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# Grouse science as a process: where do we stand?

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The paper sketches the state of grouse science as reflected by the 8th International Grouse Symposium held at Rovaniemi, Finland, in September 1999, by contrasting the representation of species, topics and trends in the literature and at the Symposium. The analysis was based on 5,349 grouse papers published between 1930 and 1998 and 75 abstracts submitted for the Symposium. In the past, grouse research has focused on the species with the greatest economic and cultural importance. During the 1990s, population dynamics, habitat and behaviour have become the major research topics. At the Symposium, a number of trends became apparent: increasing importance of genetic and landscape ecological studies, integration of disciplines, approaches and explanations, as well as increasing cooperation. However, a significant gap seems to exist in the documentation and communication of experience in grouse conservation and management.

*Key words: grouse, International Grouse Symposium, publications, research, Tetraonidae*

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Grouse *Tetraonidae* have always received particular attention in wildlife research and management. Their prominence is explained by their cultural and economic importance as game species, but also by the many specialised traits in grouse ecology, physiology and mating systems (Storch 2000). Even grouse conservation has a relatively long history: probably one of the first species recovery programmes led to the successful reintroduction of capercaillie *Tetrao urogallus* into Scotland in the 1830s (Starling 1991).

Grouse science, as any cultural undertaking, has been changing throughout its history. The questions researchers ask keep changing, as do their approaches and concerns. This process is documented by the writings grouse scientists have published. Since 1978, the tri-annual International Grouse Symposia have been milestones that reflect these changes within the process of grouse science. In this paper, I shortly review some aspects of the evolution of grouse science over time, covering the period from the 1930s until 1999. I use the term 'grouse science' in a broad sense, covering all the topics represented at the grouse symposia, and including research as well as management and conservation. My major objective is to sketch the state of grouse science as presented at the 8th International Grouse Symposium held at Rovaniemi, Finland, in September 1999.

## Methods

My approach to this summary is to contrast grouse science, as documented in the literature, with the presentations at the 8th International Grouse Symposium, hereafter referred to as the Symposium. I analysed the grouse literature using the CD Wildlife Worldwide (NISC 1999) which contains references to 410,000 wildlife papers, theses and reports published during 1930-1998. I searched the file based on titles and key words using search statements according to Boolean logic. I distinguished 17 topics (Table 1), allowing for mul-

Table 1. Topics distinguished in the analysis of grouse literature and search statements used.

| Topic | Search statement |
|---|---|
| Grouse | grouse or capercaillie or ptarmigan or Tympanuchus or Tetraoni* |
| Behaviour | behavio* or ethолog* or mating or lek* or social or socio* |
| Conservation | conserv* or protect* or preserv* |
| Diet | diet or nutrition or food or feed* |
| Disease | disease or parasit* |
| Genetics | genetic* or DNA |
| Habitat | Habitat |
| Hunting | hunt* or harvest* or shoot* or bag or exploit* or poach* |
| Human disturbance | disturb* and (recreatio* or sport or ski* or hunt* or leisure or human or tourism) |
| Landscape ecology | landscape or fragment* or patch* or metapop* or spatial or connectiv* |
| Management | Management |
| Movements | movement* or home range or dispersal or migration |
| Physiology | physiol* |
| Population dynamics | (population and dynamic*) or cycle |
| Predation | predat* |
| Release | releas* or captiv* or restock* or introduc* or transloc* |
| Taxonomy | taxonom* or systemat* or morpholo* or anatom* |
| Threatened taxa | threat* or endanger* or declin* or extirpat* or extinct* |

tiple topics per paper, and recorded the number of publications by topic and year of publication. I applied the same procedure to 75 abstracts submitted for presentation at the Symposium that were provided by the organisers.

## Results and discussion

### Annual publication records

In the 1990s, some 150-200 papers, theses and reports on grouse are registered annually in the database wildlife worldwide (NISC 1999). Thus, the 89 presentations, 43 lectures and 46 posters that were given at the 8th International Grouse Symposium in September 1999, may be regarded an adequate sample to sketch the state of grouse science towards the end of the 20th century. The number of publications dealing with grouse has steadily increased between the 1930s and 1970s. Annual publication numbers reached a peak around 1980 and have since remained at the same level. This development reflects a general trend in wildlife publications. The proportion of grouse papers in wildlife literature, however, has dropped despite increasing annual publication rates (Fig. 1).

### Top species: capercaillie and black grouse *Tetrao tetrix*

Grouse are often referred to as one of the best studied groups of wildlife taxa. However, publications are unevenly distributed over the 18 species. During 1930-1989, the majority of papers concerned ruffed grouse *Bonasa umbellus*, capercaillie and willow ptarmigan *Lagopus lagopus*. These species clearly were the ones with the most pronounced economic and cultural importance (e.g. Johnsgard 1983, Storch 2000). The four species endemic to Asia, however, have received very little attention: Siberian grouse *Falcipennis falcipennis*, Chinese grouse *Bonasa sewerzowi*, Caucasian black grouse *Tetrao mlokosiewiczi* and black-billed capercaillie *Tetrao parvirostris*. It should be noted, however, that the Russian and Chinese language literature is not well represented in the database used for this analysis. In the 1990s, most grouse publications were on capercaillie, black grouse, and hazel grouse *Bonasa bonasia*. In general, during the 1990s North American species apparently have lost much of their former attention. Thus, the clear European focus at the Symposium might not only have been due to the Symposium's European venue. Almost 30% of the presentations dealt with capercaillie, 25% with black grouse, and 12% with hazel grouse and rock ptarmi-

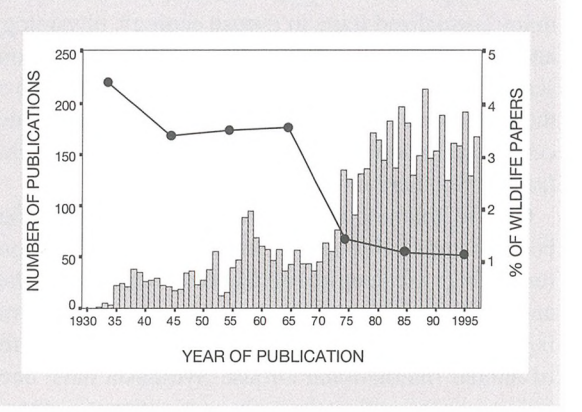


Figure 1. Number of publications on grouse by year (columns, left axis) and proportion of grouse papers (%) among all wildlife publications (N = 410,000) by decade (points, right axis). (Source: CD Wildlife Worldwide, NISC 1999).

gan each (Fig. 2). Grouse research, it seems, presently receives much more attention in Europe than in other parts of the world.

## Top topics: habitat, behaviour and population dynamics

Between the 1930s and 1980s, grouse biologists have mostly published on population dynamics, diet, habitat and behaviour of grouse, and a high proportion of the studies was related to management or hunting (Fig. 3). In the 1990s, work on diet and hunting of grouse lost significance, whereas population dynamics remained strong and habitat, behaviour and movements received increased attention. At the Symposium, the major topics of the 1990s were well represented, particularly population dynamics and habitat with 27% of the presentations each. In the presentations on grouse dynamics, cyclic population fluctuations and their possible causes received particular interest. In habitat studies, a focus was on larger-scale aspects of grouse/habitat relationships. Two topics indicated new trends: compared to their representation in the literature of the 1990s, landscape ecology and genetics are clearly gaining importance in grouse research (Fig. 4).

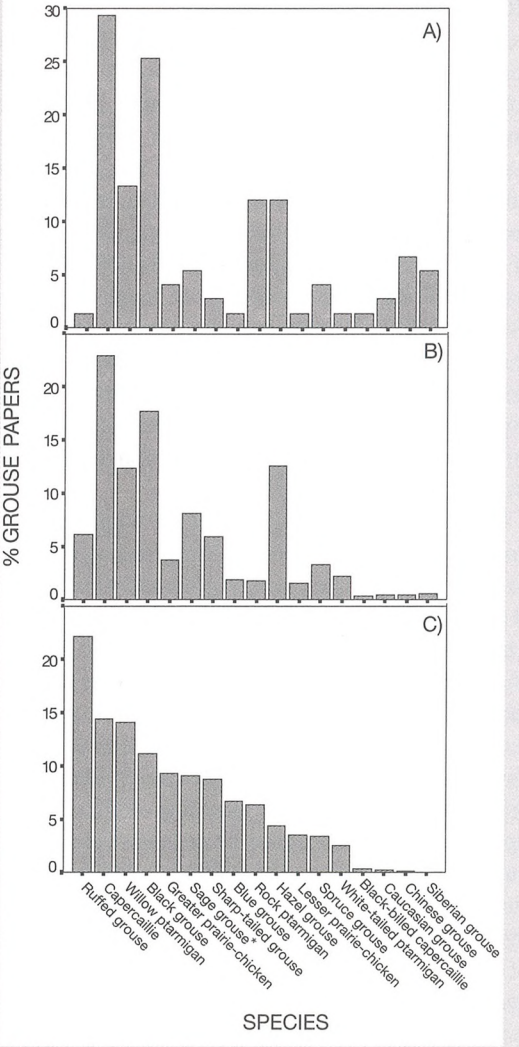


Figure 2. Relative proportion of presentations at the 8th International Grouse Symposium 1999 (A; N = 75) according to species, and of grouse papers published during 1990-1998 (B; N = 1,336) and 1930-1989 (C; N = 4,013), respectively (Source: CD Wildlife Worldwide, NISC 1999). * *Centrocercus urophasianus* and *C. minimus*.

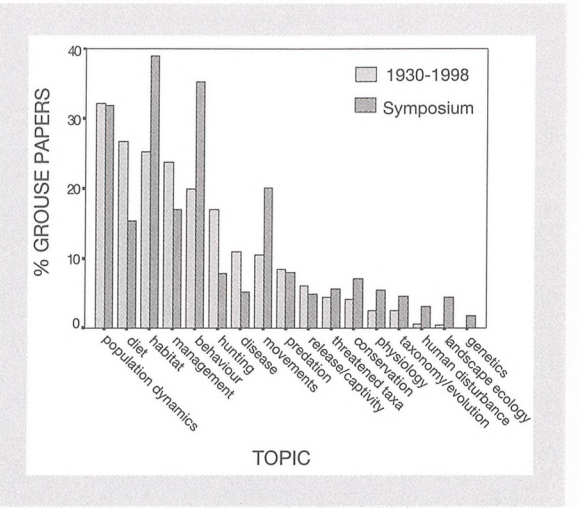


Figure 3. Proportion of grouse papers published during 1930-1998 (light grey columns; N = 5,349) and at the 8th International Grouse Symposium (dark grey columns), according to topic (see Table 1), (Source: CD Wildlife Worldwide, NISC 1999).

## New trends: grouse genetics

Only recently, have geneticists discovered grouse, or have grouse biologists discovered genes: from the 1980s (0.1%) to the 1990s (2.0%), there was a 20-fold increase in the proportion of grouse publications dealing with genetics. At the Symposium, as many as 7% of the presentations dealt with grouse genetics (see Fig. 4), and at present, many studies are in progress. Technical advances in molecular biology have led to a general increase in genetic studies of wildlife during the 1980s and particularly during the 1990s. Conservation genetics has become recognised as a sub-discipline of conservation biology (e.g. Loeschcke, Tomiuk & Jain 1994). This trend is also apparent in the grouse literature. There are three major applications of genet-

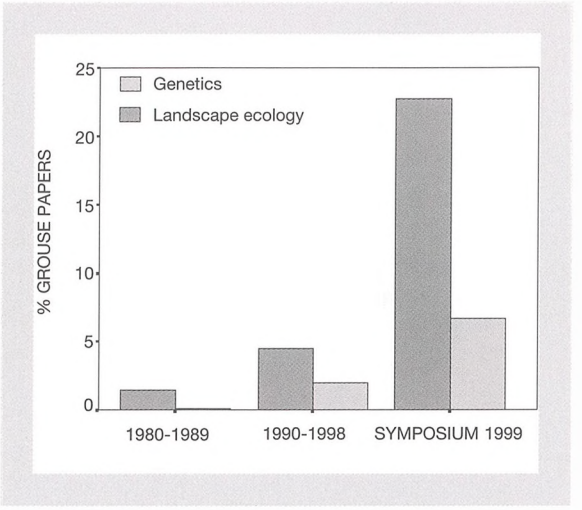


Figure 4. New trends in grouse science: Proportion of grouse publications dealing with genetics (light grey columns) and landscape ecology (dark grey columns; see Table 1), respectively, during 1980-1989 (N = 1,633), 1990-1998 (N = 1,336) (Source: CD Wildlife Worldwide, NISC 1999), and at the 8th International Grouse Symposium 1999 (N = 75).

ic methods in grouse research: 1) in studies of kinship and mating systems; 2) in studies of population structure, connectivity and viability, that may bear major implications for conservation; and 3) in studies of phylogenetic relationships and evolution, that may lead to a revision of grouse taxonomy.

Do genetic studies have any significance for the conservation problems grouse are facing? "It is... more important to find out exactly what the needs of a grouse population are than to speculate on how grouse may have evolved" (Moss 1991). In his concluding remarks at the 5th International Grouse Symposium in Norway, Robert Moss made this statement from a conservation biologist's point of view in 1990. Spontaneously, most grouse researchers probably would still agree in 1999. However, evolution and taxonomy have gained new significance as foundations of conservation biology, and indeed play an important role in grouse conservation. The reason is that red data lists are based on taxonomy. They are important tools in conservation policy and practice and are used to identify conservation priorities. Red-listed taxa receive particular attention. Most red data books list species and subspecies (e.g. IUCN 1996), and therefore, it does make a difference if a distinct race of grouse is considered a species, a subspecies, or just another population. Most grouse species are widely distributed and show a considerable degree of geographic variation in life-history traits and ecology. Numerous subspecies have been described, mostly based on morphological, behavioural or ecological differences observed between various parts of the range. According to del Hoyo, Elliott & Sargatal (1994), 129 subspecies are recognised; other authors give slightly different figures. The evolutionary validity of these subspecies is doubtful, however. Some might not be justified, others may not have been recognised. The intraspecific taxonomy of grouse merits careful evaluation (Storch 2000). In this context, genetic studies may help to identify units of evolutionary significance, and thus, to find more objective criteria for conservation priorities.

## New trends: landscape ecology

Relevant for grouse conservation and management are genetic techniques also with regard to landscape ecology. Questions of the spatial structure of habitats and populations have become a major topic in grouse research. Many grouse populations are patchily distributed, and exchange between populations may be important for their persistence. At present, our knowledge of the dispersal behaviour of grouse is not sufficient to reliably evaluate the viability of local populations (Martin 1998). Studies into the genetic structure of spatially structured populations may help to assess dispersal patterns and connectivity, questions which are highly relevant for management and conservation, but not always easily answered by more conventional field techniques such as radio telemetry.

Landscape ecological studies of wildlife populations increased as a response to large-scale, man-made habitat changes. The rapid fragmentation of the boreal forests of Europe and North America due to industrial clear-cutting, that became apparent in the 1970s and 1980s, proved small-scale explanations of habitat-relationships and population dynamics to be insufficient (e.g. Wiens 1976, Harris 1984). The need for larger-scale approaches to wildlife ecology became evident. Grouse biologists have been in the front line of this new development: the first landscape-scale grouse studies came out of Fennoscandia in the 1980s (e.g. Andrén, Angelstam, Lindström & Widén 1985, Lindén & Pasanen 1987, Rolstad & Wegge 1987). In the 1990s, only 2% of all wildlife publications, but 5% of the grouse papers dealt with landscape ecology. At the Symposium, landscape ecology was among the three leading topics (see Fig. 4).

Compared to many other taxa, forest grouse are particularly susceptible to man-made habitat fragmentation, because industrial forestry typically creates landscape patterns with fine to medium graininess, i.e., an

average grouse home range is several times larger than an average forest stand. Home range size and predation risk are likely to increase with increasing habitat fragmentation, which may have negative consequences at population level (e.g. Rolstad & Wegge 1987). Landscape ecological approaches will further improve our understanding of the spatial and demographic requirements of populations and metapopulations in patchy habitats, and thus bear important implications for grouse management and conservation. Major topics are dispersal patterns, population connectivity and metapopulation dynamics.

## Towards integration and cooperation

During the 8th International Grouse Symposium, a number of trends became apparent: a better representation of Asian species and researchers, as well as an increasing role of new fields such as genetics and landscape ecology. Most importantly, however, the range of topics and methods in grouse research seems to become broader. In part, this tendency may be explained by technical advances, e.g. in population modelling, molecular biology and landscape analysis. However, the presentations at the Symposium left me with the impression that also the range of questions asked by grouse biologists has become broader. More weight is put on larger-scale and longer-term patterns and processes, without neglecting the smaller scales, and there is evidence of an increasing integration of disciplines, approaches and explanations. Grouse scientists, so it seems, have finally begun to leave behind the old dichotomies. Increasing cooperation between scholars of various disciplines and institutes is an apparent consequence.

## Science as a basis for management and conservation

Thus, scientific advances in the study of grouse cannot be denied. A major motivation of grouse research, however, is to provide a basis for management and conservation. Regarding the trends pointed out above, one may argue that this scientific basis is certainly improving. However, at the Symposium very little was heard about the application of this knowledge. Only five of 75 presentations (<7%) explicitly discussed aspects of management or conservation of grouse. In the grouse literature, the proportion of papers related to grouse management has been declining during the 1990s, and conservation-related papers accounted for 7% only (see Fig. 3). Particularly with regard to the many threats that grouse are facing worldwide, a significant gap seems to exist in the documentation of grouse conservation and management. Little is published on techniques, successes and failures or management experiments.

Here, I can only speculate why this is so: biologists with positions in management and conservation practice may be less likely to attend international conferences, and their employers may neither encourage nor honour publications in international journals. Also, reports on management and conservation tend to be descriptive, deal with small sample sizes and will often fail to meet the interests and the standards of peer-reviewed scientific journals. I believe that much more valuable grouse management and conservation experience exists than is reflected in the literature. However, as long as this knowledge is not effectively communicated, it will not be available. To improve this communication should be an important task of future grouse symposia.

*Acknowledgements* - this paper is based on the concluding remarks I presented at the 8th International Grouse Symposium. I thank the organisers for inviting me to summarise the Symposium, and the editors of this issue for requesting a written form of this summary.

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