

ACTION PLAN FOR THE GYRFALCON (*FALCO RUSTICOLUS*) IN EUROPE

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The Gyrfalcon is one of the rarest diurnal bird of prey in Europe. Its breeding range is confined only to the Arctic and Subarctic regions in the north. The Gyrfalcon has been classified as vulnerable in Europe (recently provisionally as rare) due to low population numbers, past population decline and susceptibility to versatile threats. An expert group compiled an Action Plan on behalf of BirdLife International and the Commission of the European Union to direct and implement practical conservation measures needed to guarantee the viability of the Gyrfalcon populations in northern Europe. This paper is a shortened review of the Action Plan aimed to set the guidelines also for further research.

Key words: Gyrfalcon, conservation, action plan, Europe.

ПЛАН МЕРОПРИЯТИЙ ПО ОХРАНЕ КРЕЧЕТА (*FALCO RUSTICOLUS*) В ЕВРОПЕ. П. Коскимиес. Киркконумми, Финляндия.

Кречет – один из самых редких видов дневных хищных птиц Европы. Его гнездовой ареал ограничивается арктическими и субарктическими районами. В Европе, кречет отнесен к категории уязвимых видов (а в последнее время предварительно классифицируется как редкий) из-за низкой численности популяции, ее сокращения в прошлом, а также восприимчивости к различного рода негативным факторам. От имени организации BirdLife International и Комиссии Евросоюза, экспертная группа составила План мероприятий по координации и реализации мер по охране вида с тем, чтобы обеспечить выживание популяций кречета в северной Европе. В данной работе представлен краткий обзор этого Плана, где оговариваются и направления для будущих исследований.

Ключевые слова: кречет, охрана, план мероприятий, Европа.

PREFACE

The European Union has published action plans for conservation of the 23 globally endangered bird species living in Europe (Heredia *et al.* 1996). In addition, similar plans have been published also for eight priority bird species of special conservation concern in Europe (Schäffer & Gallo-Orsi 2001). At present there are several additional plans of the priority species recently published or under preparation. The Gyrfalcon belongs to this third group of species.

In 1998 EU Commission asked BirdLife International to prepare a European-wide action plan for the Gyrfalcon, according to general guidelines set by the Commission. I was asked to act as a compiler for the plan, to write a draft, gather a specialist group for a workshop, and write the final draft after consultation of the attending specialists and other major experts of the species.

This paper describes the action plan, published in the European Commission's Internet pages (Koskimies 1999), as a shortened version. It includes some up-dated information on the present status and classification of this threatened species, as well as recent conservation measures, country by country, based on the material at my disposal. The list of threats and conservation measures and their evaluation have remained exactly the same as in

the original action plan, including a summary of reasoning for each of them. I have excluded the Annex of the original action plan, listing the recommended measures by country.

The plan intends to provide a framework of action for the governments, non-governmental conservation organizations, and individuals responsible for, or interested in, the conservation of the Gyrfalcon. The Gyrfalcon is a site-tenacious species breeding in traditional sites which can be preserved by national legislation and other measures.

This Action Plan is primarily targeted to and needs active implementation in those European countries where the Gyrfalcon breeds: Iceland, Denmark (Greenland), Norway, Sweden, Finland and Russia west of the Ural Mountains. The Gyrfalcon often remains resident on its breeding range throughout the year, but some birds, especially juveniles and also a minority of adults, disperse hundreds of kilometres south of the breeding range or to the coastal regions in winter.

INTRODUCTION

The Gyrfalcon is distributed circumpolarly in the Arctic. It does not belong to the world list of threatened birds by BirdLife International and The World Conservation Union, IUCN (BirdLife International 2000, Hilton-Taylor 2000). In Europe, however, the

species was classified as vulnerable by Tucker & Heath (1994), having fewer than 2,500 breeding pairs (Greenland included). Recently, BirdLife International (2004) classified it provisionally as rare, after slightly modified criteria. In addition, BirdLife International classified it as category 3 among the Species of European Conservation Concern: species whose global populations are not concentrated in Europe, but which have an unfavourable conservation status in Europe (Lindberg 1994, BirdLife International 2004).

The Gyrfalcon is listed in Annex I of the EU Birds Directive (1979), and it has been included in the list of priority species of the directive. It belongs also to the species listed in Appendix I of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1982) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington Convention or CITES, 1975). The Gyrfalcon belongs to species of special European concern in the 1997 list by the Council of Europe. These conventions, together with the Biodiversity Convention (1992), provide an adequate legal framework for the international cooperation in conservation of the Gyrfalcon and its habitat, and all the countries where the species occurs are encouraged to implement them fully.

In Europe the Gyrfalcon is a rare species (e.g. Lindberg 1994, Falkdalen & Blomqvist 1997, Cade et al. 1998). As a breeding species it is confined to Greenland, Iceland, Fennoscandia and northern Russia. At least in northern Fennoscandia the population seems to have declined considerably in the late 19th and early 20th century, possibly due to intensive and large-scale egg collecting and simultaneous shooting of adults for decades, decline of the Willow Grouse *Lagopus lagopus* and Ptarmigan *L. mutus* populations, and habitat deterioration (e.g. Rassi et al. 1992, Tømmeraaas 1993, 1994, 1998, Väisänen et al. 1998). Gyrfalcon populations continued to be stressed at least locally up to the late 1900s due to shortage of food, habitat destruction, disturbance of nest sites, and illegal removal of eggs and young for collections and falconry (e.g. Tømmeraaas 1993, 1998, Cade et al. 1998, but see Koskimies 2006).

Preparation of the action plan

A workshop to compile this action plan was organized at Kilpisjärvi biological station, Finnish Lapland, on 6–7 March 1999. Representatives from the following countries were present: Finland (Pertti Koskimies), Iceland (Ólafur K. Nielsen), Norway (Karl-Otto Jacobsen, Kenneth Johansen, Arve Østlyngen), Sweden (Johan Engström (†), Ulla Falkdalen, Peter Lindberg), and USA (Tom J. Cade). The Gyrfalcon's status and threats were thoroughly discussed, and the most important actions to safeguard its future in Europe were outlined.

In addition to above listed contributors, Tom Christensen (Greenland), Torsten Stjernberg

(Finland), Eugene Potapov (Russia), and Torsten Larsson and Martin Tjernberg (Sweden) commented on the first draft. The information on especially the life history in this action plan is based on a thorough literature review by Cade et al. (1998).

The conservation status and threats to the Gyrfalcon are fairly well understood, although there is very limited knowledge on many basic population parameters such as mortality, longevity, dispersal and main reasons of death. The most important aims of research in the near future are to make a demographic population model and to study the use of habitat by the species. Information on these aspects is badly needed to conserve viable populations effectively. Gyrfalcon populations respond to long-term, more or less cyclic fluctuations of the grouse populations, and ecology of the falcon must be studied and populations monitored preferably for several decades to get reliable results throughout a cycle. The number of territorial pairs in Iceland, for example, has changed by a factor of 1.5 from low to high years (Nielsen 1999). Fluctuations of the number of breeding pairs and of the breeding success are much higher.

Table 1. Estimated number of territorial pairs of the Gyrfalcon in the European range states in the late 1990s.

Finland	20–30
Greenland	500–1000
Iceland	300–400
Norway	250–385
Russia	100–300
Sweden	80–135
Total	1250–2250

BACKGROUND INFORMATION

Distribution and population

The Gyrfalcon is distributed circumpolarly over the large part of the tundra zone and at the northern limit of the coniferous forest zone, including Arctic-alpine mountainous regions. In Europe it breeds in Greenland, Iceland, Norway, northwestern Sweden, northern Finland, northern half of the Kola Peninsula and along the timber line east of the Kanin peninsula. Within EU the species breeds only in northern Finland and Sweden. The majority of the adult population probably stays in the breeding area, except for high Arctic, throughout the year, but at least part of the immature and some adult birds winter in coastal areas of the Atlantic or Arctic Ocean.

The population is fairly well known in Fennoscandia and Iceland but poorly so in Greenland and especially Russia. According to the most recent information compiled for this report, there are 1250–2250 territorial pairs in the whole of Europe (table 1). Earlier estimates do not deviate markedly from this (Lindberg 1994, Cade et al. 1998, see also Gensbøl

& Koskimies 1995, Falkdalen & Blomqvist 1997, Frydenlund–Steen 1999). The total population in Europe has probably remained at the same general level since the mid-1900s, although numbers appear to have declined at least locally in northern Fennoscandia and northwestern Russia also during the late 20th century (Tømmeraas 1993, 1994, Lindberg 1994, Gensbøl & Koskimies 1995, Ahlén & Tjernberg 1996, Koskimies & Kohanov 1998, Väisänen et al. 1998, Koskimies 2006).

Life history

Breeding

The Gyrfalcon breeds on a ledge or in a cavity of a steep cliff, usually in an old stick nest of another species, in particular Raven *Corvus corax*, but sometimes Rough-legged Buzzard *Buteo lagopus*. The nest site has to provide shelter from mammalian predators, wind, rain (snow cover) and extreme exposure of sunlight by a well-developed overhang. Birds also accept artificial stick nests (e.g. Tømmeraas 1978). If Gyrfalcons are short of suitable cliffs they breed sometimes in stick nests in trees, more commonly in Arctic Russia and Siberia than in northwestern Europe. Usually a pair has 2–5 alternate nest sites within ca. 10 kilometres (Cade et al. 1998).

The female starts laying already in April. The normal clutch size is 3–4 eggs, and they are incubated 34–36 days mostly by the female. The young are brooded still up to the age of 10–32 days. Fledging period is 45–50 days, but after that the young are dependent on their parents for several weeks. They disperse from the natal territory usually 3–4 weeks after fledging.

In most populations the mean productivity is 1–2 fledglings per breeding attempt or 2–3 fledglings per successful pair. The number of successful pairs, more variable annually than the average number of young, varies usually from ca. 30 to 80% and is dependent on weather conditions during the early phase of nesting and the abundance of food. Heavy snowstorms or low temperature lasting for days during March and early April may prevent the female from reaching the required condition for egg-laying. Most birds probably start breeding at 2–3 years old, some at 1 year old in good grouse years (Cade et al. 1998).

Feeding

The Willow Grouse and the Ptarmigan are the main prey of the Gyrfalcon in the whole range and throughout the year (Cade et al. 1998, Koskimies & Sulkava 2002). During courtship, laying, incubation, and early nestling period falcons in some areas feed almost 100% on *Lagopus* sp., as well as during winter. A pair has been estimated to consume ca. 470 g of grouse per day (Tømmeraas 1994). A pair with four young requires, on average, 1160 g biomass/day (a little more than two adult grouse, Lindberg 1983). During the nestling period the fal-

cons start to take other prey in varying degrees, e.g. waders, larids, ducks and goslings, and even passerines.

Breeding Gyrfalcons may hunt in an area of at least 300–600 km² and often many times larger, thus ranging some dozens of kilometres from their nest. They probably concentrate, however, in the most productive parts of the home range. The proportion of waterfowl, waders, larids and other medium-sized birds is higher, on average, for pairs nesting near coast, lake, wetland or peatland areas than in homogenous heathland habitats (Cade et al. 1998).

Habitat requirements

The Gyrfalcon breeds in cold, Arctic and Subarctic latitudes, and in Arctic-alpine zones at or above treeline, including sea-cliffs and islands. In Fennoscandia and Russia it breeds also in broken and barren pine or birch forests along river valleys and near mountain bases.

The most important habitat requirement is a safe nest site on a shelf of an abrupt cliff. Unless based on seabird colonies near-by, Gyrfalcons normally hunt over wide area of open terrain with short, sparse vegetation or willows and other shrub, or around large bodies of water.

THREATS AND LIMITING FACTORS

The following probable threats to the European Gyrfalcon population in the next few decades are listed in their order of importance. There is also a general more hypothetical threat than the others: climate change. The Gyrfalcon, confined to the Arctic zones of the Earth, may be one of the species affected most negatively by marked warming of the Arctic zone (e.g. Green et al. 2001). Climate change may also have a considerable effect on its prey populations. Because this change probably affects the Gyrfalcon more slowly than the following threats, and due to the difficulties in estimating its effect, it has not been taken into further account in the action plan.

Reduced prey numbers

The Gyrfalcon is peculiar among raptors for going from courtship to late nestling period by preying on the adult segment of the main prey populations, the Willow Grouse and Ptarmigan, during annual low point in their numbers, even in the harsh environment of the high Arctic. Grouse are usually the only available prey during the most critical periods in winter and spring, and their decline may cause serious difficulties for the birds to over-winter and reach necessary physical condition for breeding.

Especially in Fennoscandia, *Lagopus* sp. populations seem to have declined at least locally in recent decades (Väisänen et al. 1998). Possible reasons for the reduced food supply are said to be excessive hunting, expanding red fox *Vulpes vulpes* populations, disturbance by snow mobile traffic, and changes in vegetation from overuse of forage

by livestock and reindeer (e.g. Tømmeraas 1993, 1994), but the problem needs further study.

Importance: high

Disturbance of nest sites

The Gyrfalcon is a sensitive species to human activities near its nest site. Pairs are confined to traditional nest sites which are scarce in many areas. Due to a long breeding season and the time required for the young to become independent, the female seldom has time enough to lay a repeat clutch if the first has been lost (Cade et al. 1998).

Hiking, rock climbing, bicycling, skiing, driving snow mobiles, and all other kinds of outdoor activities have become more popular all over northern Europe. Also too eager bird-watchers and nature photographers as well as scientists, rangers and other field workers may unintentionally disturb birds.

Importance: high

Habitat destruction

In addition to availability of prey, also other environmental factors of a habitat must remain in a natural state to hold a viable Gyrfalcon population. The most serious changes include building of dams and reservoirs, roads, snow mobile and skiing routes, and other tourist infrastructure, as well as cottages, reindeer fences and powerlines (Cade et al. 1998). Forest cutting, military activities and reindeer husbandry can also cause problems. If exploration and development of petroleum industry should be intensified anew in Russia since the collapse in the 1990s, it may cause disturbance to falcons and their prey.

Importance: medium

Robbing of nests for egg-collections, falconry, and captive-breeding programmes

The Gyrfalcon belongs to the most highly prized bird species among egg collectors and falconers. Thus, robbing of nests might extend to such a spatial and temporal intensity that it could cause a population to decline seriously, especially with many other negatively affecting factors acting simultaneously. In Germany, for example, there were probably about 500 Gyrfalcons in captivity in the early 1990s, 70–80% of which originated from the wild (Forsslund 1993). In 1992, for example, more than 35 Gyrfalcons, all collected from wild in Fennoscandia, were confiscated by police. The number of birds robbed and smuggled from Russia is probably much higher and growing rapidly. In Britain the number of captive Gyrfalcons is estimated at ca. 400, of which two thirds are hybrids of different sorts.

Illegal robbing of eggs and young has been confirmed in several parts of Norway, and up to the mid-1980s also in Iceland. There are also some hints of nest robbing in Sweden and Finland. Young Gyrfalcons have been robbed illegally in several areas in northern Russia, leading to at least temporary

disappearance of a local population in the late 1980s (Morozov 1991). In Kola Peninsula robbing of eggs and young is considered as the most severe threat by Koskimies & Kohanov (1998). The disintegration of the former Soviet Union in 1991 led to a decline of the general control of the laws protecting wildlife, although the collapse of infrastructure in the high Arctic at the same time may give protection to birds in many regions (Flint 1995).

An increasing problem for both wild populations of Gyrfalcons and Peregrine falcons *Falco peregrinus* is the risk of gene-contamination from escaped captive-produced hybrid falcons, which have paired and nested with wild birds at least in Sweden.

Importance: medium

Shooting adults and destroying nests

Shooting of adult Gyrfalcons and destroying their nests mainly for game protection was formerly a more common threat all over the range. Persecution probably continues locally, especially in Russia.

Importance: low

Lack of nests due to decline of Raven populations

Possible decline in Raven populations may cause lack of stick nests accessible to Gyrfalcons. Availability of winter food is critical for the arctic Raven populations. They have benefited by the increasing populations of both reindeer and moose and lessening of persecution in many parts of the range during recent decades (Väisänen et al. 1998). New EU Directives, however, restrict considerably the leaving of slaughtered offal and use of carcasses by nature photographers, reducing availability of the main food sources accessible to the Ravens. Persecution of Ravens is still going on in some regions, e.g. fairly intensively in Iceland (Hardardottir & Nielsen 1999).

Importance: low

Collision with cars and fences, and electrocution by power lines

At least in Fennoscandia the total length of reindeer fences will increase still in the future. According to preliminary data, thousands of Willow Grouse and Ptarmigan die each year after collision with fences, which may have locally an effect also on the prey populations. Also Gyrfalcons may collide with fences. Collision with power lines and electrocution have most probably only marginal effect on Gyrfalcons.

Importance: low

Trapping of adults

Up to the early 1990s as many as 2000 Gyrfalcons have been estimated to have been killed each winter in Russian Arctic by traps set for arctic fox *Alopex lagopus* (Ellis & Smith 1993). Fur farms and most individual trappers have ceased to oper-

ate in the 1990s, however. Outside Russia trapping of Willow Grouses and Ptarmigans by snares has probably a minor effect on Gyrfalcons.

Importance: unknown

Chemical contamination

Pesticides seem to have affected Gyrfalcon populations considerably less than many other raptors, probably due to the remoteness of the breeding range and the sedentary habits of the Gyrfalcon (e.g. Lindberg 1984, Ólafsdóttir et al. 1995). Also acid rain and radioactive fallout may be potential problems needing more study, especially in Russia (Cade et al. 1998). More study is needed to evaluate the importance of chemical contamination, however, because there are some new sampled eggs with high levels of chemicals.

Importance: unknown

CONSERVATION STATUS AND RECENT CONSERVATION MEASURES

Finland

The Gyrfalcon has been protected by the Nature Conservation Law in Finland since the year 1926. It is listed as vulnerable in 1985 and 1991, and endangered by different, standardized IUCN criteria in 2000 (Rassi et al. 2001).

The species breeds very sparsely in northern Lapland, and fewer than a quarter of the pairs breed in national parks and other strictly protected areas. The majority of the pairs, however, live in areas protected by the Wilderness Law, which regulates e.g. forest cutting, building of roads and cottages etc. The Finnish population has been monitored since the early 1990s (Koskimies 1995, 1998, 2006).

Greenland

The Gyrfalcon's eggs were first totally protected in Greenland in 1958, and in the following year export of live or dead birds was prohibited. From 1960 to 1976 the bird and its eggs were fully protected from 15 May to 31 August, and throughout the year since 1977. These Greenlandic prohibitions were replaced in 1988 by countrywide laws under Greenlandic Home Rule (Information from K. Kampp and D.M. Boertmann).

Gyrfalcons breed widely but sparsely throughout the ice-free coastal lands, with only a few pairs in protected areas. A population has been monitored around Sondre Stromfjord from 1972 (e.g. Burnham & Mattox 1984). Since the late 1990s The Peregrine Fund has organized large scale monitoring and conservational studies in various parts of Greenland (Cade & Burnham 2003).

Iceland

The Gyrfalcon was protected for the first time in Iceland from 1919 to 1929, and permanently since 1951. It has been listed as an endangered species. There are ca. 30 occupied territories in nature re-

serves. The most important conservation efforts are the laws giving to the Gyrfalcon a total protection and prohibiting disturbance at the nest site. A population in northeast Iceland has been monitored since 1981 (e.g. Nielsen 1999).

Norway

The Gyrfalcon has been protected by law in Norway since 1971. It has been listed as vulnerable in the 1990s. In northern Norway ca. 15–20% of the pairs breed in protected areas. The breeding range extends from south of Hardangervidda to Finnmark. In western Finnmark and northern Troms county, a monitoring project has been continued for over 30 years (e.g. Tømmeraas 1998). An intensive monitoring has been going on in the whole northern Norway since the early 2000 (Koskimies 2006).

Russia

In the Russian Federation the Gyrfalcon has been listed as a rare species. It has also been protected by various hunting regulations. The order by the General Game Management Committee (1964) prohibits the shooting, capturing and nest control of birds of prey in land where game hunting is allowed. According to general hunting regulations, adopted in March 1979, shooting of all birds of prey and owls is forbidden. These rules were inherited in the new federal law on the protection of Animal Kingdom since 1995, prohibiting also other actions which may result in the death or decrease in numbers of the Gyrfalcon, or the destruction of its habitat (Danilov-Daniljan et al. 2000).

Sweden

The Gyrfalcon has been totally protected since 1957 and has been classified as vulnerable in 1996 and endangered in 2000 (Gärdenfors 2000). The species breeds in the mountain area of northwestern Sweden, and about 25% of the population is found in areas protected as national parks or nature reserves. However, these parks are used for several activities which disturb birds.

A monitoring project started in Jämtland-Härjedalen in 1994, as concern was raised about the long term survival of the Gyrfalcon due to new hunting regulations (1993) increasing the pressure on grouse populations (e.g. Danielsson et al. 2002). It has been followed by large-scale intensive surveys further north in Västerbotten and Norrbotten since 1996 (e.g. Ekenstedt 2003).

AIMS AND OBJECTIVES OF THE ACTION PLAN

Aims

The action plan has both short term and long term aims.

1. In the short term, to maintain the present numbers of the Gyrfalcon throughout its present range.

2. In the medium to long term to ensure range expansion and population growth in areas where the species has disappeared due to human factors.

Objectives

1. Policy and legislation

- 1.1 To promote policies which ensure long-term conservation of the habitat of the Gyrfalcon

1.1.1 Including territories in protected areas

The most important habitats of the Gyrfalcon, including nest sites and productive hunting areas, should be protected as thoroughly as possible. In protected areas the quality of the habitat can be protected and improved through appropriate management, and the species-specific requirements can be taken fully into account. As many Gyrfalcon territories as possible should be included in national parks and other protected areas. In addition to extensive nature reserves, possibilities of founding local and smaller protection zones around individual eyries should be encouraged.

Priority: high
Time-scale: ongoing

1.1.2 Increasing food supply by hunting regulation and other measures

Every effort should be tried to increase the numbers of Willow Grouse and Ptarmigan, including conservation of their habitats and regulation of excessive hunting. The most productive grouse habitats should be protected by all disturbing factors. Hunting should be more restricted especially in mid-winter compared to the present.

Priority: high
Time-scale: short

1.1.3 Taking Gyrfalcon into account in management plans

Habitat and other requirements of the Gyrfalcon should be taken into account in management and utilisation plans for protected areas. An environmental impact assessment should be prepared for any work or project that might alter or have an effect on the Gyrfalcon or its habitat in a non-protected area.

Data on exact nest sites should neither be collected in a public register nor given freely and in detail to authorities, however. If the amount of people knowing traditional nest sites increases, the risk of this kind of information going to "wrong hands" and intentional disturbance will increase as well. In areas where human activities may lead to habitat deterioration of the Gyrfalcon, and where nature conservation authorities are really able to influence these plans, they should be in contact with researchers and other specialists of the Gyrfalcon to solve these kinds of site-specific problems.

Photographing birds at nest or access to nest sites in other non-conservation purposes should be prohibited without special permits in all range countries, whether the nests lie in a nature reserve or not.

Priority: medium
Time-scale: ongoing

1.1.4 Wardening of sensitive nest sites

There are some nest sites robbed or disturbed for years. The primary effort should be attracting the birds to a new secret site by providing them an artificial nest in a safer place. If this is not possible, the most seriously disturbed nests should be under watch. Automatic cameras and other equipment can also be used in surveillance work.

Priority: low
Time-scale: ongoing

- 1.2 To promote national legislation which adequately protects the species and its habitat

1.2.1 Compiling conservation management plans

Every range state should compile a national plan for management of the Gyrfalcon and its habitat, based on this European-wide plan and taking into account that Fennoscandia and northern Russia have a common metapopulation of the species. The plan should take into account regionally the species-specific habitat and other requirements, threats, and conservation possibilities, monitoring and research.

Priority: high
Time-scale: short

1.2.2 Reviewing and updating national laws

A review and update of national laws and regulations should be encouraged to ensure that the Gyrfalcon is given the maximum level of protection, and heavy penalties are instated for shooting, trapping, taking, poisoning, disturbing, possessing or trading specimens or eggs.

Priority: low
Time-scale: ongoing

- 1.3 To promote implementation of international conventions and treaties

1.3.1 Implementing international conventions and treaties

All the countries where the species occurs, having ratified the Bern Convention and CITES, together with the Biodiversity Convention and the EU Birds Directive, will be encouraged to implement these conventions into full power.

Priority: medium
Time-scale: ongoing

1.3.2 Controlling of captive-breeding programmes

Captive-breeding programmes should continue to be monitored by DNA methods to discourage the illegal entry of wild birds into captive collections. The hybrids should be sterilised before they are sold or released for hunting.

Priority: medium
Time-scale: ongoing

1.3.3 Intensification of co-operation between nature conservation authorities, customs, and police

Customs officials should be educated more thoroughly than at present in the problems of bird crime by environmental administrators and non-governmental nature conservation organizations. Also co-operation and information exchange between authorities and the general public should be intensified.

Priority: low
Time-scale: ongoing

1.3.4 Activating international co-operation in research and conservation

The entire Eurasian metapopulation could be viewed as a single conservation entity. Conservation of Gyrfalcons benefits from keen international co-operation among researchers and environmental administrators. Resources should be increased co-operatively to monitor and research Gyrfalcons especially in Russia.

Priority: low
Time-scale: ongoing

2. Species and habitat protection

2.1 To ensure that the habitat retains the necessary conditions for the presence of the Gyrfalcon

2.1.1 Improving food availability for the species throughout the year

The availability and numbers of the Willow Grouse and Ptarmigan should be increased by protecting productive habitats, improving degraded range, regulating hunting, and reducing mortality due to reindeer fences and other factors.

Priority: high
Time-scale: short/ongoing

2.1.2 Improving the availability and quality of nests

By providing carcasses in winter Ravens may be attracted to live and probably breed in the same areas as the Gyrfalcons. Other means of improving the quality of nests is to reinforce nests in suboptimal ledges, and to build artificial nests to attract falcons from traditional nest sites which have become unsafe.

Priority: low
Time-scale: ongoing

2.2 To eliminate or control non-natural factors which are affecting the Gyrfalcon

2.2.1 Reducing incidental mortality from trapping

The use of sight-baited leg-hold traps for arctic foxes and other animals should be discouraged in all areas frequently used by falcons, and possibilities to change traps or trapping techniques should be investigated to prevent the falcons getting caught (see Glenn 1998).

Priority: high
Time-scale: short

2.2.2 Preventing human disturbance

Human disturbance may be prevented by constructing snow mobile or skiing routes, paths, cottages and other infrastructure further away from Gyrfalcon nest sites and other core parts of their territories. Because a general archive with exact nest sites should not be founded for local and regional environmental administration – the fewer persons know the exact eyries the better – authorities should contact researchers responsible for monitoring when a land-use planning possibly affects Gyrfalcon habitat in order to receive appropriate data on the occurrence of the species.

Bird-watching tours to Gyrfalcon nests should be prohibited in areas without a good surveillance due to a risk that information on exact eyries may be distributed to potential robbers by visitors. Even then, a "safety zone" will vary according to the characteristics of the land; 1 km is recommended as a minimum distance if the nest cliff remains invisible from a longer distance, but it may increase to 2–3 km for a visible nest. In nest sites where human disturbance is a persistent cause of breeding failure, wardening should be organized.

Priority: medium
Time-scale: ongoing

2.2.3 Preventing nest robbing and illegal trade

Keeping nest sites secret is the main means against robbers (see also 2.2.2.). Heavy fines for taking birds should be included in national laws, and they should be adequately publicised and enforced. Also the parentage of birds in captive-breeding programmes should continue to be controlled by DNA testing. Also more information needs to be gathered about the way nest robbers operate and the routes of the illegal trade.

Priority: medium
Time-scale: ongoing

2.2.4 Reducing mortality due to intentional hunting and other directly affecting activities

Governments should be urged to enforce control of illegal persecution and increase surveillance especially in protected areas where Gyrfalcons occur. Awareness campaigns targeted at hunters' associations should be undertaken in those areas where these problems are especially acute.

Priority: low
Time-scale: ongoing

2.2.5 Reducing mortality from collision by reindeer fences and electrocution by powerlines

With the help of environmental impact assessment, reindeer fences, powerlines, windmills and other constructions causing a threat to hunting and flying falcons should be built further away from Gyrfalcon nest sites and most productive hunting areas. Reindeer fences should probably be marked more clearly to warn both Gyrfalcons and grouse, and also their design affect the threat.

Priority: low
Time-scale: long

2.3 To extend the current distribution area and increase density

2.3.1 Surveying of potential recolonisation areas

If a marked part of the Gyrfalcon's current range becomes unsuitable for the species, or there are other good reasons and practical ways for extending or moving the breeding range, areas where recolonisation would be possible should be identified. All potential recolonisation areas must be carefully identified before any juveniles can be released. In general, the IUCN Species Survival Commission's guidelines on re-introductions should be followed (IUCN 1998).

Priority: low
Time-scale: long

2.3.2 Maintaining captive breeding programme for recolonisation

If a natural catastrophe or disease brings population levels dangerously low, it may be necessary to have access to a captive-breeding stock to provide for reintroduction. Young and adult birds originating from the respective region, either captive-bred or stolen, victims of accidents etc. can be used in a captive-breeding and release programme.

Priority: low
Time-scale: long

3. Monitoring and research

3.1 Monitoring

3.1.1 Continuing present monitoring projects of the Gyrfalcon populations and initiating new programmes in poorly known areas

Special monitoring projects cover most accurately Finland and Sweden at present, and also central and northern parts of Norway and northern Iceland. Monitoring projects should be extended also in other areas to ensure the representativeness of the present areas. Nature conservation authorities should feel responsibility for funding of the moni-

toring work to ensure its continuation, but the leading of the field work and data analysing should be done by professional ornithologists to guarantee the scientific validity of the work.

The status of the species is more poorly known in Greenland and especially Russia than in the Nordic countries. Intensive monitoring of populations should be initiated there also in order to evaluate the effectiveness of conservation measures adopted. At least the number of breeding pairs and their productivity should be determined in a standard way.

Priority: high
Time-scale: ongoing

3.1.2 Intensifying monitoring of population parameters

Monitoring projects should be intensified to cover, in addition to population size and natality, also mortality, site fidelity, migration, causes of death and other life history traits.

Priority: high
Time-scale: ongoing

3.1.3 Monitoring grouse populations and availability of nest sites

Intensive monitoring of the Gyrfalcon should cover abundance of prey animals, especially the Willow Grouse and Ptarmigan. Availability and quality of suitable nest sites and other key features of the Gyrfalcon habitat should be evaluated. This information helps in determining how healthy the environment is for the species.

Priority: medium
Time-scale: ongoing

3.1.4 Monitoring levels of chemical pollutants in eggs

The effect of pesticides on the productivity and mortality of the Gyrfalcon is documented imperfectly so far. In addition to eggs, it would be interesting also to monitor the levels of chemical pollutants in adult Gyrfalcons.

Priority: medium
Time-scale: ongoing

3.2 Research

3.2.1 Promoting research of population viability

One of the most important gap in our knowledge of the Gyrfalcon's ecology is the lack of a usable model for survival rates of both young and adult birds. An intensive and long-lasting population study with identifiable individuals is needed in several study areas. Based on demographic, genetic, geographic and other variables, a viable population analysis should be made as a part of making a more detailed management plan for the Gyrfalcon.

Priority: high
Time-scale: long

3.2.2 Promoting research which helps to identify limiting factors and population renewal

A better understanding of the species' habitat and energy use, home range of adult pairs, and the movements of the young after leaving the nest would be very helpful for future conservation efforts. The mechanisms regulating population density and requirements for settlement of new pairs in potential habitats are also important research objects. Also the energy requirements of breeding birds need to be investigated: the number of young that can be produced, the cost of the adults, and the amount of food required.

Priority: medium
Time-scale: long

3.2.3 Studying wintering areas and migration routes

Especially adult Gyrfalcons should be marked in different techniques to delineate migration routes, to identify mortality factors outside breeding season, and to locate the wintering areas of birds belonging to different European populations.

Priority: medium
Time-scale: ongoing

3.2.4 Studying techniques for increasing grouse populations

The relationships between grouse populations, habitat changes, hunting pressure and other human-caused factors should be studied to find out techniques for increasing the density of grouse.

Priority: medium
Time-scale: medium

3.2.5 Studying feasibility of reintroducing Gyrfalcons by hacking captive-bred or confiscated young

It would be worthwhile to determine whether or not the same techniques used successfully for the Peregrine Falcon will work for the Gyrfalcon. Small-scale experimental releases should be carried out.

Priority: low
Time-scale: long

4. Public awareness

4.1 To improve and maintain awareness, concern and support for the protection of the Gyrfalcon and its habitat among the public

4.1.1 Implementing awareness campaigns for the general public

All conservation measures will only achieve maximum efficacy when there is a sufficient level of awareness at all social levels involved. It is especially important to tell the people how to avoid disturbance of the nesting birds. This could succeed with educational material like brochures, talks, lectures, round tables and film shows. The willingness of the general, well-informed public to cover the costs

of the management of the species should be guaranteed.

Priority: medium
Time-scale: ongoing

4.1.2 Raising awareness of the special problems facing Gyrfalcons

Specific problems such as disturbance by hikers, rock-climbers, photographers, tourists, reindeer people and other drivers of snow mobiles must be resolved by focusing education on specific groups of people. There is a marked interest of bird-watching companies to find nest sites, leading to increasing disturbance by tourists, and by local people (especially in Russia) willing to earn money by guiding (western) visitors. These visits can lead to a wider publicity of nest-sites also among nest-robbers. Nature and ecotourism companies should be informed of the risks of their operation on the birds.

Priority: medium
Time-scale: ongoing

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