the site to build trust [***done, to continue***];
- ❖   Promulgate the idea of not trapping adults in breeding areas or buying such birds [***continuing***].

The second stage had two options, for which the choice will depend on high level stakeholder decisions.

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.

Stage I of the Management Pathway is now implemented in Farsi, Pashto and Russian as well as Arabic. Surveys confirmed the practicality of engaging falconers and trappers through the internet, and also that trained Sakers are widely marked by veterinarians, who are prepared to help use this for conservation purposes so that a system could monitor populations, harvest and trade. Discussion with falconers and veterinarians following the initial survey reinforced appreciation of need for an internationally recognised management system, due to the uncomfortable position of CITES authorities in some countries at a time of growing pressure for action on wildlife trade.

The second year of survey attempted to increase sample sizes, notably by removing questions that may have deterred completion in some countries. The sample for Central Asia increased to the

minimum of 10 responses, but we lacked time to secure more substantial prizes which might have increased responses from Gulf States. A final small informal survey of those in a position to influence falconers about the initiative indicated that where the survey response was greatest there had been most effective encouragement to visit the site, using social media, whereas in others there had been reluctance to spread a recommendation to access the survey.

Despite these minor set-backs, enough data were in hand for analysis of the effectiveness of engagement with influential falconers having substantial establishments, single falconers, trappers and veterinarians using personal interviews, the web-site and surveys on the internet (Table 8). We also knew from survey results that although single falconers with small numbers of falcons were engaging with our activities, there were also establishments with many tens of birds and several falconers employed, owned by 'substantial falconers' with government connections who may have visited the websites but were not represented at all in the web-survey. It therefore became absolutely clear that the use of a microtransponder system for both veterinary and trade-monitoring would need to be agreed by falconry clubs and others influential falconers as well as by veterinarians and governments, and also to provide e-passporting useful to the falconers and trappers.

Table 8   Effectiveness of engagement of the Saker Portal team's activities with falconry stakeholders in projects during 2013-2016.

	Interview in person	Website	Web-survey
Substantial falconers	Untested	Uncertain	None
Single falconers	Almost all agreed	More than 3,000 visits	Often <2%, up to 100%
Trappers	Almost all agreed	Many were trappers	Probably similar
Falcon veterinarians	All agreed	Some had visited	Untested
	Good response	**Some response**	**Poor response**

Effort was therefore focussed on consultation with practitioner representatives and discussion with CMS about what form a management system might take to register birds for conservation purposes as well as their own benefit. Meetings held by IAF, and notably of countries from IAF's Middle East and North African (MENA) region in Abu Dhabi in late 2016, indicated a preparedness to host further research and management for a system to combine Saker population monitoring with e-passports to simplify procedures for falconers. The success of Sakernet I also created request for portal extension to accommodate English, Mandarin and Urdu, which can be based on template design changes made for Perdixnet. Thanks to Perdixnet, it also became clear that the SYCL template would benefit from adjustment to handle right-to-left scripted languages internally, because formatting in Word and pasting into the HTML editor of SYCL is a less convenient solution for local editors.

These steps would make the network more attractive for satellite sites hosted both by veterinarians that expressed interest in these sites for communicating with their clients in local languages (e.g. with news of offers, clinics, diet, bird-care etc), and by established and nascent falconry clubs. Satellite sites run by national organisations could have content extended and facilities enhanced to become even more attractive for practitioners by covering local events, such as competitions,

without these seeming to be endorsed by cooperating international bodies through being on www.sakernet.org or www.sakerfalcon.org. A proposal to provide a master spreadsheet of data from marking systems for wild and trained Sakers (entered to a DropBox as ring or transponder numbers on Excel submission templates) was abandoned in favour of completing planning for Stage II with a more-easily-used electronic management system linked conveniently to falcon veterinary establishments and system management (Figure 10, in **blue**).

Figure 10 Portal (as in Figure 8) but with an added electronic management system (**blue**).
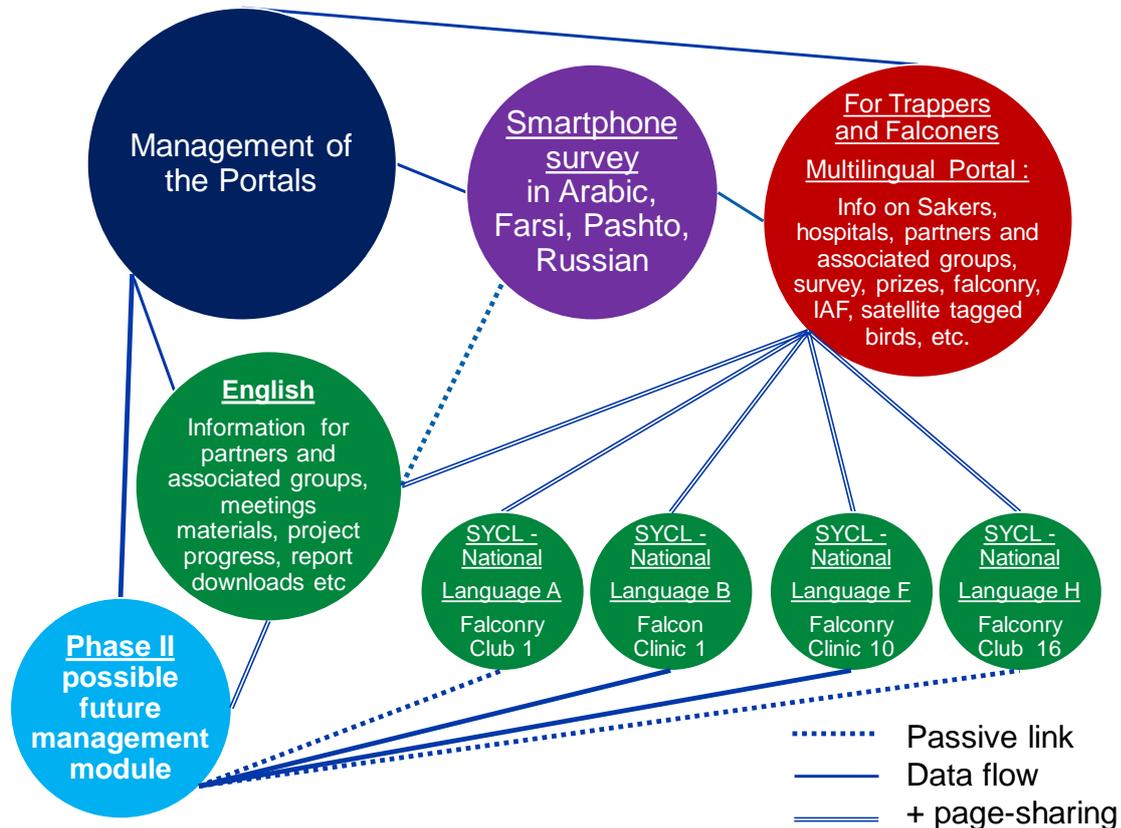
VIII.   Towards Sakernet II - Establishing an Electronic Management System (EMS)

VIII.1   An overview

This project has used web technology, including new software for creating and managing a multilingual web-site and survey, to gather sociological data on factors which could be important for managing the conservation of Sakers through sustainable use in falconry. The successful outreach of the project (to more than three times the initial target of site visitors) has resulted in further portal work by IAF. Thus, Perdixnet (www.perdixnet.org) has developed techniques for networking from one multilingual site to many sites in local languages, while Sakernet has identified national falconry clubs and falcon hospitals as potential foci for a network to encompass falconers, trappers, veterinarians and biologists.

The next stage of www.sakernet.org involves aligning it with the learning and structure of Perdixnet, by engaging falconry clubs and falcon clinics as the trusted local foci for activity clusters. Because IAF is (as in Perdixnet) reaching beyond its traditional support base of falconers, to embrace in this case

trappers, veterinarian and biologists, motivating all of them to engage with the system is going to be a challenge. The task in Sakernet Stage II is to develop tools to enable legal sustainable use (including trans-border movement) of Saker Falcons, which benefits falconers, while also adequately benefiting the activities and economy of trappers, veterinarians and others necessary for running the system.

VIII.2   Sustainable use of Saker Falcons

In the past, the prolific Saker Falcon was trapped on migration, and then released after hunting. With Saker trapping based on their urge to feed or kleptoparasitise, it would have been impossible to trap birds that were not hungry or aggressive enough and at favoured trap sites. Some birds will also have survived after release. Impact on Saker stocks from small nomadic human populations would have been lower than from larger modern populations, with trapper access to wide areas on modern transport. To counter threats to Sakers also from modern power-lines, poisons and prey shortage, conservation of falcons need monitoring of breeding stocks and of harvests, and for trade to be legal.

If biologists, trappers and falcon hospitals cooperate, mark-recapture techniques can be used to assess the size and productivity of Saker populations, as tested by UAE in the 1990s. The principle is that if 300 young birds are marked in 100 nests, and 30 of them recaptured later in the year, then the average productivity was 3 young birds per nest, and the harvest rate was 10%. Moreover, if the 30 captures of marked birds were among 1200 total captures, then they also estimate a total of 300 x 1200/30 young birds (i.e. 12,000 young birds), which would represent 4,000 nests at 3 young/nest.

It is not quite that simple, because there is a need to obtain adequate samples for estimating populations in different parts of the Saker distribution, where both productivity and recapture rates may differ. For each area where trapping occurs, one needs to have an estimate of the catchment from which young birds originate. Fortunately, tracking by satellite to estimate migration routes can assess catchments initially, while research on genetic traits or stable-isotopes is becoming available to identify origins of trapped falcons. Indeed, researchers in both these fields, from Qatar and Saudi Arabia, were at IAF-MENA's Abu Dhabi meeting late in 2016. All these approaches require systematic marking of birds across the distribution of the Saker falcon, initially as a surge to establish base-line estimates and then routinely for continued monitoring.

VIII.3   Sustainable socio-technology

Maintaining a development requires it to be sustainable economically and socially as well as ecologically. In other words, after an initial start-up cost to establish the ecological base-lines and the costs of the system, including technology and training, the maintenance of the system for monitoring Saker ecology and sustainable trade needs to be easy and self-financing.

For this to occur, the routine aspects of the system need to be inexpensive to run, in terms of markers and marking, and simple in terms of administration. Fortunately, radio-frequency identification devices (RFIDs, often called 'microchips') are inexpensive markers suitable for an electronic system that can automate routine tasks. Long-term, it is the marking of wild and trained birds that is likely to be most labour intensive and hence the most expensive routine component of the system, provided that automated administration is designed efficiently.

The costs of the marking need to be paid willingly by those who benefit most from the system. In this context, it needs to be recognised that marking has benefits beyond assessment of Saker populations. Falcon hospitals have been marking birds to identify individuals with digital efficiency, and the same approach can be applied to facilitate legal movement of birds across borders, just as e-passports speed people across borders. Fortunately, CITES already recognises passports for

movements of individually-owned animals, so falconers too could benefit from an e-passport system for raptors, as could those who administer wildlife trade. Trappers too could benefit if harvest quotas were linked to issue of RFIDs that simplify movement of legally acquired birds.

As RFIDs could be moved from marked individuals to those of higher value (especially after deaths) it would be important that biological samples be banked from all marked Sakers and those captured by trappers. Any suspicion of tampering could then be checked by obtaining DNA also from a new sample, with expenses met from trade control budgets (including fines). Fortunately, small feathers now suffice, and can also be used for stable-isotope analysis to estimate origins and refine population estimates. The basic cost is of obtaining and banking samples.

VIII.4   Costs of system establishment and operation

These considerations raise five main cost considerations for the socio-economic sustainability of the system, assuming that the technology and training is funded as part of the set-up. These costs are:
1.   For marking wild birds for population assessment;
2.   For encouraging trappers to report for population assessment;
3.   For contracting falcon hospitals to mark for e-passports and report for population assessment;
4.   For administration, including (a) markers (b) samples for population assessment and mark-bank;
5.   For falconers using e-passports.
Separating these costs also identifies the five main categories of actor in the system, which are each considered further below. Further details, from a thorough consideration in Kenward et al. (2013), are in Annex I. Estimation of these costs needs to come from trial of a system, as detailed in Annex II, in one or two countries still to be agreed.

1. Markers of wild birds. To minimise costs, marking of wild birds should be established by raptor biologists training local people to mark and record into the system, during which time an adequate payment per bird marked would need to be defined. Discussion with trappers would also be necessary to agree optimal placement of markers, either subcutaneously as used in the 1990s or in rings that are now available. It is suggested that marking of adequate samples to give baseline estimates with 5% accuracy for Saker breeding populations in about 6 possible catchments, to be defined by expert agreement but roughly including (i) Europe west of Turkey, (ii) Northwest Asia to the Altai, (iii) Southwest Asia to Mongolia, (iv) Mongolia, (v) Tibetan plateau, (vi) Eastward Asia. A cost estimate is possible based on the 1990s work that marked about half the numbers given in the estimation example above, and modern refinement has been informed by JS, MP, AD and colleagues still active from the 1990s.

2. Trappers. Consultation with trappers would be necessary from the start to define their requirements for engagement. Saudi trappers consulted in the GAP-planning survey were not eager to mark trapped birds in case this was taken to indicate previous possession; consultation should show if this reluctance could be overcome by open-access to marking data so that marked falcon origins were clear to owners. However, trappers would need compensation for providing reports and feather samples from all captured birds. Being engaged in a legal scheme needs to enhance value of birds for trappers. Ensuring adequate reporting by them may require a reward for reporting of each bird trapped, because merely making reporting a condition for quota allocation could result in under-reporting unmarked birds and hence under-estimating Saker populations. Consultation with CMS and falconry representatives would also be important for defining extents of compliance with a system that would justify initiating quotas.

3. Veterinarians already include marker application as a cost they pass to customers as part of their service, and in Qatar such marking is apparently required for entry to falcon races. All veterinarians

serving the public were interested to know the history of pre-marked birds (Figure 7), which could encourage linking existing systems to the EMS if this is made simple. Payment for entry into the e-passport system should be charged separately. As this may be the enduring source of income for maintaining the system, it may be advisable to extend the system at an early stage to other raptors than Sakers, in order to maintain an adequate income stream from countries where few Sakers are flown. The system would in any case have benefits for conserving other raptors by monitoring trade.

4. Administration would need to secure a supply of ISO RFID Transponders of the FDX-B Standard during system establishment. RFIDs would need to be issued to local people marking wild birds and eventually to trappers if agreements could be reached to use these for legal quotas. Administrative costs of collecting and banking biological samples, which would require CITES compliance if moved between countries, could be minimised by creating a protocol to be followed by veterinarians or falconry organisations for banking samples in each country. Samples would then only need to be moved for analysis (a) for project work to refine population estimates or (b) for forensic tests, in each case with costs met from other budgets.

5. Falconers would benefit in two ways from successful introduction of a Saker EMS. In terms of the reputation of falconry, recently enhanced through Gulf-led accreditation to UNESCO, replacement of illegal trade by legal movements of raptors is indispensable. In terms of facilitated movement of individual falcons, for hunting or trade, there would be benefits for falconers owning single falcons or large establishments. However, it is the falconers that are ultimately going to need to manage and find finance for the maintenance of such a system.

The international-to-national multi-lingual networking, which would be necessary to support an electronic management system for Sakers, has been developed for Perdixnet through the desire of falconers to restore prey to farmland ecosystems in Europe. The same team is ready to provide software and training for a Saker EMS. Successful trials of the system proposed for Sakernet Stage II could lead to international roll-out, if appropriate endorsements from CMS and CITES were obtained, and falconers could benefit more widely if other raptors of interest for falconry and conservation were included in the system. However, building Perdixnet needed strong cooperation of national falconry organisations, guided by IAF. Similar engagement of falconry organisations in the MENA and Eurasian regions would be required for development and their continued management of Sakernet II.

Prerequisites for an effective Saker EMS are the readiness of falconry organisations, veterinarians and governments in the Gulf region to use such a system, and of the parties to CMS and CITES to agree to its use. With coming meetings in Kyrgyzstan and Abu Dhabi, a timeframe exists for developing and testing an EMS before the Conference of Parties to CMS in 2020.

References
(Internet documents were last visited on 28/06/2017)

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

CITES (1975) Convention on International Trade in Endangered Species of Wild Fauna and Flora. Available at: http://www.cites.org/eng/disc/E-Text.pdf

CMS (1979) Convention on the Conservation of Migratory Species of Wild Animals. Available at: http://www.cms.int/en/convention-text

Kovács, A., Williams, N.P. and C.A. Galbraith (2014) Saker Falcon *Falco cherrug* Global Action Plan (SakerGAP), including a management and monitoring system, to conserve the species. CMS Raptors MoU Coordinating Unit, Abu Dhabi. CMS Technical Series No. XX. Available at: http://www.cms.int/sites/default/files/document/Inf_10_8_SakarFalcon_GAP_Eonly.pdf

Dixon, A., Batbayar, N., Purev-Ochir, G. and 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. and N. Batbayar (2013) The problem of raptor electrocution in Asia: case studies from Mongolia and China. Bird Conservation International 23:520-529.

Dixon, A. (2016) Commodification of the Saker Falcon *Falco cherrug* : Conservation Problem or Opportunity? pp. 69-89 in F.M. Angelici (ed.) Problematic Wildlife. Springer International, Switzerland. DOI 10.1007/978-3-319-22246-2_4

Fox, N.C., Eastham, C.P. and H.J. Macdonald (1997) ERWDA handbook of falcon protocols. Emirates Research and Wildlife Development Agency, Abu Dhabi.

Fox N., Barton N. and E. Potapov (2003) [Conservation of the Saker and Falconry]. Steppe Bulletin 14:28-33 [In Russian].

IUCN (2000) IUCN Resolution WCC2.74. Conserving the Saker Falcon. http://www.sakerfalcon.org/data/00063/IUCN2-74_635578775192801569.pdf

IUCN (2008) IUCN Resolution WCC4.26. Trust building for biodiversity conservation and sustainable use in line with the *European Charter on Hunting and Biodiversity.*

Ivanova, M. and 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/sites/default/files/Ivanova%20and%20Roy%20GEG.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.

Kenward, R., Katzner, T., Wink, M., Marcström, V., Walls, S., Karlbom, M., Pfeffer, R., Bragin, E., Hodder, K. and A. Levin (2007) Rapid Sustainability Modeling for Raptors by Radiotagging and DNA-Fingerprinting. Journal of Wildlife Management 71: 238-245.

Kenward, R.E. and M.J.G. Gage (2008). Opportunities in falconry for conservation through sustainable use. Pages 181-204 in Sielicki, J. and T. Mizera. (eds.): Peregrine Falcon Populations - status and perspectives in the 21st Century: EPFWG/Turul, Warsaw.

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. and K.H. Hodder (2001). Setting harness sizes and other marking techniques for a falcon with strong sexual dimorphism. Journal of Field Ornithology 72:244-257.

Kenward, R., AlRashidi, M., Shobrak, M., Prommer, M., Sielicki, J. and N. Casey (2013) Elaboration of a modelling framework to integrate population dynamics and sustainable use of the Saker Falcon *Falco cherrug*. UNEP-CMS Office, Abu Dhabi.
(http://esug.sycl.net/data/00064/Modelling_Contract_Final_635647068305894090.pdf)

Riddle, K. E. and 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.

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.

This conceptual model requires mathematical predictive models. One type of model 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 11).

Figure 11   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.
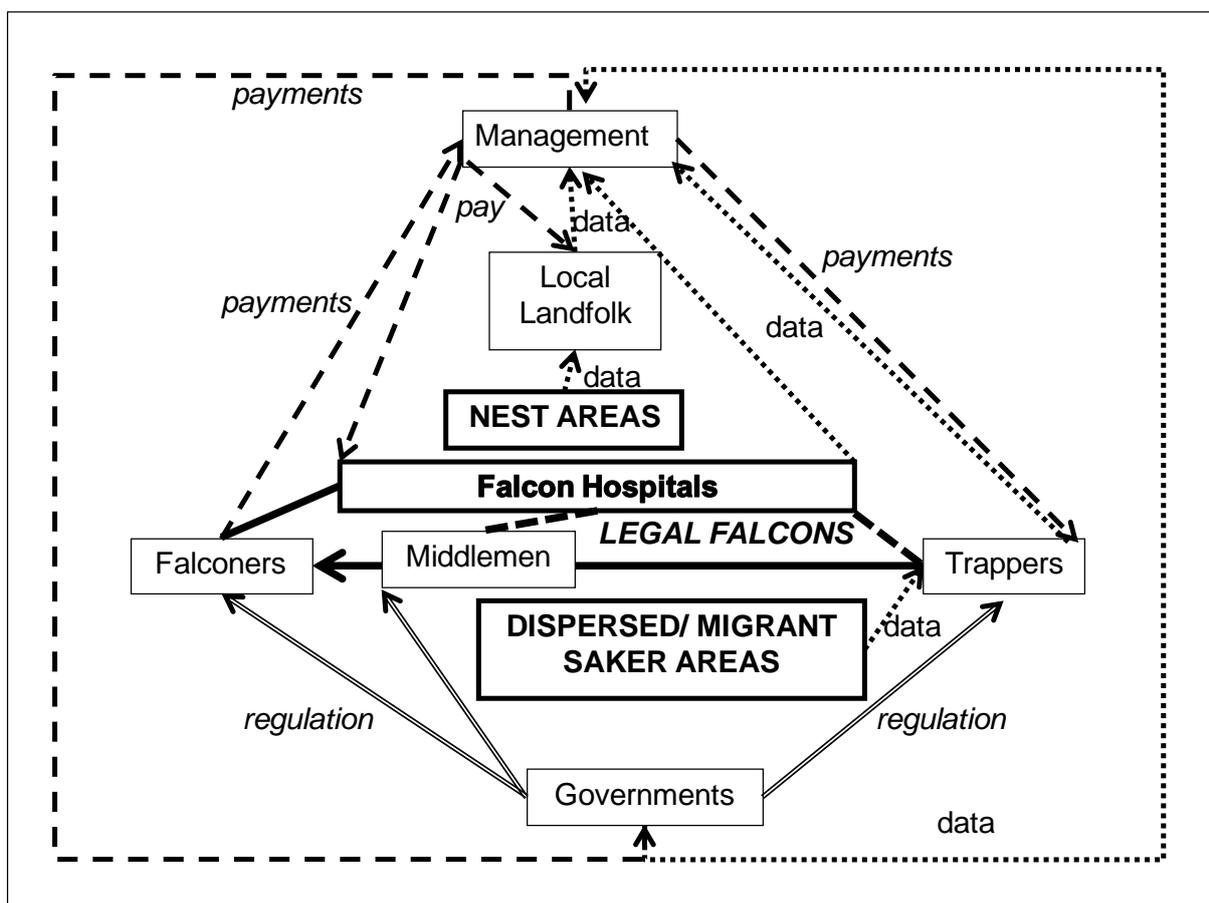
Operation and modelling in such a conservation management system would need :

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 and/or veterinarians to record and provide feathers (DNA) and other simple data from birds they capture, in exchange for payments (P_t) from the necessary conservation budget (B).

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 funding, 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. **At start-up, an initial conservation budget (B) 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 loss of infrastructure due to conflicts in some home countries, 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 falcons 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 could 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 x ΣH_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 ($g_j\Sigma F$), 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. This is an integral part of the management system design, based on Use-Cases in Annex II.

Annex II   Use-Cases for a management system, from Kenward et al (2013)

This Annex provides information used in preliminary costing for a system to monitor 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. Some re-design would be necessary to take make best use of Stage I findings, for example with much tagging done by vets. It may also be possible to make some savings on the complete system through not activating a trade control system initially, and through use of new systems for retrieving and managing veterinary records by reading micro-transponders, but the interfacing could also increase costs. The cost for a revised design is therefore unlikely to be appreciably below US$150,000.

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 larger. Indeed, managing 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 system 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 Trade Controllers 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 trade controllers and veterinarians, 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 trade control communications. Biology administration manages 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 administration. 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 administration in the provided envelop so that biology administration 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. This aspect will need re-design to accommodate requirements of tagging by veterinarians

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 may have to make payments to use the system unless they are working through veterinarians.

Trade control (e.g. customs or police) officials 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.

The coding time estimate 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 trade control application controls an RFID scanner and it is unlikely that any provided developer toolkits can be run from a browser, although software for veterinary records may do so. 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: veterinarians tag birds routinely, others are paid for tagging
	Falconers: register birds, view bird history and make payments
	Trade controllers: scan bird tags, view birds info and are 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
Design and Preparation	
Analysis and architecture	Build a requirements list, identify data objects and functionality and create formal designs based on these.
Specification document	Complete with costings and roadmap
Wireframe designs	To indicate GUI requirements (approx. 60 pages @ approx. 1 hour each)
Database design	Designing the database tables, fields, indexes and data relationships and scripting to SQL so it can easily be installed.
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.
Environment setup	Setting up a development environments (installing software, databases, creating paths etc.)
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. 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.
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.
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.
Login	Access to administrator tools must be restricted. Here he enters user name and password
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.

View/edit details	Allows for changing name, address, password etc.
List users	List all users for editing. Filters and search tools help find events quickly.
Create users	Create other system users: administrators, biology admin, taggers, falconers and trade controllers
Edit users	Change their details, name, email address, password and role
Email users	Bulk email users from the application or email individuals
View user events	Provides the ability to quickly see user activity - log in, event creation etc.
Access to biology admin accounts	Use biology admin application as if the administrator had logged in as a particular biology admin user.
Access to tagger accounts	Use tagger pages as if the administrator had logged in as a particular tagger.
Access to falconer accounts	Use tagger pages as if the administrator had logged in as a particular falconer .
List trade control installations	A list of the trade control sites or mobile agencies
View/edit trade control installations	Allows set up and logging of trade control sites or mobile agencies for recording where they are and providing an installation code to identify communications from the installation.
Delete trade control installations	Delete an installation record
List payments	View all payments made
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.
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.
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.
Biology Admin Interface	
Template and navigation	Includes page furniture to appear throughout the biology admin web pages with links to all pages in this interface.
Login	Biology admin enters username and password to allow him to use these pages. As for system administrator.
Forgot password	As for system administrator
View/edit details	Allows for changing name, address, password etc. As for system administrator
List birds	List all birds currently registered. Biology admin can use filters and search tools to help find an individual bird quickly.
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.
Create bird	Creates a database record for a bird. This data in this record will populated by the biology admin and the other actors.

Edit bird details	Edit the bird data record such as the description, location caught, feather received, recognition code etc.
Add bird images	Photographs of the bird can be uploaded.
Delete bird	Delete a bird record only if it is not valid or a repeat.
Merge birds	It is possible that two separate records are created for the same bird for example, a falconer 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.
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.
Create "Received feather" event	The biology admin will definitely create an event when he receives a feather from a tagger.
View bird alerts	Displays a summary of bird alerts and other reports
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.
Tagger Interface	
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
Template and navigation	Includes page furniture to appear throughout the tagger web pages with links to all pages in this interface.
Login	Tagger enters username and password to allow him to use his pages. As for system admin.
Forgot password	As for administrator
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
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.
View birds	View a list of birds tagged with a limited view of events
View payments	View a list of payments to date

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.
Privacy Policy	What we do with collected data
Terms and Conditions	What a user can do with the application
Falconer Application	
Template and navigation	Includes page furniture to appear throughout the falconer web pages with links to all pages in this interface.
Signup	Falconers can sign up to the use the application. They enter username, password, contact details, etc.
Login	Falconer enters username and password to allow him to use these pages. As for system admin
Forgot password	As for administrator
View/edit details	Allows for changing name, address, password etc
List birds	List all birds currently registered to logged in falconer. Filters and search tools to help find an individual bird quickly.
View bird	Allows the falconer to view the bird details and its history.
Register exisiting bird	Falconer registers a bird by entering the provided bird code. This will create a bird registration event.
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.
View payments	View payments made to the system
Make payment	Payments are made either on registering a bird or on sign up.
Privacy Policy	What we do with collected data
Terms and Conditions	What a user can do with the application
Trade control Interface	
System start-up	The software runs when the system starts. There is no login - system has been installed with a unique code to identify it.
Interface and navigation	Create the interface and buttons to different parts of the application
Test connection	The software regularly tests its connection to the central database and alerts the user if there is a problem.
Store data locally	If the internet connection is lost, store input data locally until it is restored.
Software update	The software is alerted to new versions and automatically updates itself.
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.
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.
Report untagged bird	If bird is untagged, trade control and biology administration are alerted so that suitable action can be taken.

Access Pages	
Graphic Design	These pages are public-facing and need to be suitably styled and layed out.
Template and navigation	Site headers and footers for every page. Would include links to the various user applications.
Home Page	Introduction to the project. Photographs and screenshots
About	Describes the project in more detail.
Privacy Policy	What we do with collected data
Terms and Conditions	What a user can do with the application
Cookies policy	Provide explanation of cookie use and allow user to agree to their use (users cannot log in without cookies enabled)
Contact Us	Provides contact details and form to message the system administrator
Search Engine Optimisation and Registration	Site needs to reach the those who are interested

Other Application Tasks	
Help Files	Implementation of a help file system and integration with all the applications.
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.
Encryption for secure data transferal	Displaying login and cc card pages over a secure socket layer (SSL) for secure data entry
Exception handling	Trapping exceptions and passing them to the developer whilst displaying a friendly message to the user.
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.
Trade control terminal and tag scanner specification and selection	Terminals for running the trade control software need to be selected along with the scanners for the tags
RFID tag specification and selection	Suitable RFID tags for attaching to birds must be selected.
Server patching strategy	Describes a mechanism to update the operating software (OS and databases) on the live servers with the minimum of downtime.
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.
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.
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.

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.
Live setup	This is where the final system resides after thorough testing. It needs the same hardware and operating software as the staging setup.
	TOTAL HOURS 1,090

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, trade control 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.
Trade control and veterinary terminal hardware	Trade control and veterinary officials 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.
Trade and veterinary terminal software installation	Trade control and veterinary hardware 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 trade control or veterinary officials 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.