

The ups and downs of a Northern Goshawk *Accipiter gentilis* population over a 30 year period - Natural dynamics or an artefact?

Volkher Looft

INTRODUCTION

The population of the Northern Goshawk *Accipiter gentilis* increased in Central Europe since 1970 and has stabilised at a high level (Kostrzewa & Speer 1995, Olech 1998). This observation raises the question as to which are the factors responsible for the development.

Longterm investigations are well suited to find out the most important factors as well as to project the future population development. The ability of the Northern Goshawk to respond to changing environmental conditions mainly influenced by human beings is analysed in the study. Focus of further investigations should be put on human persecution and to what extent the population development depends on the availability of food.

STUDY AREA AND METHODS

A Northern Goshawk *Accipiter gentilis* population was studied from 1968 to 1997 using the same methods. The study area was located in Schleswig-Holstein (54.5°N/9.4°E), in the very north of the Federal Republic of Germany close to the Danish border. It is nearly square in shape with sides approximately 41x48 km long and covering 2,000 km². The landscape consists of geological formations of younger and older moraine of glacial origin in similar proportions. The forested area amounts to about 8%, consisting of mainly deciduous trees (with a predominance of beech and oak) on the moraine and coniferous trees (mainly pine) in the sandy areas (Fig.1).

During the investigation period the study area was searched every year, using the same procedures and similar effort. Only in the first years, effort was larger due to some open questions which have been answered in the meantime (for the results see Looft and Busche 1981). The search for Northern Goshawk nests was initially based on previous known sites and then, later on, searches for other nests were made in relevant patches of forests 40 or more years old. In the first 15 years additional nest visits were carried out in order to determine the average clutch size.

During the 30 years all known nesting trees in the study area were climbed at the beginning of June in order to ring the nestlings and to record their age and sex. On this occasion further data were

collected, such as the number of unhatched eggs which were buried below the fresh twigs and foliage placed on the nest as the chicks grow. Also, moult feathers around the breeding places were collected, marked and afterwards associated with nest sites and individuals.

Figure 1. North-east part of the study area. This open landscape is characterised by small woods and hedges on walls. Two to four pairs of Goshawk were breeding in this part.

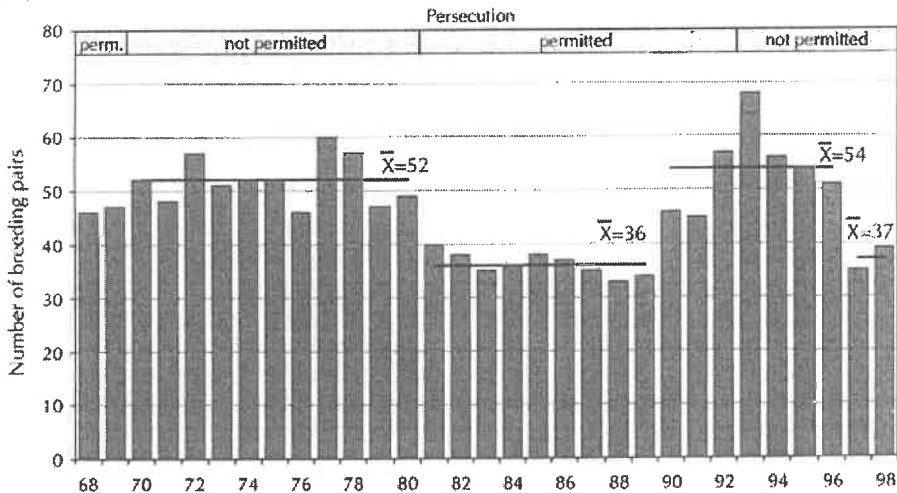


RESULTS

Development of the breeding population

Over the 30 years, the development of the breeding population was markedly irregular, divided roughly into three phases of almost equal length (Fig.2).

Figure 2. Population trends of Northern Goshawk in northern Germany (Study area: 2000 km²)



In the first eleven years after the termination of all persecution began in 1970, the number of breeding pairs was on a relatively constant high level of about 52 pairs. However, the annual fluctuations were occasionally large, up to 15 breeding pairs between 1976 and 1977.

From 1981 to 1989 the population decreased to a considerably lower constant level of 36 breeding pairs on average. In the following 8 years the absolute peak of this long-term study was already reached after 4 years (1993) with a total of 68 breeding pairs. Afterwards the population decreased again to a minimum of 35 breeding pairs in 1997 and 1998.

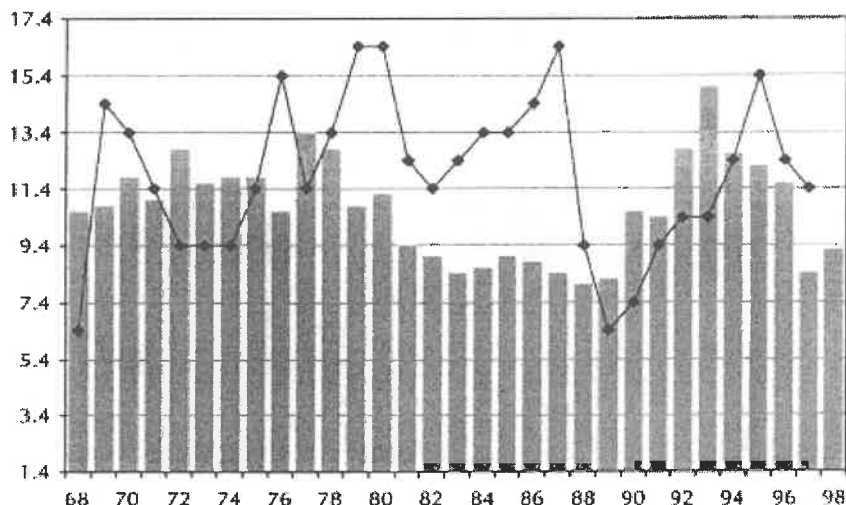
Breeding biology

Beginning of laying

The time of laying has usually been counted back by using the estimated age of nestlings at time of ringing and an incubation period of 38 days (Brüll 1964). Only in the first ten years was the beginning of laying recorded exactly in some individual cases.

During the 30 years the average varied by only 11 days (Fig. 3)- between 6th April (1968, 1989) and 16th April (1979, 1980, 1987).

Figure 3. Mean laying date



Clutch size

This parameter does not appear to correlate with the population trends. However, a clear statement cannot be made as random samples in the second half of the investigation period were too small, so that the average had to be calculated for six year blocks (Fig.4). Thus, it became evident that clutch size decreased by nearly one egg on average during the 30 years, possibly from 1975 onwards. As the development of the reproductive rate is also declining this finding would have been partly able to explain the decrease in the population development during the following years. It is, however, in contradiction to the large increase in the 1990s.

Number of young (Partial breeding success / Reproductive rate)

The number of young also does not correlate with the population development (Fig.5). It is, however, remarkable that the figures for young per successful breeding pair (Fig.6) are higher in the second half of the investigation period and that the reproductive rate increased by about two young until 1993, which could have resulted in the population peak.

Figure 4. Average clutch size (average values, weighted with annual number of clutches)

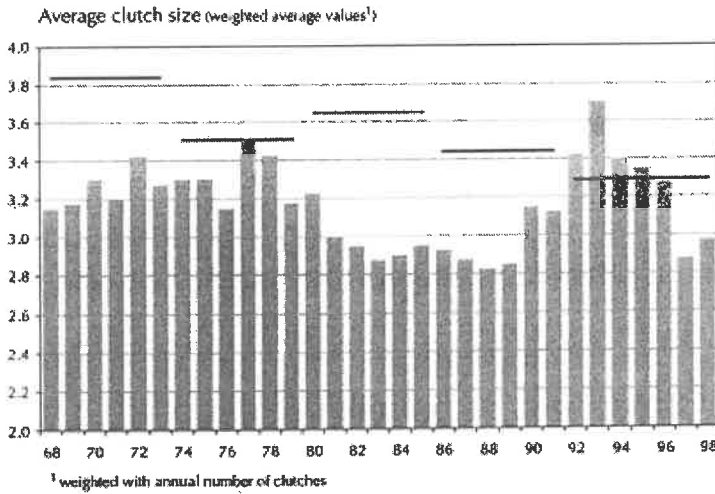


Figure 5. Average number of young per pair (all pairs)

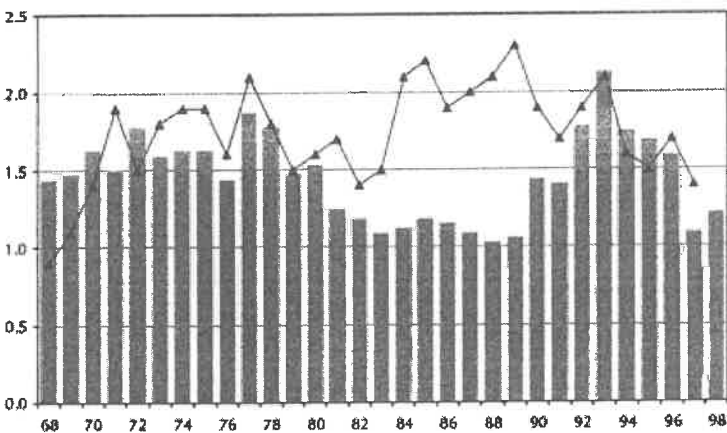
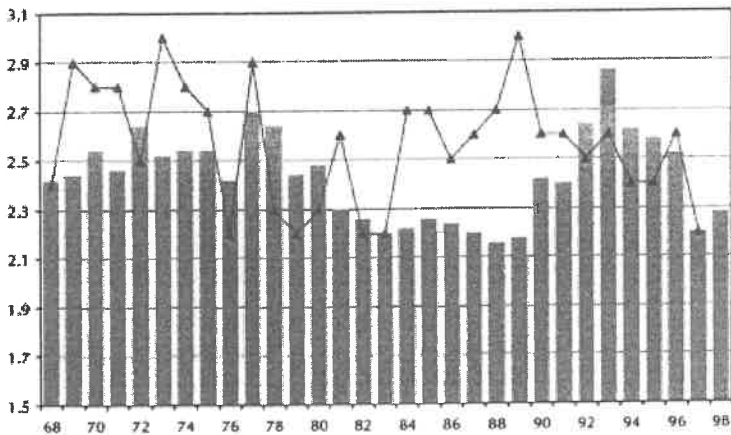
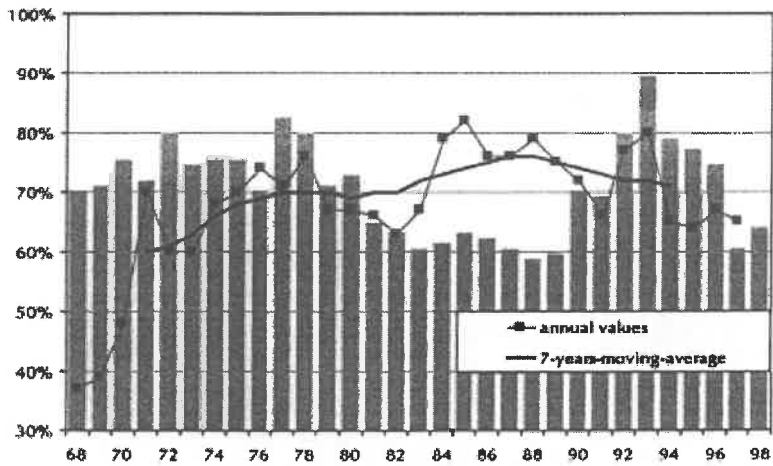


Figure 6. Average number of young per successful pair (at least one young fledged)



After the closure of hunting in 1970 the breeding success remained relatively constant at 75% (60-80%), while the decade from 1984 to 1993 produced the highest figures (Fig.7). It could thus have been expected also that the Northern Goshawk population would have profited thereby in the longterm and would not have suffered from a new population decline.

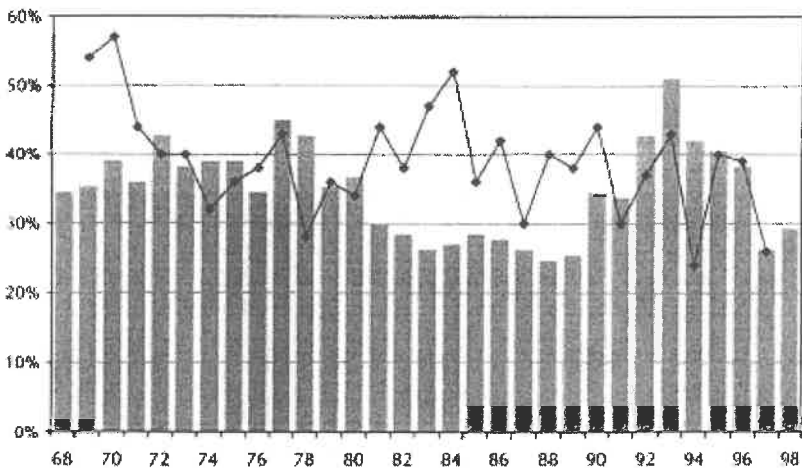
Figure 7. Percent pairs fledging young



First breeders

“First breeders” were female Northern Goshawks which, irrespective of their age, occurred for the first time as breeders in the study area. Apart from the expected high figures during the first years up to 1970 (start of documentation, hunting season closed) there is no clear trend (Fig. 8). The proportion of first breeders usually ranged from 30 to 45%; except from 1983 to 1984 with over 50%.

Figure 8. Proportion of females breeding for the first time in the study area

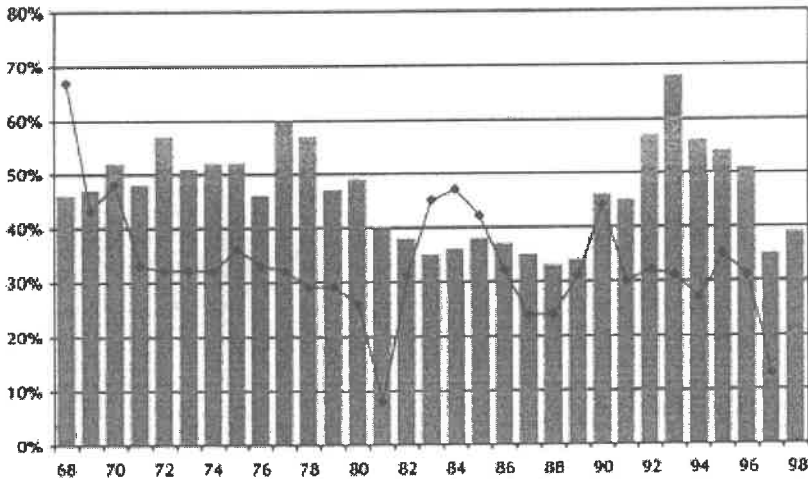


A comparison of the graphics does not show any correlation between the Northern Goshawk population and the number of first time female breeders.

Age structure of breeding females

Moulted feathers allow the exact definition of age in the first two years as well as the lifetime identification of an individual. These feathers were used to define the yearly age classes of females. Too few feathers from males were collected to apply this method to them. Thus, the one- and two-year-old females were compared with the older Northern Goshawks (Fig.9).

Figure 9. Proportion of females in the breeding stock aged less than three years



Over the 30 year period, the younger breeding females represent a very constant proportion of about one third of the breeding population. However, years when human persecution was legal show an exception: A limited, legal hunting period existed until 1970, and then between 1980 and 1993 with so-called “Goshawk Traps”. The use of the latter probably showed an effect as late as 1983 to 1985. In this case, the Northern Goshawk population seems to have reacted to high, short-term losses by recruiting younger birds into the breeding population (Looft 1984).

DISCUSSION

As the population development over the 30 year period showed three distinct phases, there was reason to believe that these phases were, at least partially, influenced by reproductive parameters. However, individual breeding factors do not explain the fluctuations in the breeding population, neither over the whole study period nor for shorter periods. The size of the breeding population was related neither to reproductive nor demographic parameters (rank correlation analysis after Spearman; Table 1).

Since separate comparisons of breeding parameters versus breeding population size did not show any correlation, it might be expected that the bringing together of individual factors would show a correlation. However, none of the comparisons offered conclusive results. Since the survival rate of the adult females (Ziesemer 1983 and the author’s unpublished data) and the number of young produced remained on a relatively constant level, the fluctuations in the population could be due to changes in the survival rate of young birds before they reach sexual maturity. This can partly be explained by human cropping of the breeding population (Bezzel, *et al* 1997, Bilsma 1993). In

the initial investigation period, from 1968 to 1970, shooting and trapping of Goshawks was allowed outside the breeding season (November to February), which might also have caused a reduction of the breeding population. After 1980 (with certain reservations until 1993), a further decline can be detected. During this period, the bordering Danish population was also affected by a similar decline (Jorgensen 1989), probably resulting from a large-scale homogenous development. After the hard winter of 1978/79, which resulted in a shortage of prey, Goshawks could be easily caught by means of traps (August to February). According to official figures 846 Goshawks were caught in Schleswig-Holstein (mainly in the southern part of the study area) between 1980 and 1993, i.e. an average of 60 per year (Ministry of Environmental Affairs, unpublished documents). The rapid increase of the breeding population in the last four years of trapping could partly be explained by a decrease in this persecution.

Table 1: Rank correlation between the number of Northern Goshawk breeding pairs and some biological parameters during a 30-year-study in Northern Germany.

	<i>Spearman's rho</i>	<i>P</i>	<i>N</i>	
Mean number of eggs	0,164	p=0.55	14	only for years with 10 values
Mean date of the beginning of incubation	0,002	p=0.99	30	
Mean total breeding success	-0,076	p=0.68	30	
Mean partial breeding success	0,106	p=0.57	30	
Proportion of first-time-breeding females	-0,046	p=0.81	29	excl. the first year
Proportion of breeding females 3 years old	0,148	p=0.43	29	excl. the first year

I can only speculate as to the reasons for the surprising decline of the population in the end of the investigation period. It is possible that the rapid increase of the Eagle Owl *Bubo bubo* population during the last years together with this species' settlement in the few forested areas of Schleswig-Holstein has put enormous pressure on the Northern Goshawk population, i.e. they might not be able to settle close to Eagle Owls and alternative sites are lacking. Newton (1979) and Kenward (1982) pointed out that the development of the population depends on the availability of food, the most important avenue for further study.

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Volkher Looft
 Verwalterhaus
 24250 Gut Bothkamp
 Germany